Management for Professionals

Martin A. Bader
Sevim Süzeroğlu-Melchiors *Editors*

Intellectual Property Management for Start-ups

Enhancing Value and Leveraging the Potential

Springer

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Editors

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Editors
Martin A. Bader
THI Business School
Technische Hochschule Ingolstadt
Ingolstadt, Germany

Sevim Süzeroğlu-Melchiors
Technical University of Applied
Sciences Regensburg
Regensburg, Germany

ISSN 2192-8096 ISSN 2192-810X (electronic)
Management for Professionals
ISBN 978-3-031-16992-2 ISBN 978-3-031-16993-9 (eBook)
https://doi.org/10.1007/978-3-031-16993-9

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Endorsements

This edited book volume offers valuable insights, bringing together perspectives of key stakeholder groups from a wide variety of innovation ecosystems—an invaluable resource.
—Carsten Fink, *Chief Economist, World Intellectual Property Organization*

A timely book for those wanting a clear overview of the issues the different players encounter in the start-up ecosystem. A useful resource indeed. Congratulations to the editors and team.
—Audrey Yap, *Managing Partner YUSARN AUDREY LLC, Past President LESI, Chairman Singapore Innovation & Productivity Institute, Singapore*

A 'must read' for all innovators in the start-up world. It is truly a fantastic book and one I would recommend being bought and read (in full)!
—Laurence Freeman, *Professor (Adjunct), CU Denver Business School, Jake Jabs Center for Entrepreneurship, Denver, Colorado, United States*

This book provides pragmatic advice for start-ups on how to most effectively manage their intellectual assets and intellectual properties at various stages of the start-up life cycle. The interesting examples of lessons learned and anecdotes based on first-hand experience shed a powerful spotlight on potential devastating effects when IA/IP is not handled properly. Authors offer actionable steps and prudent considerations to increase the value of IA/IP to start-ups.
—Tao Zhang, *Vice President Deputy General Counsel, Juniper Networks, Sunnyvale, Silicon Valley, California, United States*

Valuable insight into how early-stage businesses can use IP to drive growth and business value, with a global perspective on the IP ecosystem and a strong guidance on how start-ups can establish beneficial IP positions through best practice.
—Mike McLean, *Chief Executive Officer, Innovation Asset Collective, Canada*

An all-round view of the ecosystem members with chapters authored by practitioners. I highly recommend using this book both to broaden perspectives and as a reference guide.
—Dr. Hemang Shah, *Startup and Technology Licensing Executive, India*

The book demonstrates the impact of IP on commercial success by drawing on diverse and highly relevant perspectives of the participants in the start-up ecosystem. It is a must read!
—Karima Bawa, *Chair of IP Ontario, Senior Fellow at the Centre for International Governance Innovation, former Chief Legal Officer and General Counsel for Research In Motion (BlackBerry), Vancouver, Canada*

A comprehensive and practical approach to creating and managing the IP portfolios that ultimately will define the value of start-up technology.
—Henry Hadad, *Senior Vice President and Deputy General Counsel, Bristol-Myers Squibb, Princeton, New Jersey, United States*

A comprehensive guide to IP management for start-ups in any stage of their development. It includes perspectives from all the key stakeholders involved in IP management and value creation, as well as actionable tools and resources that start-ups can use to protect their IP assets.
—Luis Allo, *Global Director R&D, External Technology Innovation at Johnson and Johnson Consumer Health EMEA*

The role of IP as business enabler—a new currency for deals to come—is also relevant for start-ups. And this is the reason why it is so exciting to read this book.
—Dr. Uwe Over, *Corporate Vice President and Associate General Counsel,Head of Intellectual Property, Henkel Law Group, Germany*

As intellectual property is no longer only about protection, this book will be your guide to building a comprehensive view about intellectual property implications and developing a solid strategy for your business. I highly recommend it.
—Yann Dietrich, *Group Head of IP, Atos, France*

This is the book you came across too late. When you are excited about your idea and your start-up, you probably don't have the time to read this insightful book. Well, you better had! Read it before your second start-up. It is full of condensed experience from seasoned people.
—Dr. Malte Köllner, *Köllner & Partner, Patent Attorneys, Germany*

An interesting and important book about patent management in the start-up eco space with cleverly assembled essays from authors who know their subject. The book not only provides insights from different industries but also from around the world.
—Michael Kucher, *Attorney at Law, Slater & Matsil, Dallas, United States*

IP is enormously important for most start-ups. However, entrepreneurs often lack sufficient experience and expertise to fully leverage IP as a business tool. This excellent book brings together contributions from six stakeholder groups that are key to the entrepreneurial ecosystem covering perspectives from a wide range of countries and technology sectors. Highly recommended!
—Prof. Dr. Frank Tietze, *Professor in Technology and Innovation Management, Institute for Manufacturing, University of Cambridge*

A great book to understand the management side of intellectual property, showing the high value of those intangible rights in the real world.
—Mistrale Goudreau, *Professor of Law, University of Ottawa, Canada*

This book provides practical advice and examples from around the globe and is a 'go-to' resource for those who are new to this world as well as the experienced entrepreneur.
—Mark Weber, *Ph.D., P.Eng., Director, Innovation and Partnerships, McGill University, Canada*

This volume envelops cross-regional tips for coping with changing realities and disruptive and incremental innovations. A good read for managers and inventors.
—Shulamit Hirsch, *Head of IP at the tech transfer division of the Technion University, IP manager of Cathworks, and IP consultant for Kornit Digital*

A marvellous mixture of individual reflections and perspectives.
—Jeff Skinner, *Executive Director, Institute of Innovation and Entrepreneurship, London Business School, United Kingdom*

The value here lies in the wide-ranging perspectives provided by authors from around the world, grouped into different sections of 'Views' about the challenges of managing IP for start-ups. The key is to read the chapters from viewpoints other than your own, to understand better how others see the issues you are facing from different angles.
—Tom Hockaday, *Director, Technology Transfer Innovation, United Kingdom*

A multifaceted multinational digest providing perspectives of pertinent stakeholders in the global entrepreneurial field.
—Asa Kling, *President of the AIPPI Israel Regional Group and former Director of the Israel Patent Office, former Commissioner of Patents, Designs and Trademarks*

Valuable and comprehensive insight into the considerations and perspectives that one must take into account when dealing with the IP management of early-stage companies.
—Ofir Alon, *Director of the Israel Patent Office, Commissioner of Patents*

A comprehensive overview of integrated IP strategies for start-ups focusing on growth. I believe that this book is a must read for IP professionals and start-up founders involved in IP-driven technology and business creation.
—Mustafa Çakır, *Patent Attorney, Co-Founder of Patent Effect,President of LES Turkey*

An ultimate and rich source of explicit intellectual property related knowledge for all players in the start-up ecosystem—especially for our Bavarian start-ups, investors, companies, innovation consultants, and technology transfer centers.
—Bruno Götz, *Head of Patentzentrum Bayern, Bayern Innovativ, Bavaria/Germany*

The professional management of IP is a key success factor for entrepreneurial universities. In Germany and Europe, there is still a considerable need for

development in this field. This book makes an important contribution to bundling this know-how.
—Prof. Dr. Helmut Schönenberger, *Co-Founder and CEO of UnternehmerTUM, the Center for Innovation and Business Creation, and Vice President Entrepreneurship at Technical University Munich (TUM), Germany*

When at the crossroads of investment and IP, understanding and making the right turn are pivotal.
—Hon. Yves Fortier, *PC CC OQ QC, Ad.E., Canada*

In my experience of coaching and supporting tech start-ups I have observed that managing intellectual property is probably the most unfamiliar challenge for them in their early development stage. However, IP management could be the most strategic issue for the sustainable development of a young organization. With this book, Prof. Dr. Martin A. Bader and Prof. Dr. Sevim Süzeroğlu-Melchiors address the pain points of many start-ups and stakeholders in the ecosystem. It is a valuable manual for start-ups in navigating through the complex but critical domain of IP management.
—Prof, Dr. Zheng Han, *Chair of Innovation and Entrepreneurship, CDHK, Tongji University, Shanghai, China*

Foreword

How can start-ups grow and scale into a global market? What are the sources of competitive advantage of unicorns? Typically, it is intellectual property (IP). In our research on "Born Globals"—start-ups which achieve growth on a global scale—we found out that nearly all companies had IP in their core. For most economies, export-oriented, high-tech SMEs are highly important for the national economy. But how does one set up a patent strategy despite the liability of smallness? How can one create and capture value with IP? In my 20 years as a professor at the University of St. Gallen, I am keenly aware of the need for an expert resource for entrepreneurs and their collaborators to navigate intellectual property management. I very much appreciate the six different perspectives of the book: entrepreneur, investor, corporation, IP office, university, and advisor.

Professor Martin A. Bader and Professor Sevim Süzeroğlu-Melchiors succeeded in curating a rich collection of international perspectives from a cross-section of industries. This is the first time I have seen the topics of IP management and start-ups examined together in such a focused, impact-oriented volume. The breadth and depth of insights in the book will prove to be an essential reference for anyone in the start-up/intellectual property management ecosystem.

There are many books that describe IP management from a legal, technical, commercial, or strategic point of view. Most of these books are primarily about established corporations and large SMEs that have a budget for professional and efficient IP management. Because start-ups have limited capital, constraints on their time, and talent focused on their business's core competency, it can be a challenge to dedicate resources to IP management. In addition, start-ups are often confronted with strong incumbents or monopolies. I very much welcome the fact that Martin and Sevim focus this edited volume on the specific challenges facing start-ups when it comes to IP management. This collection of articles and insights can serve as an important roadmap for start-ups and their partners.

For those of us who live and breathe innovation in our daily life, we learn to appreciate genuinely unique approaches to existing challenges that will truly move the field forward. That is what readers will find in this timely book that aggregates a wide range of IP management experience and expertise from across the globe into practical concepts that serve as a guide to start-ups and their stakeholders.

The editors, Sevim and Martin, are uniquely qualified to identify the most relevant information in the field of start-up intellectual property management and to convene the most knowledgeable practitioners in the world to create this first-of-its-kind collection. I have known both for many years and had the pleasure of companioning with both in the field of intellectual property; but also, to co-found with Martin BGW, an innovation and intellectual property management specialized boutique advisory firm. Each approached me after they had already gained significant industry experience and were eager to apply their vast understanding of intellectual property management, also in practical, relevant research.

As CIPO, chief intellectual property officer, of a world-leading semiconductor firm, Martin brought his huge knowledge of intellectual property and innovation into academia and taught me the basics of IP. As CFO of a large IP intermediary in Europe, Sevim approached me with her request to write a doctoral thesis on IP management focused on the strategic importance of IP management in small and medium-sized businesses.

Today, both scholars are full professors (Ingolstadt and Regensburg) and create impact with their valuable knowledge, based on research and practice. We share the ambition of our university: "From Insight to Impact."

I am honored to have been asked to write a foreword to this important book. May it inspire ambitious founders and technology managers at different institutions to create and capture value via IP.

University of St. Gallen (HSG) Oliver Gassmann
St. Gallen, Switzerland
January 2023

Preface

Engaging a network of experts that help founders navigate intellectual property management is critical for laying the foundation for sustainable growth. Among the many competencies that founders need in order to bring innovative ideas to market, managing their intellectual property (IP) often remains an unknown source of value creation and risk mitigation. Even within the entrepreneur's ecosystem, theories about the role of intellectual property cover a wide spectrum from underestimating to overestimating its relevance for start-ups. Simply put, there is not a one-size-fits-all approach. It is our contention that everyone in the start-up ecosystem should understand how IP management fits into a business's strategy. We hope our readers—entrepreneurs and those who support them—will use this book as a comprehensive reference for creating company value and mitigating risk through intellectual property management.

The inspiration for this book came from our combined 40-plus years of experience as consultants, entrepreneurs, business owners, and researchers in the fields of intellectual property, patenting, entrepreneurship, innovation management, technology management, finance, and business strategy. Despite the breadth and depth of our experience, we still grappled with the complex and diverse aspects of managing intellectual property. In our search for answers, we came across a host of books on the topic of start-ups and others on the topic of IP management, but we discovered a vacuum on the topic of managing IP specifically as it relates to start-up enterprises.

While this collection is about start-ups, its content will benefit not only the entrepreneurs, but also the investors, corporations, institutions, universities, and advisors that collaborate with them. We recognize that each of these stakeholders has unique objectives and challenges when it comes to managing IP. As such, we have organized contributions into six sections representing each perspective: the start-up's view, the investor's view, the corporation's view, the university's view, the global IP office's view, and the advisor's view. Each section consists of chapters written by leading experts from around the globe including Silicon Valley, Israel, Switzerland, Germany, France, Finland, Japan, Singapore, Australia, Brazil, Canada, India, and South Africa. Contributors bring practical experience from various industries, such as information and communication technology, software, artificial intelligence, machine learning, cybersecurity, industrial automation, inter-

net of things, life sciences, pharma, crop science, biotech, medtech, mining, sustainability, climate tech, and even quantum technologies.

By featuring a wide range of perspectives from international specialists reflecting different experiences and vantage points, we hope to: stimulate valuable discussions among entrepreneurs and their stakeholders and advisors; encourage investors to review their portfolio of start-ups through the IP lens; inspire start-up entrepreneurs to develop their IP management and strategy competence to signal credibility with potential partners; and facilitate conversations about IP management across institutions and corporations that value the commercialization of start-up technology. Regardless of what role you play in the start-up ecosystem, after reading this book we believe you will see more possibilities, ask more questions, and identify new resources to create your own IP management strategy.

The most important assertion this book makes is that all start-ups and their stakeholders should actively include IP management in the business's overall strategy—even if that strategy does not result in claiming intellectual property. Auditing and understanding the IP landscape of one's industry helps one see how IP might provide a sustainable competitive advantage. Identifying competitors with similar technology and systems can help one exploit their innovations and avoid infringing on others' IP. And, of course, patents are powerful assets to safeguard one's own innovations.

It is important for everyone in the start-up ecosystem to remember that even if you are not paying attention to your industry's IP landscape, your competitors are. Entrepreneurs and their investors are often so focused on getting a business off the ground, they forget that generating and retaining the value of an innovative business often relies on leveraging the potential of their intellectual property. When they finally do achieve success, they may be surprised to find the value of their intellectual property has eroded and that it is then too late to leverage it. On the other hand, some start-ups recognize that intellectual property is an issue they need to address but become overwhelmed by navigating the complexities of managing it. No matter what the circumstances are, the decisions around managing intellectual property should not be speculative but rather deliberate. We hope this book will help entrepreneurs, investors, corporations, universities, institutions, and advisors tease out what is right for their unique start-up situation.

The word "ecosystem" evokes images of systems working together for the best possible outcome of its members. While everyone in the start-up ecosystem genuinely wants entrepreneurs to succeed, each stakeholder has a different motive—profit, prestige, access, etc. Each chapter provides a different perspective and opinions from different members of the ecosystem. We offer this book as an unbiased view on value-enhancing approaches and practices for start-ups to manage their intellectual property.

What readers will not find in this book is a set of how-to-file-a-patent instructions. While we do provide some practical guidance, the broad range of experiences with distinctive perspectives from around the globe should serve as a resource for start-ups and their partners to plot their own next steps in making use and enhancing the value of their intellectual property.

As entrepreneurs, investors, corporations, university tech transfer offices, patent and trademark offices, and advisors such as consultancies and specialized legal practices collaborate to build successful businesses, all these parties need a common playbook to shape the best IP management strategy for their unique situation.

In Part I, *The Start-up's View*, experts answer the most common questions and concerns that founders have about protecting their IP, avoiding infringement of others' IP, exploiting existing IP as well as gaining and growing assets for valuation and exit. Readers will learn about best practices for managing intellectual property in Israel, Germany, Australia, and Brazil, including industry insights from the cybersecurity industry, the information technology and software industry, the mining equipment technology services sector, and the sustainability and climate tech sector.

In Part II, *The Investor's View*, experts evaluate IP as a proxy for value creation and future growth as well as how to tackle IP during the due diligence and valuation processes. Readers will take away insights from US, Canadian, Swiss, and Israeli investors who consider intellectual property as a key asset class in their investment decisions and learnings on non-equity-based funding opportunities in the form of IP-backed financing services.

In Part III, *The Corporation's View*, experts address the innovation and growth strategies of established companies via start-ups that provide access to new technologies and markets. Readers will learn how established international companies such as Siemens, Nokia, and Bayer value and handle IP in partnerships with start-ups in the context of their global business perspectives and how Japanese companies bridge the cultural gap between start-ups and corporations.

In Part IV, *The University's View*, experts analyze how technology transfer and licensing of IP works from a university's perspective. Readers will learn about academic technology commercialization from the US-Israeli Jacobs Technion-Cornell Institute, NYC; gain insights from South Africa's Stellenbosch University technology transfer; see what Swiss ETH Zurich proposes to manage tensions between universities and their spin-offs; and learn how the tech transfer office spins out its research and deals with commercialization and investments at Europe's largest entrepreneurship center in Munich, Germany.

In Part V, *The Global IP Office's View*, experts examine current developments and evolving institutional programs that support start-up IP activities. Readers will learn about IP Australia's patent and trademark work that connects and guides Australians leveraging their IP in China; the European Patent Office's Patent Academy that offers training programs to facilitate the commercialization of technology and high growth; and how the French patent and trademark office views the international start-up landscape with a United Nations perspective on IP management.

In Part VI, *The Advisor's View*, experts explore the most common intellectual property right types, giving the reader an introduction to the complementary use of formal and informal protection strategies for start-ups to gain and sustain competitive advantage. Readers will learn how to capture the value of innovation, how to

secure IP in technology- and science-driven start-ups, how to use patent searches and analyses, and how to bypass a patent by applying the inventing methodology TRIZ.

After reading this book, anyone with a vested interest in start-ups will be able to judge how best to handle intellectual property in their unique circumstance. Readers may identify with one expert's perspective but disagree with others. If so, then we will have succeeded in presenting the multifaceted landscape start-ups encounter while considering their options for managing and leveraging intellectual property.

This book is unique not only because it examines the role of managing IP in the start-up context but also because it delivers multiple perspectives on this controversial and complex topic encouraging start-ups and their partners to have informed discussions and make wise decisions about IP management. Readers will find case studies, success stories, best practices, pitfalls, and wisdom that can spare them the regret that comes from not understanding the role an IP management strategy plays in creating value and sustaining a competitive advantage especially for start-ups.

The two of us have known each other since we were doctoral candidates studying under the guidance of Oliver Gassmann, a prominent researcher in the field of innovation management at one of Europe's leading business schools. After our PhD studies, we regularly bumped into each other at conferences where we discussed our common interest in the intersection of intellectual property and entrepreneurship, albeit from different perspectives. After several such discussions, we realized that there was not a comprehensive resource that provided both start-ups and their stakeholders with a general framework for understanding intellectual property management in the start-up context.

Martin, a European and Swiss patent attorney, brings many years of experience in the intellectual property field. As Vice President and Chief Intellectual Property Officer at Infineon Technologies, a DAX 30, he successfully implemented IP and licensing strategies. He co-founded the renowned innovation and IP advisory firm BGW AG, based in St. Gallen, Switzerland. Currently, Martin is Professor of Technology Management and Entrepreneurship, Director of the Entrepreneurship and Digital Business Master's Program at the THI Business School, Ingolstadt, Germany, where he works with start-ups to help bring project ideas to life.

Sevim, a leading appraiser for IP valuation projects, draws on intellectual property and finance experience from both a practitioner's and an academic's viewpoint. As Chief Financial Officer of Dennemeyer Group, she drove numerous innovation and IP projects with multinationals, SMEs, and start-ups. Currently, Sevim is Professor of Entrepreneurship and Finance, Director of the Digital Entrepreneurship Master's Program at the Technical University of Applied Sciences Regensburg, Germany, where she helps start-ups pursue their ideas and launch successfully.

Together, we draw on a wealth of experience in the two core areas of IP and start-ups to bring you, the reader, a comprehensive collection of expertise to shape your IP management strategy.

We would very much like to thank all our contributing authors for their expertise, time, perseverance, trust, and patience. Also, for their constructive comments, Michael Kucher, Partner at Slater & Matsil (Dallas, Texas) and Laurence Freeman from the Jake Jabs Center for Entrepreneurship at CU Denver Business School

(Denver, Colorado), both in the USA. Furthermore, Jessica Volz, Sara Aros, as well as Victor Marcos for their support. A special thanks goes to the THI Business School at the Technical University of Applied Sciences Ingolstadt, the faculty of Business Administration of the Technical University of Applied Sciences Regensburg, as well as from both of us to the Free State of Bavaria, Germany, and the Bavarian Research and Innovation Agency. We also generally and specifically thank our academic "godfather" Prof. Dr. Oliver Gassmann from the University of St. Gallen, Switzerland, for his long-standing support and collaboration. Finally, we would like to thank Dr. Prashanth Mahagaonkar, Ruth Milewski, Martina Himberger, Ramya Prakash, and Jana Yagnavaragan from Springer Nature for managing the overall publication process.

We wish our readers success in developing their unique IP management strategy that will lead to enhanced value creation and risk mitigation. Please share your success stories, insights, case studies, and best practices with us via email, our blog, and LinkedIn.

Ingolstadt, Germany — Martin A. Bader
Regensburg, Germany — Sevim Süzeroğlu-Melchiors
January 2023

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Editors and Contributors

About the Editors

Martin A. Bader is a European and Swiss Patent Attorney. As well as being a Partner and Co-Founder of the specialized innovation and intellectual property management advisory group BGW AG St. Gallen, he has, since March 2016, been Professor of Technology Management and Entrepreneurship at the University of Applied Sciences Ingolstadt (THI) in Germany. Previously, he was Head of the Intellectual Property Management Competence Center at the Institute of Technology Management at the University of St. Gallen (HSG) and was Vice President and Chief Intellectual Property Officer at Infineon Technologies, Munich. He is a mediator at the Mediation Center for Alternative Dispute Resolution at the World Intellectual Property Organization (WIPO) and has for many years been regarded as being among the top 300 intellectual property strategists worldwide according to *Intellectual Asset Management* magazine's IAM Strategy 300 index. He is also a long-standing author of numerous specialist publications and an internationally sought-after speaker in the field of intellectual property management.

Sevim Süzeroğlu-Melchiors is Professor of Digital Entrepreneurship and Finance and the Director of the Master's Degree Program in Digital Entrepreneurship at the Technical University of Applied Sciences Regensburg, Germany. In 2016, she completed her PhD at the University of St. Gallen, Switzerland. Her professional background in the intellectual property area started in 2007 as Chief Financial Officer and a member of the Board of Directors of Dennemeyer Group, the leading European IP services company, headquartered in Howald, Luxembourg. Later, as Global Head of Consulting, she was a founding member of the innovation and intellectual property consulting division of Dennemeyer Group located in Munich, Germany. Since then, she has been active as a researcher, IP management consultant, and speaker at international conferences, as well as a lead impartial appraiser in many different international IP valuation projects. Her broad industry experience has roots in numerous international innovation and IP projects with multinationals, SMEs, and start-ups. Her research interests focus on a value-driven approach to IP.

Contributors

Robert Alizon Fairway Family Office AG, Zürich, Switzerland

Joshua Arbter McKinsey & Company, Zurich, Switzerland

Martin A. Bader THI Business School, Technical University of Applied Sciences, Ingolstadt, Germany
European and Swiss Patent Attorney, BGW AG Management Advisory Group, St. Gallen, Switzerland

Thomas Bereuter European Patent Academy, European Patent Office, Munich, Germany

Philippe Borne Délégué INPI Grand Est, INPI Alsace – Région Grand Est, Strasbourg, France

André Brosowski JenaBatteries GmbH, Jena, Germany

Oliver Bücken UnternehmerTUM Academy for Innovators, Garching (greater Munich area), Germany

David Durand Attorneys Corporation Inc., Montréal, QC, Canada

Adéla Dvořáková LESI High-Growth Enterprise (HGE) Task Force, Munich, Germany

Christian Ebner Rentsch Partner Ltd., Zurich, Switzerland

Michael Falk Office of the Chief Economist, IP Australia, Phillip, ACT, Australia

Alexander A. Fink Department of Management, Technology, and Economics, ETH Zurich, Zurich, Switzerland

Rudolf Freytag Siemens AG, Munich, Germany
Siemens Technology Accelerator GmbH, Munich, Germany

Sven Gensler JenaBatteries GmbH, Jena, Germany

Fernando Gómez-Baquero Jacobs Technion-Cornell Institute at Cornell Tech, Cornell University, New York, NY, USA

Philipp E. Hammans JenaBatteries GmbH, Jena, Germany

Madelein Kleyn Technology Transfer, Stellenbosch University, Stellenbosch, South Africa

Louis Lagler Rentsch Partner Ltd., Zurich, Switzerland

Sonja London TactoTek Oy, Oulunsalo, Finland
Nokia, Espoo, Finland

Thiago Marques Senac-SC, Florianópolis, Brazil
Zucchetti, Florianópolis, Brazil

Oliver Mayer Mayer Engineering, Munich, Germany

Roy S. Melzer Computing Technologies Department, Ehrlich Group, Tel Aviv, Israel

Ben Mitra-Kahn Australian Bureau of Statistics, Canberra, ACT, Australia

Cédrick Mulcair David Durand, Attorneys Corporation Inc., Montréal, QC, Canada

Andressa Pacheco Universidade Federal de Santa Catarina, Florianópolis, Brazil

Alexandros E. Papaderos Tach2yone GmbH, Munich, Germany

Alexander T. Puutio United Nations Economic and Social Commission's Asia-Pacific Research Network on Trade (ARTNeT), Bangkok, Thailand

Lally Rementilla BDC Capital, Toronto, ON, Canada

Ilja Rudyk European Patent Office, Munich, Germany

Ulf G. Schaberg Intellectual Property Business Partners, Fideris, Switzerland
AO Foundation (a not-for-profit foundation), Davos, Switzerland

Frank C. Schnittker THL Engineering, Damme, Germany

Pallavi Shah Mobity LLC, Mountain View, CA, USA

Praveen Shah Mobity LLC, Mountain View, CA, USA

Sevim Süzeroğlu-Melchiors Technical University of Applied Sciences Regensburg (OTH Regensburg), Regensburg, Germany

Jörg Thomaier Bayer IP GmbH, Monheim am Rhein, Germany

Charlotte Trinh Australian Embassy Beijing, Beijing, China

Stephan M. Wagner Department of Management, Technology, and Economics, ETH Zurich, Zurich, Switzerland

John Walker Dennemeyer Group, Sydney, NSW, Australia

Beat Weibel Siemens AG, Munich, Germany

Dallas L. Wilkinson Dennemeyer Group, Sydney, NSW, Australia

Haiyang Zhang Department of Science, Energy and Resources, Canberra, ACT, Australia

How to Increase the Success of Innovative Start-Ups with Intellectual Property: An Introductory Overview

Six Views but One IP to Rule Them All

Sevim Süzeroğlu-Melchiors and Martin A. Bader

Do not be driven into darkness.

1 Start-Ups and Their Need for Capital

Have you ever been in a situation where you have had a brilliant idea and later hear about a start-up that is having incredible success with a similar idea? This happens to many people who have great ideas, but they don't immediately start their own business. There are numerous books about founders, start-up strategies, framework conditions, and the start-up ecosystem. Many ingredients are important for the successful establishment of a start-up. One important ingredient that contributes to the success of start-ups is intellectual property, which must be managed regardless of whether it is protected or not.

The last 10 years have been characterized by a rising interest in start-up ventures and high investments in start-ups worldwide. New types of investors have entered the market, such as hedge funds, corporations, or the "crowd" besides the classical investors such as venture capitalists and private equity firms. In 2021, start-ups

S. Süzeroğlu-Melchiors (✉)
Technical University of Applied Sciences, Regensburg, Germany
e-mail: sevim.suezeroglu-melchiors@oth-regensburg.de

M. A. Bader
THI Business School, Technical University of Applied Sciences, Ingolstadt, Germany

BGW AG Management Advisory Group, St. Gallen, Switzerland
e-mail: martin.bader@bgw-sg.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_1

raised US$628 billion which more than doubled compared to the previous year, and more than 528 private firms became "unicorns"[1] (CB Insights, 2022b).[2] This was favored by expansionary monetary policy and a high volume of money in circulation in the largest markets. Regardless of market conditions, there are snowstorms – ups and downs which again impact the enthusiasm of investors.

Current trends and developments affecting the start-up market include:

- After the fat years, dealmaking is slowing down;
- More new businesses are springing to life;
- Multiple start-up hubs are rapidly evolving around the world; and
- China's ambitious plan to become the world's next center of innovation.

Fat Years of Dealmaking Are Slowing Down Recent trends indicate a turning point. Crises, wars, supply-chain shortages, sharply rising inflation rates, which is counteracted by rising interest rates, erode the value of future cashflows and lead to a reassessment of investments in the start-up market. The quarterly CB Insights report found that global venture funding dropped in Q1 2022 to US$143.9 billion raised across 8,835 deals. This is a 19% decrease from the previous quarter's funding, as shown in Fig. 1.[3] Global venture funding continued to decline sharply in Q2 2022 to US$112.6 billion and in Q3 2022 to US$74.5 billion (CB Insights, 2022b). Also, global medium valuation of late-stage deals dropped to US$1.054 billion. Despite this revaluation, there are numerous start-ups that remain highly valued. In Q1 2022, the three highest valued unicorns worldwide were: *ByteDance*, founded by *Zhang Yiming*, the Chinese tech company which owns *TikTok*, valued US$350 billion; *Ant Group* (China), founded by *Jack Ma*, valued at US$150 billion; and *SpaceX* (United States), founded by *Elon Musk*, valued at US$100 billion (CB Insights, 2022a). Solid start-up valuations based on promising business models, technologies, and intellectual property will persist, and start-ups with well-strategized intellectual property (IP) concepts will find it easier to raise capital (Süzeroglu-Melchiors & Hammans, 2022).

More and More Start-Ups Are Springing to Life In 2021, the number of newly formed companies was 15% higher than the average before the pandemic (The Economist, 2022). According to the global start-up ecosystem's 2022 rankings, most start-ups are established in the *software* and *data* industry, with 31.8%, followed by *healthtech* with 12.7%, *social* and *leisure* with 10.4%, and *fintech* with 10.2% (Crunchbase, 2022).[4]

[1] Start-ups with a valuation greater than $1 billion.

[2] https://www.cbinsights.com/research/report/venture-trends-2021 (accessed October 24, 2022).

[3] https://www.cbinsights.com/research/report/venture-trends-q1-2022 (accessed October 24, 2022).

[4] Based on a sample of more than 100,000 start-up entities. https://about.crunchbase.com/blog/trends-global-startup-ecosystem-2022 (accessed July 07, 2022).

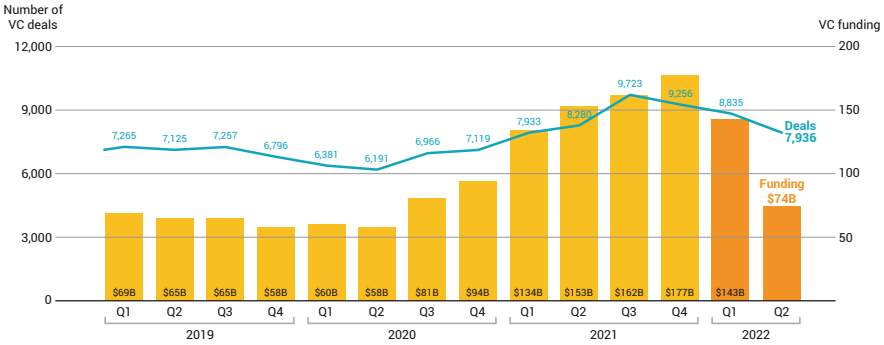

Fig. 1 Worldwide venture capital funding 2019–2022 (source: CB Insights)

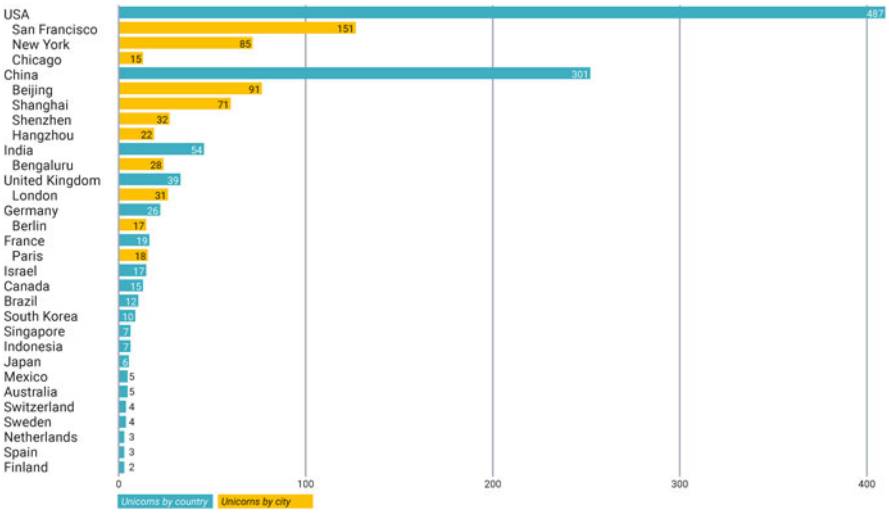

Fig. 2 Top 20 ranking of countries and cities with the most unicorns in 2021 (source: Statista. https://www.statista.com/statistics/1062457/cities-highest-number-of-unicorns, accessed October 24, 2022)

Multiple New Start-Up Hubs Are Evolving Around the World In recent decades, *Silicon Valley* has been the engine of start-up activities and the birthplace of many tech start-ups. A number of large cap companies[5] were founded in Silicon Valley, such as *Apple*, *Hewlett-Packard*, *Intel*, *Google*, and *Uber*, while others, including *Facebook*, have moved to the Valley shortly after being founded. Today, Silicon Valley is still the most fertile soil for start-ups, but other start-up hubs around the world are evolving and catching up, as shown in Fig. 2.

Reasons for this development are the diffusion of investments and funds into big cities and government support programs which foster growth in start-up hubs.

[5]Large cap refers to companies with a market capitalization of more than $10 billion.

Besides *Silicon Valley*, the largest start-up hubs today include *Tel Aviv*, *Beijing*, *London*, *Berlin*, *Singapore*, *Bengaluru,* and *São Paulo*.

In 2021, there were a total of 1,058 unicorns in 42 countries. Some 487 unicorns were headquartered in the *United States*, including 151 in *Silicon Valley*. Other countries in the top five rankings were *China* with 301 unicorns, *India* with 54 unicorns, the *United Kingdom* with 39 unicorns, and *Germany* with 26 unicorns, as shown in Fig. 2 (Statista, 2021a, 2021b).

China's Ambitious Plan to Become the World's Next Center of Innovation The 14th Five-Year Plan (FYP) (2021–2025) announced in March 2021 *China's* ambition to become a world-leading innovator by 2035. The 14th FYP proposes to foster high-quality development by supporting innovation and upgrading human capital. Research and development spending is planned to increase by at least 7% every year between 2021 and 2025 (East Asia Forum, 2021).[6] These ambitious plans are also reflected in the development of the start-up scene. China's government offers extensive subsidies to start-ups, and state-supported incubators are driving the domestic e-commerce start-up scene, increasingly turning China's digital founders into genuine Silicon Valley competitors.

2 Why IP Actually Does Matter: The Status Quo

It may be common sense in practice and academia that intellectual property is broadly used by established companies for creating an innovative edge and sustaining their competitive advantage (Gassmann & Bader, 2017; Gassmann et al., 2021; Grandstrand, 2018; Holgersson et al., 2018; Tietze, 2019). And surely many start-ups have heard the advice "file your patents." But in reality, start-ups are often overwhelmed with intellectual property matters. Reasons are diverse, such as the lack of IP knowledge, no dedicated budget, limited capacities, no access to IP software tools, etc. From an IP perspective, start-ups are at a disadvantage per se. This can be compared to a 100-meter race, where the IP-experienced companies already have a 10-meter lead, wear better running shoes, and thus have a clear advantage. Despite the general advice to file valuable patents, start-ups often prefer a risky but fast approach based on confidentiality. Therefore, this compilation is designed to draw attention to IP issues and to show why IP actually does matter, for reasons such as:

- Few start-ups protect their IP, but these are more successful;
- Patents are signals to stakeholders that the start-up is worth investing in;
- Patents are a weight on the negotiating table;
- Functions of patenting support the start-up.

[6] https://www.eastasiaforum.org/2021/05/08/chinas-plan-to-become-a-world-leading-technology-force (accessed October 24, 2022).

Few Start-Ups Protect Their IP, but These Are More Successful Only a few start-ups protect their IP rights, but these are significantly more successful than start-ups that do not protect IP rights. According to a recent study by the EPO and EUIPO (2021), fewer than 9% of European SMEs rely on protected IP rights, but this subset of companies appears to generate 68% higher revenues per employee than SMEs without IPR portfolios. There is clearly a positive relationship between patenting start-ups' innovations and economic performance.

Patents Are Signals to Stakeholders that the Start-Up Is Worth Investing in It is widely known that patents are a proxy for innovation. Patents can be seen as proof that the technological idea is new and innovative and that a start-up is investing precious funds in patent applications. Patents signal the legitimacy to move from conception to commercialization. Most investors perceive intellectual property rights, such as patents, patent applications, utility models, and trademarks, as an indicator for quality and value. A study utilizing data from 468 early-stage Canadian start-ups shows that patents clearly increase the likelihood and amount of receiving venture capital because they signal the quality of the venture (Vo, 2019). This perceived signal has its validity, as there is clearly a positive relationship between patenting start-ups' innovations and economic performance (EPO and EUIPO, 2021). Furthermore, patents have a positive effect on other financing instruments such as governmental funding programs and debt financing. Recent studies show that patents increase the likelihood of receiving governmental grants (Islam et al., 2018), and patents are assets that can be used as collateral for loans. For example, in 2016, there were 117,262 patents and patent applications serving as collateral in secured financing by banks in the United States (Nguyen & Hille, 2018). Another U.S. study shows that 36% of technology start-ups in the computer software, semiconductor, and medical devices sector used patent-backed financing to receive loans (Hochberg et al., 2018).

Interestingly, signaling effects of patents work like a chain effect. Patents make an essential contribution to the success of early-stage funding, and prior funding positively affects follow-up financing because prior funding certifies firm quality to investors and reduces information asymmetries. A study based on 221 business plans and project descriptions of start-ups that ran equity crowdfunding campaigns on the British platform Crowdcube in 2017 and 2018 found that prior financing positively affects crowdfunding campaign success (Kleinert et al., 2020). Also, start-ups which received a prior grant were 12% more likely to acquire subsequent venture capital (VC) funding (Islam et al., 2018). This clearly shows that patents, have a positive effect on the raising of capital throughout the venture life cycle. As an asset, they are used as collateral and an indicator for the venture quality and help start-ups to acquire funding and overcome the well-documented valley of death.

Patents Are a Weight on the Negotiating Table Start-ups are often faced with the situation that they are dealing with experienced investors and large corporations that wield effective negotiation tactics. Patents are a unique selling point here because they prohibit others from using the protected technology. Protected intellectual

property rights strengthen the negotiating position vis-à-vis investors and large corporations and can make a significant contribution to successful negotiations, securing orders, and achieving a return on the invested (ROI) research and development.

Functions of Patenting Support the Start-Up Often early-stage ventures decide against patenting in favor of non-disclosure agreements (NDAs). This can make sense if the patenting process would take too long compared to the short technology life cycle or if the probability of obtaining a patent is low. On the other hand, patents are a good alternative to NDAs because they provide stronger control over information disclosure. In any case, start-ups should weigh the options carefully. The functions of intellectual property are not only to protect one's own innovations from imitation, but also to ensure commercial exploitation through licensing, to create collaborations through cross-licensing, and to guarantee freedom to operate (WIPO, 2021). A series of EPO case studies in 2017[7] shows impressively that start-ups can leverage their IP rights to grow and expand by licensing in and out, establish partnerships, and prevent others from imitation, therefore securing high profit margins (see also EPO and EUIPO, 2019; EPO, 2022).

There are diverse ways to leverage IP and take advantage of positive effects such as signaling effects. It takes more to harness the full potential of IP than just to manage a brilliant idea. Start-ups are strongly advised to treat IP as a key ingredient, creating and protecting value for their company. We take a detailed look at this ingredient – intellectual property – from diverse stakeholder views, state of the art in research and in practice, and we address many important questions within the start-up ecosystem.

3 Six Main Views That Allow Differentiated Insights on Intellectual Property Management for Start-Ups

This book was written to fill what we believe to be a gap in the field of intellectual property management for start-ups. The fact that IP is important for young ventures as well as established companies is undisputed. While established companies spend both financial and professional resources to give this topic the attention it deserves, start-ups struggle to manage their intellectual property. There are various reasons for this, such as:

- Lack of awareness of valuable intellectual property;
- No knowledge about the various IP rights and conditions and ways to become the proprietary owner of intellectual property;
- Obliviousness to develop intellectual property strategies;

[7] https://www.epo.org/case-studies (accessed on July 04, 2022).

- Limited experience in how to exploit intellectual property and defend themselves against third parties;
- Ignorance of the fact that legal consequences can be an existential threat for start-ups; and
- Finally, start-ups are frequently overwhelmed with the complexity of the intellectual property domain.

This list could go on for a long time. We address precisely these problems, ask the main questions about IP, and provide answers in a best-practice, user-friendly way. Literature on start-ups does not only speak about individual start-ups but often refers to the critical infrastructure, namely the start-up ecosystem, which is particularly important for young companies. We make use of stakeholder perspectives that often have a major influence on the success and failure of start-ups. There is a long way to go from invention to commercialization of the innovation, and in between, there are many steps and activities which involve different stakeholders. The most common business questions and concerns that arise include:

- What type of IP is needed to create and capture value for sustainable success?
- What should be proprietary IP and what can be shared IP?
- Which signals does the start-up send to the market with IP?
- What can be publicly disclosed and what should be kept confidential?
- Which inventions are patentable and who can help?
- How can inventions be best protected?
- What are the benefits of registering IP?
- What budget is needed for IP protection, for how long, and how can it become part of the investment plan?
- What is to be done for a reasonable risk mitigation?
- Does the start-up infringe others' IP?
- Can IP be used to gain and grow assets for start-up valuation and exit?
- How does academic technology commercialization work?
- What are current developments and evolving institutional programs that support start-up IP activities?
- Which databases and methods can be utilized for strategic and effective IP management?
- Which best practices for managing intellectual property can support start-ups' IP activities?

In this compilation, we address all these questions contributed by some of the world's most renowned experts in IP and related fields.

We identified six main categories of stakeholders that define the space for IP management for start-ups through active, passive, or advisory intervention. These six stakeholders enrich the volume with their own perspective, experience, interest, and stories.

Therefore, the book is structured into six parts each reflecting a range of perspectives from a specific stakeholder group in the start-up ecosystem. These six main views cover a wide range of all relevant topics on IP management for start-ups,

Fig. 3 Six stakeholder views within the start-up ecosystem on IP (authors' own figure)

as shown in Fig. 3. This structure reflects: the start-up entrepreneurs, encounters with investors, corporations, university technology transfer offices, global IP offices, and advisors, i.e., consultancy and specialized legal practice services. The six parts of the volume are prepared by selected expert contributions based on their track record and profound expertise in IP and related fields.

The six viewpoints that form the connecting thread of this book provide a broad picture of diverse opinions, which are partly overlapping but also partly conflicting. There is no "one and only" management theory that perfectly reflects all aspects of IP management for start-ups. Thus, this compilation is to be understood as a bridge between academic aspects, existing literature, and applied practices. The six views contain IP topics from all over the world and cover a wide range of different technology sectors and industries. It is this diversity that provides the added value for the reader.

To conclude, some start-ups and their stakeholders might still be floating under an umbrella of foggy ignorance; others might be paralyzed into inaction. The acronyms *FOMO* and *SOBS* come to mind in this situation: You don't want to spend money and time on IP just for *fear of missing out* on a potential opportunity, but you don't want the *shame of being suckered* either if you find your company value eroded for not having duly invested in IP. The decision shouldn't be speculative but rather deliberate, and we hope this book will help start-ups and their ecosystems tease out what is to be done.

In the following, we introduce each partition with an explanatory summary that is provided based on the chapter abstracts. We conclude with a condensed overview of the covered topics, industries, technologies, regions, and countries by the six stakeholder views provided in Table 1:

Part I: The Start-Up's View

The Start-Up's View addresses the most common questions and concerns that founders have regarding protecting IP, avoiding infringement of others' IP, exploiting IP, as well as gaining and growing assets for valuation and exit. Authors share learnings coming from Israeli start-ups and their specific ecosystem, also known for the high relevance of its cybersecurity sector; from the German climate tech and sustainability sector where IP proves to be a new value driver; from the Australian global mining industry where innovation relies on the mining equipment technology services sector; and from the concentrated Brazilian information technology and software industry, which maintains strong links to the financial capital and "matchmaking" region Silicon Valley.

Israeli Start-Ups and Ecosystem has been contributed by Roy Melzer, a patent attorney and the Head of the Computing Technologies Department at Ehrlich Group, Tel Aviv, Israel. He summarizes: Israel is referred to as the "Start-up Nation" due to the population's unique entrepreneurial DNA, the massive research and development activity, the high level of venture capital activity, and its substantial state funding that nourishes highly successful start-ups across industries. Most start-ups in Israel and worldwide have a defined life cycle of different phases. Each phase has unique characteristics that directly affect the strategy for intellectual property in general and patents in particular. His chapter describes the adaptable IP strategy, different intellectual property matters that are typical for each start-up stage, and demonstrates best practices for handling these matters (Melzer, 2023).

IP as a New Value Driver for Sustainable Start-Ups has been contributed by our authors Dr. Sven Gensler, Chief Financial Officer, Dr. André Brosowski, Chief Sustainability Officer, and Philipp E. Hammans, CEO, all three at JenaBatteries, Jena, Germany. They summarize: Total investment for climate tech firms, the pace of start-up development, and the average funding size have all increased during the last 10 years. Early-stage venture financing for climate tech start-ups totaled US$418 million in 2013. However, overall venture capital surged by more than 3.750% in 2019 to $16.1 billion. While it is fashionable to be sustainable, little is known about how a business model benefits and successfully implements sustainable technology. Theoretical and realistic sustainability approaches share several similar characteristics: Enhancing sustainability often requires transition, innovation, or adaptation. The question is: What is the difference between "sustainable technology" and "sustainable innovation"? The ability to innovate in sustainability is a requisite business capacity, whether linked to minor incremental measures or extreme, revolutionary developments. There is, however, a lack of transparency and consistency in the terminology and a lack of demonstrated scientific grounding in value creation. To valuate a new venture or start-up is a critical and long-debated question in entrepreneurial financing. Determining a start-up or any other company's economic valuation is one of the more challenging and vital discussions a founder can have with institutional investors. One of the greatest assets of a start-up and the cornerstones in innovation is intellectual property and intellectual property rights. Their chapter discusses how sustainability, defined through the Sustainable Development Goals (SDGs) metrics, is used as a new driver in the valuation of the technology and intellectual properties in order to reflect the true value of a

company's intellectual property when looking for financing through, for example, collateralization of its IP (Gensler et al., 2023).

Mining IP: A Story of Start-Ups in the Global Mining Industry has been contributed by our authors Dr. Dallas L. Wilkinson, Regional Managing Director Asia Pacific, and John Walker, Senior IP Consultant and patent and trademarks attorney, both from Dennemeyer Group. They summarize: Two SME companies (considered start-ups) which operate in the Mining Equipment Technology Services (METS) sector of the Global Mining industry have been studied to understand the role that their IP, along with their associated IP strategy, has played in their success. With both companies starting to expand internationally, their IP strategies have become increasingly important. Both companies are reliant on technology and thrive due to a focus on and understanding of IP. Generation and protection of IP has allowed these organizations to continually grow by maintaining a strong awareness of IP across their organizations. Key insights from the case studies include the importance of IP awareness, training, non-disclosure agreements, the critical nature of a company strategy composed of robust technology and IP strategies, the importance of utilizing all relevant types of IP protection, complexities added through collaboration, taking a proactive approach, and finally, the absolute requirement to remain focused on the commercialization goals while being very conscious of IP. The clear message is that IP is a valuable asset which needs nurturing and must be actively managed throughout the entire technology life cycle and interconnected commercialization phase (Wilkinson & Walker, 2023).

IP and Start-Ups in the Context of Florianópolis, the Silicon Island of Brazil, has been contributed by our authors Dr. Thiago Marques, Professor at Senac-SC and Chief Marketing Officer at Zucchetti, and by Dr. Andressa Pacheco, Professor at Universidade Federal de Santa Catarina, both from Florianópolis, Brazil. They summarize: The management of a company's intellectual property is a key issue in its strategic planning and long-term competitiveness. This issue becomes even more relevant when it comes to start-ups given the inherent innovative nature of this type of business. Despite its clear importance, developing countries such as Brazil suffer from a lack of structure, delays, high costs, and legal insecurity in the matter of patents and intellectual property, which makes it difficult for start-ups to obtain the necessary registrations. One of the most common ways to solve the problem in this case is to look for ways to facilitate the process available in the local innovation ecosystem. Florianópolis is one of the most important start-up centers in Brazil and serves as a benchmark for cities and governments in developing countries that want to create strong innovation ecosystems (Marques & Pacheco, 2023).

Selected Takeaways (the Start-Up's View)

- The clear message is that IP is a valuable asset which needs nurturing and must be actively managed throughout the entire technology life cycle and interconnected commercialization phase.

(continued)

- A typical start-up will go through certain stages in its life cycle; each has its own characteristics and challenges that directly affect the strategy for intellectual property in general and patents in particular.
- The "Israeli way" of creating extremely successful start-ups involves a great deal of creativity, thinking outside the box, perseverance, and the ability to fail, learn, and repeat.
- The connection with the local ecosystem facilitates the understanding of the importance of legal protection of the innovation and can bring immediate benefits to the start-up seeking this support.
- A pre-deal IP valuation project is an optimal tool for risk assessment as the vital part of an IP valuation project consists of identifying legal, economic, and technical risk potentials within a company's intangible asset portfolio.

Part II: The Investor's View

The Investor's View addresses IP as a proxy for innovation and future growth as well as how to tackle IP during the due diligence and valuation processes. Authors examine the significance of IP in early-stage start-up investment decisions on the basis of insights from the United States, Israel, and Switzerland, and the role of IP and intangible assets in tech private placements from a Silicon Valley investor's perspective, as well as the relevance of IP for the investment process in start-ups and early-stage companies from a Canadian angle. Non-equity-based capital raising opportunities for start-ups on the basis of leveraging their intellectual property and intangible asset portfolios are revealed by front-runner BDC Capital.

IP Is Paramount: The Significance of IP in Early-Stage Start-Up Investment Decisions has been contributed by Dr. Ulf G. Schaberg, an IP consultant at Intellectual Property Business Partners, and IP Manager of the AO Foundation, a not-for-profit foundation in Davos, Switzerland, who has interviewed three different investors from the United States, Israel, and Switzerland. He summarizes: Venture capital investors play an important role in the start-up ecosystem, particularly during early stages. To understand how investors think about intellectual property and what role it plays in their investment decisions, this chapter provides interviews with three experienced VC experts. The interviews confirmed, unsurprisingly, that intellectual property is a very important aspect for VC investors in their investment decision-making process. Investors have clear expectations in certain areas while they are less concerned in others, and clear preferences exist as to how and when intellectual property should be in the focus during a typical assessment process. A stepwise approach is recommended for founders to gradually and efficiently climb up the ladder of IP savviness, to be prepared to meet investor expectations in the next pitch to unlock access to capital (Schaberg, 2023).

The Role of IP and Intangible Assets in Tech Private Placements has been contributed by our authors Praveen Shah, Founder and CEO, and Pallavi Shah, Managing Director, Transactions, both of Mobity LLC, a Silicon Valley boutique

firm that, founded in 2002, is a strategic advisory, IP transaction broker, and venture incubator/accelerator headquartered in Mountain View (Silicon Valley), California, United States. They summarize: We examine the role intellectual property and intangible assets play in technology private placements from the viewpoint of an investor. We also incorporate the perspectives of various other stakeholders involved in launching, financing, operating, scaling, and exiting technology ventures. To provide actionable insights our readers can use on their next deal, whether as an investor or an investee, we attempt to engage and educate our readers through illustrative case studies based on our combined six decades of relevant and personal experiences. We also draw upon the collective wisdom of various industry practitioners we have worked with during our careers (Shah & Shah, 2023).

What's the Big Idea? The Crossroads Between Investment and Intellectual Property has been contributed by our authors David Durand and Cédrick Mulcair, both Avocats/Lawyers at David Durand Attorneys Corporation Inc., Montréal, Canada. They summarize: The purpose of our chapter is to assist readers in demystifying the investment process in start-ups and early-stage companies. The authors address this topic from both a start-up and investor perspective and provide further insight on determinant factors of the investment decision-making process. While focusing on the Canadian regulatory landscape, the authors emphasize the importance of establishing an intellectual property strategy (MVIP) early on, enhancing the ability of start-ups to attract capital from investors, as well as to foster competition and productivity (Durand & Mulcair, 2023).

Intellectual Property-Backed Financing has been contributed by Lally Rementilla, Managing Partner at BDC Capital, Toronto, Canada. She summarizes: Start-ups can access non-dilutive financing by leveraging their intellectual property and intangible asset portfolios through intellectual property-backed financing. The author uses her own experience to show how intellectual property-backed financing works, its costs and benefits, and how start-ups can prepare themselves better to access this type of financing (Rementilla, 2023).

Selected Takeaways (the Investor's View)

- If you want VC funding, take IP seriously.
- To get there, work up the ladder of IP savviness.
- Align your IP strategy with your business strategy and model early on and find ways for them to complement one another.
- It is critical to have a strong "product-market-moat" fit, strong IP strategies, and IP management culture that are aligned with business strategy.
- IP can be a good proxy signal in the early (but less so in the later) stages.

Part III: The Corporation's View

The Corporation's View addresses corporations' start-up strategies that manage IP as an important value driver for innovation and growth along with getting access to new technologies and markets. Insights come from the automation and industrialization

industry, including the platform economy, internet of things (IoT) and Industry 4.0, i.e., the global technology powerhouse Siemens and its Siemens Technology Accelerator, the information and communications technologies industry with learnings from Nokia, and the pharmaceutical, life sciences and crop science industry sector, i.e., Bayer. Readers will appreciate insights from different cultures of international and global companies, including learnings from the Japanese start-up ecosystem and corporate culture that reveal how Japanese companies bridge the cultural gap between start-ups and corporations.

IP as an Important Value Driver for Start-Up Strategies in Established Companies has been contributed by our authors Beat Weibel, Chief IP Counsel Siemens, and Dr. Rudolf Freytag, Head of Licensing at Siemens and CEO of Siemens Technology Accelerator, Germany. They summarize: Established companies apply two types of start-up strategies to drive innovation and growth: With outside-in start-up strategies, they get access to external start-up innovations; with inside-out start-up strategies, they build independent new innovative businesses. These two strategies are fundamentally different, but they have in common that IP becomes an important value driver when a value-driven IP strategy is pursued. Based on their own experience, the authors show how this approach works in practice and theory (Weibel & Freytag, 2023).

Strategic Uses of IP: Applying Learnings from Large Companies to Start-Ups has been contributed by Sonja London, General Counsel and Licensing Executive at TactoTek Oy and former Head of Consumer Electronics Licensing at Nokia, Finland. She summarizes: Established technology companies normally have an intellectual property strategy in place. This may include at least elements of patenting, trademark filing, IP risk mitigation, and a plan for using IP in their business. For building an effective IP strategy, these companies have considered many strategic ways to exploit their IP. Start-ups can learn a lot from larger companies' approaches to IP. Drawing from her own experience, the author explains the strategic uses of IP from a large company's vantage point, as well as how to apply this knowledge to the IP strategy of start-ups. The aim is to provide start-ups with views and ideas for developing their own IP strategy. Her chapter is based on extensive experience with companies in mobile devices and related technologies, consumer electronics, and general electronics companies. In this context, IP means specifically patents and does not discuss trademarks or branding. The larger context of standard essential patents is also excluded and only addressed on a high level (London, 2023).

How the Life Sciences Industry Handles IP in Start-Ups has been contributed by Dr. Jörg Thomaier, Global Head of IP Bayer Group, Managing Director Bayer IP, Germany. As Head of IP for a global blue chip, he shares his views on how a start-up should take care of its intellectual property, strategically build up a portfolio, and avoid certain kinds of mistakes. His chapter draws on extensive first-hand experience when investigating start-ups to prepare for investing in, collaborating with, or taking over such entities. He also offers insights and takeaways for investors on what to look for and expect from a start-up and its management when getting ready to fund and invest. Some hints for licensors, specifically universities and other publicly funded

entities, are also included. The chapter is a valuable read for anyone interested in gaining insights and advice from a leading IP professional (Thomaier, 2023).

Mind the Gap: Business and Cultural Aspects for Start-Up Collaboration in Japan has been contributed by Robert Alizon, Chief IP Officer of Fairway Family Office, Zurich, Switzerland. He summarizes: Corporations seek partnerships with start-ups to enhance their innovation efforts and to introduce disruption in their market, provided a strong IP portfolio supports the opportunity developed by the start-up. It is thus important for the start-up to apply IP management principles that will lead to successful partnerships. Namely making sure that the start-up owns all IP related to their proposition, the IP secures a strong exclusivity to keep the competition at a distance from the market it has developed, and avoids infringing the IP of other players in the market will attract corporations. His chapter will review these points with an emphasis on the business culture gap that exists between a start-up and a Japanese corporation that is often seeking partnerships with overseas start-ups to compensate for the modest number of start-ups in the Japanese ecosystem (Alizon, 2023).

Selected Takeaways (the Corporation's View)

- IP has become an important value driver of start-up strategies of established companies especially if value-driven IP strategies are applied.
- Using IP strategically allows companies to build shareholder value by securing optimal freedom of action in the relevant market and enabling an advantageous position over competitors.
- IP strategy implementations for start-ups include considering different ways of value creation and assessing risk and planning for its mitigation.
- Ensure that IP rights are unequivocally owned by the start-up and respect employee invention law.
- Make sure to acknowledge cultural gaps between start-ups and corporations.

Part IV: The University's View

The University's View brings an understanding of how technology transfer and the licensing of intellectual property works from a university's perspective. Authors examine the successfully applied practices and case studies from New York City's U.S.-Israeli Jacobs Technion-Cornell Institute at Cornell Tech, South Africa's Western Cape-based Stellenbosch University illustrating the technology transfer journey from invention to commercialization, and Europe's largest entrepreneurship center at the Technical University of Munich, Germany. In addition, we share the results of a study performed by the renowned Swiss university ETH Zurich on how to manage IP-related tensions between universities and spin-offs to navigate through the agreement finding process.

Experimentation in Academic Technology Commercialization has been contributed by Dr. Fernando Gómez-Baquero, Director of Runway and Spinouts, Jacobs Technion-Cornell Institute at Cornell Tech, Cornell University, New York,

United States. He summarizes: Technology commercialization is now one of the cornerstones of the experience in the academic environment. Universities and colleges are now highly dedicated to understanding and giving priority not only to creating new technologies but also to commercializing them. His chapter describes some of the experiences and empirical evidence that we received as we were building the Runway Startup Postdoc Program at the Jacobs Technion-Cornell Institute at Cornell Tech. It explains three broad steps of technology transfer experimentations and flips the traditional technology and transfer office (TTO) model. Experimenting should be a natural component of incubator programs and the most effective way of producing meaningful change in technology transfer systems. His recommendation to academic incubators and TTOs is to embrace experimentation and build a technology transfer culture that is less concerned about the traditional output metrics (i.e., patents, licenses, revenue) and is more geared toward providing people with the resources, connections, and knowledge they require to create a start-up (Gómez-Baquero, 2023).

A University Perspective with a South African Flavor has been contributed by Dr. Madelein Kleyn, Director Technology Transfer, Stellenbosch University, South Africa. She summarizes: Technology transfer of research emanating from a publicly funded research institution operates within a strict legislative and intellectual property policy framework. Understanding the complexities of the university environment is challenging but rewarding, as Silicon Valley and Stanford University, along with many other university technology and science parks, have proven over decades. Not all university innovation and technologies are suitable for licenses or start-ups. The choice of the model for commercialization is complex and intriguing. Her chapter shares some insights (Kleyn, 2023).

The Technology Transfer Office as Facilitator Between Researchers and Investors: A German Perspective has been contributed by our authors Dr. Alexandros E. Papaderos, Head of Innovation, Technical University of Munich, and Oliver Bücken, Investor and Senior Adjunct Lecturer, UnternehmerTUM, Europe's largest entrepreneurship center, Garching, Germany. They summarize: Higher education institutions face the challenge to fulfill their role in the so-called "third mission," next to research and teaching. One major part of this third mission is technology transfer and, consequently, the creation of technology-oriented and knowledge-based spin-offs. Universities and non-university research institutions can succeed in this particular mission by providing a supporting culture and suitable policies, which allow spin-offs to become important drivers of innovation. The journey from research results to the development of products and services to market maturity needs intensive research and thus time and money. An efficient intellectual property management by the university's technology transfer office plays an indisputably crucial role. Founders must be aware of the rights of third parties. Bringing patents into a company should be the normal case. In reality, the contribution of patents plays a huge role when it comes to the distribution of shares. Attracting venture capital and fresh money for scaling goes along with the necessity of freedom to operate. Having shareholders in the company who hold patents privately prevents growth capital to fuel the company. In their chapter, they present the views of a

university TTO, a university researcher/founder, and an investor/practitioner on the importance of IP for university spin-offs (Papaderos & Bücken, 2023).

Managing IP-Related Tensions Between Universities and Spin-Offs has been contributed by our authors Prof. Dr. Stephan M. Wagner, Chair of Logistics Management, and Alexander A. Fink, both at the Department of Management, Technology, and Economics, ETH Zurich, Switzerland, as well as by Joshua Arbter, McKinsey & Company. They summarize: Intellectual property is a critical asset for the growth of university spin-offs. Since the IP usually belongs to the parent university, spin-offs must find an agreement on how to access it. However, there is little evidence on how universities' technology transfer offices and spin-offs find this agreement. Their study aims to shed light on this process. Drawing on four Swiss and German TTOs and 12 related spin-offs, the authors provide insights into navigating through this process. The data reveal that both parties face four critical tensions while negotiating: (1) TTO's success might hamper spin-offs' success; (2) TTO owns the IP but is no IP protection advisor; (3) need for standardized, yet tailored processes; (4) spin-off's independence, yet further dependence on the university. The authors further determine implications from their study that help to overcome these tensions (Fink et al., 2023).

Selected Takeaways (the University's View)

- Technology transfer offices: Understand that a more effective strategy for technology commercialization is based on finding the entrepreneur who will be the vehicle of commercialization, not in promoting technology disclosures.
- Integrate technology transfer (entrepreneurship and IP management) as part of the "third mission" into the established structures and processes of the university.
- Solve the known tensions: E.g., use standardized, yet tailored processes.
- Start-ups: Reduce the time it takes to negotiate licenses by agreeing to standard and simple licenses that consider the unknown nature of start-ups.
- Don't spend all the time in the lab: Build the prototype and make sure the technology is sound and the IP is secured, but then get to market.

Part V: The Global IP Office's View

The Global IP Office's View addresses current developments and evolving institutional programs that support start-up IP activities. Authors provide insights from the Australian patent and trademark office IP Australia on the value of IP rights for start-ups, that has even a counsellor position for IP at their embassy in Beijing to guide and connect Australians to the China innovation system to help them make the most of their IP in China; the European Patent Office EPO with a Patent Academy that has developed a varied training and innovation support program to facilitate the commercialization of technology and high growth; as well as the French patent and trademark office INPI with an examination of the international start-up landscape and the United Nations lens on IP management.

Tools of the Trade: A Trading Nation's View on the Value of IP Rights for Start-Ups has been contributed by our authors Dr. Michael Falk, Office of the Chief Economist, IP Australia, Dr. Ben Mitra-Kahn, Program Manager, Australian Bureau of Statistics, Charlotte Trinh, Counsellor (Intellectual Property), Australian Embassy Beijing, and Dr. Haiyang Zhang, Economist, IP Australia. They summarize: For start-ups, effective use of intellectual property rights can help to attract resources, drive business value and growth, and take advantage of changes in market conditions. However, effective use of IP rights depends on start-ups seeking the right information and support, auditing their intellectual assets, understanding how the nature of their industry should inform their IP strategy, and drawing on the support of local partners in target markets. These benefits and approaches to IP are illustrated drawing on evidence from Australia about IP's role in entrepreneurship and business growth (Falk et al., 2023).

Market Success for Inventions: Patent Commercialization Scoreboard and Innovation Support by our authors Thomas Bereuter, Programme Area Manager Innovation Support at the European Patent Academy, Adéla Dvořáková, LESI High-growth Enterprise (HGE) Task Force, and Ilja Rudyk Senior Economist, all from the European Patent Office. They summarize: Deep tech start-up companies aiming for high growth must focus on intellectual property rights, particularly on patents. As demonstrated by the EPO's studies, patent protection makes it easier for these businesses to gain market access, strengthen their negotiation position, attract funding, or achieve strategic value in positioning the company. Start-ups and SMEs, along with universities and public research organizations, face similar challenges in commercializing their patented inventions, particularly the lack of resources, skills, and contacts. Identifying the right partners and their contacts, and the cost and complexity of negotiations, often limits collaborative exploitation. For this reason, the EPO's Patent Academy has developed a varied training program to facilitate the commercialization of technology and high growth. In particular, the EPO-LESI High-growth Technology Business initiative is tailored to enhancing the knowledge and skills of business decision-makers and IP professionals in deep tech start-ups and SMEs, thereby enabling them to maximize the market success of their patented inventions (Bereuter et al., 2023).

Raising IP Awareness of Start-Ups: A French Perspective has been contributed by Philippe Borne, Delegate of the French Patent and Trademark Office, INPI, France. He summarizes: Thanks to a high degree of active support from the public authorities, France became a leading start-up nation. This is especially the result of a realization by the country's policymakers that the ability to stay in the technology race was key to maintaining one's position in a tough world competition increasingly dominated by the rivalry between the United States and China. The early achievements manifested in the development of the French start-up ecosystem are not totally correlated with an intellectual property policy of the same magnitude. This puts the high-value French start-up community at potential risk, particularly vis-à-vis predator actions of global players in the field of disruptive technologies. An examination of the international landscape allows us to identify the possible reasons for such a situation as well as possible remedies (Borne, 2023).

Strategic Considerations and the Seed-to-Maturity Model when Establishing the Ideal IP Portfolio in the Start-Up Context has been contributed by Dr. T. Alexander Puutio, Intellectual Property Rights Advisor, from the United Nations Economic and Social Commission's Asia-Pacific Research Network on Trade (ARTNeT). He summarizes: His chapter integrates IP assets into the lean start-up method and explores the features and trade-offs of trade secrets, trademarks, copyrights, and patents in the start-up context. The utility and strategic value of these IP assets are analyzed against the seed-to-maturity framework and minimum-viable-product design process, and the chapter culminates in tangible strategies for maximizing the value of "lean IP portfolios" (Puutio, 2023).

Selected Takeaways (the Global IP Office's View)

- A very early incorporation of IP into your business strategy will greatly foster all your stages of development.
- An effective IP strategy begins by identifying your sources of intangible value, and how to support and build them using IP tools and drawing on expert advice.
- Technology start-ups should focus on IP, and patents in particular, from day one.
- Start-up founders should therefore aim to improve their IP knowledge and skills, and seek support.
- IP assets are relevant to all start-ups, at a minimum through trade secrets and trademarks.

Part VI: The Advisor's View

The Advisor's View provides an overview of the main types of intellectual property rights and serves as an introduction to the complementary use of formal and informal protection strategies to create and to capture the value of innovation. Authors advise what technology- or science-driven start-ups can do to secure and manage their intellectual property and how to avoid common pitfalls. Further insights are provided into the power of modern analytic tools and how these might be used by start-ups, and finally, a practical introduction is given on how to circumvent third-party patents in a structured way by applying the so-called TRIZ methodology.

An Introduction to Intellectual Property Rights and Formal and Informal Protection Strategies has been contributed by Dr. Martin A. Bader, Professor of Technology Management and Entrepreneurship at THI Business School from the Technical University of Applied Sciences Ingolstadt, Germany, and a European and Swiss patent attorney at the innovation and intellectual property advisory group BGW AG, St. Gallen, Switzerland. He provides an introduction to the most common types of intellectual property rights, such as patents, trademarks, designs, and more. He also highlights why only a holistic complementation of both de facto and legal protection strategies can provide effective innovation protection for competitive advantage and

to capture value. His chapter concludes with 10 practical tips for start-ups to manage protection strategies and IPRs (Bader, 2023).

Important Aspects of IP for Start-Ups: Strategies for Avoiding Common Pitfalls has been contributed by our authors Louis Lagler and Dr. Christian Ebner, both European and Swiss patent attorneys at Rentsch Partner Ltd., Zurich, Switzerland. They summarize: A technology- or science-driven start-up's intellectual property is one of its most crucial assets and thus securing its intellectual property is of utmost importance for the company's success. In their chapter, the authors draw from their own experience to highlight IP strategies and common pitfalls that start-ups face in securing their intellectual property (Lagler & Ebner, 2023).

Blind as a Mole? How Patent Data Can Help Start-Ups to Compete has been contributed by Dr. Sevim Süzeroglu-Melchiors, Professor of Digital Entrepreneurship and Finance at the Technical University of Applied Sciences Regensburg, Germany. She provides an overview about common types of patent search and analyses such as novelty search, freedom-to-operate search, IP landscapes, patent-based market and competitor analysis, technology scouting, and infringement assessment. A special section highlights the step-by-step approach for conducting an IP technology landscape. She concludes with practical tips for making the most out of patent data in a strategic and operative view (Süzeroglu-Melchiors, 2023).

Technical Patent Circumvention: How Start-Ups Can Get Around Infringed Patents has been contributed by our authors Prof. Dr. Oliver Mayer, Engineering Office Mayer, Munich, Germany, and Frank C. Schnittker, thl engineering, Damme, Germany. They summarize: When a company has a great idea to solve a technical problem, it usually gets disillusioned upon finding that this idea has already been patented by somebody else. Usually in this case one starts to activate lawyers in order to find out if one can legally get around the patent. A nullity complaint at court or negotiations on how to be able to use the patent through license fees or cross-licensing are options. There is a technical way to circumvent patents as well. The authors describe a systematic approach and a procedure on how R & D departments can work with existing patents and circumvent them with technology. This procedure is not only valid for circumventing competitors' patents but also for fostering one's own patent applications and thus developing one's own solid patenting strategy (Mayer & Schnittker, 2023).

Selected Takeaways (the Advisor's View)

- IP is not an end in itself: Amalgamate both, business and IP strategies, to gain and sustain competitive advantage.
- For IPR legal procedures, such as filings, registrations, opposition, nullity, or enforcement proceedings, it is advisable to engage an IP attorney.
- Find the right balance between your budget and scope of protection.
- Prevention is better than healing.
- IP data is a useful source for start-ups along all four venture phases.

Table 1 Overview of covered topics, industries, technologies, regions, and countries by the six stakeholder views (authors' own compilation)

Point of view (stakeholder)	Topics covered	Industries/technologies	Regions/countries[a]
I. Start-up	• Learnings from the Israel start-up ecosystem • Learnings from German sustainable technologies start-ups • Learnings from the Australian start-up ecosystem • Learnings from the start-up ecosystem 'Silicon Island' in Brazil	• Cybersecurity • IT and software • Mining • Climate tech • Sustainable technologies	• Australia • Brazil • Germany • Israel
II. Investor	• Insights of business angels, VCs, and investors • Role of IP and intangible assets in tech private placements • Crossroads between investment and IP • IP-backed financing • Monetary IP valuation methods • Definitions of intellectual assets (IA) and intellectual property (IP) • The 'ladder of IP savviness' • The 'minimum viable IP (MVIP)' management strategy • The dos and don'ts of IP protection and investor attractiveness	• Artificial intelligence (AI) • Machine learning (ML) • Software • Biotech • Consumer products • Food/nutrition • Pharma • Digital/health • Medtech • Medical instruments • Orthopedics • Sports/wellness	• Canada • Israel • Silicon Valley • Switzerland • United States
III. Corporation	• IP as an important value driver for start-up strategies in established companies (Siemens) • Applying IP learnings from large companies to start-ups (Nokia) • How the life sciences industry handles IP in start-ups (Bayer) • The Japanese start-up ecosystem and corporate culture • Strategic uses of IP and IP strategy implementations in start-ups • IP value creation, portfolio construction and strategy • IP risk identification and mitigation strategy	• Automation and industrialization • Internet of things (IoT) • Industry 4.0 • Information and communications technologies • Automotive • Consumer electronics • Life sciences • Pharma • Digital/health • Crop science/agrobusiness • Social media	• Finland • Germany • Japan • Switzerland • United States • International

IV. University	• Academic entrepreneurship • Technology transfer and commercialization • Royalty rates • Cooperative research and development agreements • The 'triple helix': university-industry-government interaction • Incubator programs • Tensions and implications for university spin-offs and TTOs	• Computer science • Software as a service (SaaS) • Biotech • Pharma • Oncoceutics	• Germany • Israel • Singapore • South Africa • Switzerland • Thailand • United States
V. Global IP Office	• Raising IP awareness of start-ups • IP as a tool of the trade and export • Policy makers and public authorities • The 'four level IP strategy model' • Patent commercialization scoreboard and innovation support • Strategic considerations when establishing the ideal IP portfolio in the start-up context	• Artificial intelligence (AI) • Blockchain • Quantum computing • Cybersecurity • Deep tech • Medtech • Medical instruments • Biotech • Cleantech • Autonomous driving • Mechanical engineering	• Australia • Brazil • China • France • India • Japan • Korea • United States • Europe • International
VI. Advisor	• Introduction to the different types of IPRs • Formal and informal protection strategies • How to capture the value of innovation with IP (the 'St. Gallen patent management model') • How to secure IP in technology- or science-driven start-ups • How to use patent searches and analyses • How to bypass a patent in a structured way: the 'TRIZ methodology'	• Technology • Science • Quantum computing • Biodegradable packaging • Medtech • Lighting • Wind energy	• The 'Big Five' world IP regions • Germany • Switzerland • Europe • International

[a]In alphabetical order

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Sevim Süzeroğlu-Melchiors is Professor of Digital Entrepreneurship and Finance and the Director of the Master's Degree Program in Digital Entrepreneurship at the Technical University of Applied Sciences Regensburg, Germany. In 2016, she completed her PhD at the University of St. Gallen, Switzerland. Her professional background in the intellectual property area started in 2007 as Chief Financial Officer and a member of the Board of Directors of Dennemeyer Group, the leading European IP services company, headquartered in Howald, Luxembourg. Later, as Global Head of Consulting, she was a founding member of the innovation and intellectual property consulting division of Dennemeyer Group located in Munich, Germany. Since then, she has been active as a researcher, advisory board member, and speaker at international conferences, as well as a lead impartial appraiser in many different international IP valuation projects. Her broad industry experience has roots in numerous international innovation and IP projects with multinationals, SMEs, and start-ups. Her research interests focus on a value-driven approach to IP.

Martin A. Bader is a European and Swiss Patent Attorney. As well as being a Partner and Co-Founder of the specialized innovation and intellectual property management advisory group BGW AG St. Gallen, he has, since March 2016, been Professor of Technology Management and Entrepreneurship at the University of Applied Sciences Ingolstadt (THI) in Germany. Previously, he was Head of the Intellectual Property Management Competence Center at the Institute of Technology Management at the University of St. Gallen (HSG) and was Vice President and Chief Intellectual Property Officer at Infineon Technologies, Munich. He is a mediator at the Mediation Center for Alternative Dispute Resolution at the World Intellectual Property Organization (WIPO) and has for many years been regarded as being among the top 300 intellectual property strategists worldwide according to Intellectual Asset Management magazine's IAM Strategy 300 index. He is also a long-standing author of numerous specialist publications and an internationally sought-after speaker in the field of intellectual property management.

Part I

The Start-up's View

VCs invest in the team, not in the product. IP can be a good indicator of the technical caliber of the team.
—Praveen Shah, Founder and CEO
—Pallavi Shah, Managing Director
Mobity LLC
Mountain View (Silicon Valley)

Israeli Start-Ups and Ecosystem

Roy S. Melzer

1 Israel Is the "Start-Up Nation"

1.1 Local Culture and Exit Ecosystem

Referred to as the "Start-up Nation," Israel's unique characteristics create a *strong entrepreneurial culture* that nourishes highly successful start-ups across industries. While it is hard to pinpoint the exact reason why this is, it appears that the "lean start-up" business model, common in tech-driven initiatives, is compatible with the *flexible and creative local environment* and *culture*. Most of Israel's population has to go through compulsory military service in the *IDF (Israeli Defence Forces)*, giving them the tools and the knowledge to lead others, solve problems quickly, improvise, adapt, and think outside the box. This forms a unique entrepreneurial DNA in the local population. There is also a wealth of talent, thanks to Israel's *highly educated population* and *significant cultural diversity,* as Israel's population was founded on immigration. Furthermore, the IDF cyber-intelligence units train young Israeli recruits in coding and hacking. Israel has more start-ups per capita than any other country. In 2021, the estimate was around 6,000 start-ups.

1.2 Substantial Venture Capital Activity

One can also refer to the VC (venture capital) ecosystem in Israel as the source of success for Israeli start-ups. There are more than 200 Israeli VC firms, around 70 foreign firms that operate in Israel, and around 60 corporate VCs. Since 2015, an average of 23 VCs are being established annually. The active VCs usually focus

R. S. Melzer (✉)
Computing Technologies Department, Ehrlich Group, Tel Aviv, Israel
e-mail: roy@ipatent.co.il

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_2

on investments in different stages of the start-up and areas of interest, while each firm has its own investment strategy. VC companies in Israel can be divided into four categories:

1. 1st generation VCs – the "godfathers" of the Israeli VC scene;
2. 2nd generation VCs – newer VCs making an impact;
3. Crowdfunding VCs – a powerful new model for start-up investments;
4. International VCs with offices in Israel – some of the world's best VCs taking part in the local vibrant start-up scene.

In 2020, VC firms continued to be the major source of capital for the Israeli tech sector, accounting for 88%. According to Ginsum (2021) the sector with the most investments in Israel is cybersecurity, followed by fintech and IoT (internet of things). As a result of the COVID-19 pandemic, there has been a rapid increase in Israeli investments in cybersecurity by 70% and now account for 31% of all global investments in this sector. Israeli cybersecurity start-ups were able to raise $2.9 billion in VC funding in 2020. Examples of Israeli VC funds investing in cybersecurity are: *YL Ventures*, *Vertex*, *JVP*, and *Team8*, among others.[1] A new VC fund was recently established in Israel called *CyberStarts*. This is a unique initiative of about 50 entrepreneurs that has built successful cyber companies in the past and made their capital from that. Overall, the first investments of Israeli VCs grew by 65% between 2014 and 2020, as compared to 25% investments from foreign markets. Israeli VCs in 2020 were responsible for 45% of all first-time investments in Israel.

Over the last decade, start-up funding for Israeli entrepreneurs increased by 400%. While the local ecosystem is mostly driven by an exit strategy to be sold to international tech giants, according to Techaviv, as of June 2022, there were 97 private tech companies founded by Israelis, valued at over $1 billion.[2]

1.3 Massive Research and Development

For the last few years, Israel has been considered the *world's biggest R&D hub*. Israel is home to seven world-leading universities, dozens of government and public research institutes, and hundreds of private entities engaging in cutting-edge research and development in various industries.

Tech giants like *Amazon*, *Google*, *Facebook*, *Apple*, *Microsoft*, *Intel*, *Salesforce*, and over 300 other multinational companies have established R&D facilities in Israel. Significant amounts of research and development are also performed in the

[1] https://www.ginsum.eu/overview-of-israels-venture-capital-landscape/ (accessed July 19, 2022).

[2] See https://www.techaviv.com/unicorns; Israeli-founded unicorns: Private tech companies founded by Israelis, valued at over $1B. Updated: June 6, 2022.

medical and pharmaceutical fields, telecommunications, power production, water resources management, and more.

According to European Commission (2022), Israel is first in the world in the number of researchers per 1,000 employed and first in the number of engineers per 10,000 people. The top-level academic research and Israel's known innovative culture make Israel the ideal place for establishing R&D centers in all industries.

1.4 State Funding

The Israeli government is a primary source of R&D funding, providing financial support for a substantial portion of Israel's R&D activities. Israel's state funding can come in the form of investments, grants, tax benefits, and more.

The *Israel Innovation Authority* offers unique tools for entrepreneurs and start-ups to support the early development stages of technological initiatives and is responsible for implementing Israel's policy of encouraging and supporting industrial research and development in Israel through the Law for the Encouragement of Industrial Research and Development 5744-1984. The Israel Innovation Authority is an independent and publicly funded agency that operates several unique funding platforms for early-stage entrepreneurs and mature companies developing new products or manufacturing processes. This public authority serves as a launchpad for successful innovative projects.

2 Adaptable IP Strategy: IP Matters for Each Phase of the Start-Up Life Cycle

Most start-ups have a somewhat defined life cycle, as demonstrated below. Each phase has its unique characteristics that directly affect the strategy for intellectual property in general and patents in particular.

In this chapter, I will describe the adaptable IP strategy, where different intellectual property matters are typical for each stage of the start-up, and will demonstrate best practices to handle these matters. In some cases, I will provide real examples of issues I have handled on behalf of my clients.

2.1 Phase 1: Pre-seed and Seed

These are the earliest stages in the life cycle of a start-up. When the idea is formed and somewhat validated by an early-stage prototype, it is usually not fully functional or viable. This is not to be confused with an MVP (Minimum Viable Product), which must be both functional and viable (see following section).

These stages are characterized by little to no resources and capital, so there is a greater emphasis on value for money. Nonetheless, as a general rule, if the start-up's

product or service solves an existing problem in a novel, non-obvious way, the best practice is to allocate funds for patent registration as soon as possible.

2.1.1 Clarify Patent Eligibility

While at this early-stage founders already identified a desired solution to a problem, the process of how to implement the desired solution might not be well defined. As in most countries, a patent is granted on a technical innovation (how the problem is solved) and not to a business innovation (what is the outcome of the desired solution), founders should take time and make effort to precisely define how their invention works, the benefits of the way their inventions work (in relation to the obvious solutions), and why their inventions work differently from other possible solutions.

As patent applications are published after 18 months, the hidden cost of revealing the inventions to third parties should be taken into account, with reference to the cost of reverse-engineering the products or services which are provided based on the inventions. The folktales of protection which is granted based on a preliminary application, such as a U.S. patent provisional application[3] that includes only a general description of the desired solutions, without explaining possible implementations of the desired solutions, must be elucidated to the founders.

There is great importance for going into details on what makes your solution better than others, even if it means delaying the patent application. One of my clients is an Israeli start-up that developed a robotics solution for personal cosmetics. It took the start-up a relatively long time before filing for a patent because we wanted to have the full picture on the solution and what makes it better than other solutions. Eventually, the patent application included a full description of the robot and its advantages over other similar solutions. After filing, we discovered that another start-up filed for a patent for the same general concept. However, this application did not include a specific description of the solution but rather a general one. Eventually, the competing application was rejected because it lacked a proper description of what makes this solution better than other solutions. Our client's application was accepted.

2.1.2 Take Care of Ownership Matters

Potential ownership claims can occur when founders conceptualized the product or service while employed at a different company. According to the founder's employment agreement, a non-disclosure agreement (NDA), and IP assignments, founders may have various obligations to their employer. The ownership of the IP should be fully settled and understood at this early stage, as such matters will deter investors

[3] A US provisional patent application has a life of validity of 12 months, and it is not published or reviewed by a USPTO examiner. Effectively, the sole purpose relates to the date of filing. Unless new (full) patent(s) are filed at least 1 day prior to the provisional patent application expiration citing the provisional patent application original filing date. Typically, full patent filings state some/most of the original provisional patent application content with relevance to newer versions of the description of the innovation.

from investing in the project, and it might prevent the start-up from reaching maturity.

However, founders should remember that identifying a problem is not part of a patentable technical solution but rather only motivation to find one. The actual moment of conception should be identified to determine the ownership issue. Also, assigning a patent application to a company formed after the patent application was filed might induce a tax event, and founders should consider consulting with a tax specialist to determine how to manage such an assignment.

There are several known cases in Israel where founders had to pay major royalties to their former employer. One example is that of *Omrix*. In 2009, the state of Israel filed a lawsuit in the amount of NIS 500 million (about $170 million) against the pharmaceutical company *Omrix* and its founder, chairman, and CEO, *Robert Taub*. About a year prior to filing the lawsuit, *Omrix* was sold to Johnson & Johnson for $438 million. Israel claimed that *Omrix's* patents regarding a unique biological adhesive for bleeding prevention and encouraging rapid healing in surgery or injury was developed by an employee of *Sheba Medical Centre* (owned by the state), using the hospital's resources, research infrastructure, budget, and the assistance of other specialists employed by the state. Therefore, the state argued that the biological adhesive and the patents claiming it are "service inventions" under Israeli Patent Law and all the rights in them belong to Israel. After years of litigation, the case was settled outside court.

2.1.3 Perform an IP Search and Freedom-to-Operate Analysis

A value-enhancing practice in the early stages of the start-up is to perform an IP search to, inter alia, confirm novelty and understand the patent landscape in the respective field. Founders should be made aware that no IP search is complete and that the cost of such a search will determine the scope thereof.

It is recommended to focus the search on potential competitors to better understand the risk involved. Freedom-to-operate analysis is very hard to complete at this stage, as the start-up's product is usually not well defined and probably will change before the launch.

Performing an IP search at this stage can potentially save you a lot of time and money. Our client, an Israeli start-up evolving media experience technology, performed an IP search and discovered that there was a registered patent very similar to their solution. They also discovered that the company that owns the patent was only a few buildings away from them. They ended up purchasing the registered patent, saving money and years in development and prosecution.

2.1.4 Non-disclosure Agreements (NDAs)

The seed and the pre-seed stages are often characterized in communicating the abstract idea to friends, family members, investors, and potential clients to validate the idea and obtaining funding.

The best course of action regarding communications with third parties at the early stages of pre-seed and seed is to expose as little as possible while obtaining a signed non-disclosure agreement (NDA), protecting the start-up's core IP assets.

2.2 Phase 2: Start-Up (Minimum Viable Product)

The start-up stage is when the start-up has obtained funding to build a working product with minimum necessary features (MVP – Minimum Viable Product) in order to get feedback from the market at a relatively low entry price. At this stage, the start-up usually still has few resources but has a better understanding of the implementation of the conceived product or service and its unique features. This stage is usually correlated with the pre-seed or seed funding stages.

2.2.1 Evaluate Core IP Assets

At this stage, it is crucial to make sure that novel aspects of the MVP are covered by patent application(s). A set of claims which read on the MVP should be drafted and described fully in the specification.

However, as the patent prosecution process takes time and the product is still primal, the best practice is to cover every possible implementation of the invention for both present and future products. The MVP will most likely change based on data gathered from users and developers' post-deployment, so it is important to describe the MVP as only one example of implementation of the invention(s).

However, bear in mind that filing patents for future products may create prior art, so adding future implementations to the inventions should be done carefully. On the one hand, the patent should include various aspects of the products and different implementations. On the other hand, there is a risk in including future implementations that are not fully known and understood because they can be regarded as not inventive and therefore not patentable, and in the future, it can be cited against the start-up's future patents that will have sufficient inventive solutions and enabling subject matter.

A common action to reduce cost at this stage is filing a single application that describes multiple inventions. Of course, this practice is not optimal for the company's IP portfolio, as it might compromise the full description of the inventive concepts for reducing costs, but the "lean" budget in this phase of the start-up might require reducing patent costs. This, too, should be done carefully, as anything less than a full description of the inventive concepts may deem the application unpatentable and still create prior art for actual fully described future patents of the start-up.

Finally, patent applications are public. The application readers are not only the patent examiner but also potential investors and competitors. This means that the application should be drafted to include the business story behind the start-up, not just the technology. Furthermore, the application's language should be simple and clear to allow readers who are not "skilled in the art" to understand the claimed technical solution. Efforts should be given to make sure the benefits of the claimed technical solution are clear and not too technical or legal to the reader. The application can potentially prevent others from raising funds for the same solutions, and therefore clarity in drafting patent applications is very important.

2.3 Phase 3: Growth (Product-Market Fit)

2.3.1 Update Patent Applications

At this point in the life of a start-up, the product or service has evolved from the MVP in accordance with feedback from the market. If the patents filed at an earlier stage were not registered yet, the best practice is to examine the possibilities for changing the claims in the application filed so that the patents will be better aligned with the actual working product. Furthermore, more inventions can be created around the product that needs to be patented as well.

If a patent is already granted at this stage, filing for one or more continuing patent applications, which are patent applications that add additional claims to inventions disclosed in the application of the granted patent, is highly recommended. This is because competitors might show up in the future and the granted protection might still be partial or slightly different. Another option is a continuation-in-part application (CIP). This is an application in which the applicant adds subject matter not disclosed in the parent application, but which repeats a substantial portion of the parent's specification and shares at least one inventor with the parent application. This possibility is valuable only when the invention has not been disclosed publicly outside the filed parent application and the parent application was not yet published

In many of the cases we have handled, we filed for a patent based on the MVP and the patent was approved. At a later stage, after the product changed and improved, we filed for a continuing application in order to align the claims to the improved product.

For example, a patent application reciting a product defined to identify reflux in ventilated patients and controlling a mechanism for preventing reflux content from arriving in the lungs was used as a basis for a continuing application with claims reciting a device for controlling feeding rate in ventilated patients. In another example, a patent application reciting a system for identifying violent human behavior was used as a basis for a continuing application with claims reciting a system for identifying crowd gathering.

In another case, right before filing for a continuing application, we discovered that competitors filed for a similar patent. This gave us the chance to include the claims of the competitors in the continuing application, saving significant costs.

2.3.2 Monitor the Market for Patent Infringements

Introducing the product to the market might lead to potential infringements. Not acting on infringements can potentially lower the level of protection of the invention and may have negative implications on the prosecution process and the general legal standing.

Closely monitoring the market throughout the prosecution process is essential, regardless of the status of the applications (registered or still in examination). If the patents are already registered, filing a continuation patent can potentially add claims to cover the new use. If the patents are not yet registered, the best course of action is to amend the claims to cover the newly discovered use by a competitor.

2.4 Phase 4: Maturity

When a start-up reaches the maturity stage, it is usually when the product or business model was proven to be profitable, and the company has started generating revenue.

At this stage, the founders will have to decide on a course of action – whether to keep growing and expanding the start-up into an operating company or to exit and sell the start-up to a larger entity. Growing the start-up's IP portfolio is the best practice in both cases. The IP strategy changes for each course of action. Moreover, IP expenses can now be managed with the understanding of which innovation is more valuable for the business. Renewals and continuing application filing can be managed accordingly.

2.4.1 Exit Strategy

Exit strategy revolves mainly around the start-up's valuation. It is done by reviewing all of the IP assets owned, used, or acquired by the start-up to assess, manage risk, and implement best practices in IP asset management. The key is to use the company's IP assets, whether they are registered, undergoing an examination, or still being conceptualized, to get a higher valuation of the start-up. One example would be splitting existing applications into divisional applications and keeping the initial patent applications alive for as long as possible.

Another value-enhancing practice is to explore the IP portfolio and IP strategy of potential buyers, to perform the right adjustments to the start-up's IP portfolio, if necessary, to increase the chances of an exit.

The company's IP portfolio should cover the company's sales pitch. Here is an illustrative scenario: There is a certain problem in a certain industry, and the company has the best technical solution for it because of A, B, and C. The company's patent portfolio should include patent protection for A, B, and C. As the company's solution changes, the sales pitch changes as well, and the patent portfolio must remain dynamic throughout the prosecution process to include these changes by filing continuation patents and amending claims at each stage of the development.

Also, founders should try and map future developments of potential buyer companies. Covering these developments with valid granted patents can have a substantial effect on the buying price and chances.

When our clients have an exit strategy, we make sure their IP portfolio is aligned with what their potential buyers are looking for. For example, a start-up developing a solution that is based on add-on tools for CRM systems should cover not only the architecture of a system independent from the CRM system but also an architecture of a CRM integrated with the solution provided by these add-on tools. In one example, we have drafted patent applications that are related to how to adapt data presentation for client manufacturing hardware sensors, as it was clear that the potential buyers will use the sensors in their platforms. If possible, we file for continuation applications to cover all aspects of what potential buyers are in the market for.

2.4.2 Expansion Strategy

At this course of action, it is the best time to start investing in building its IP portfolio to achieve a better position in the relevant market. Acquiring different IP rights that align with the company's business plan and expansion strategy is a key step for achieving market domination.

Expanding the company's IP portfolio can be achieved by purchasing specific IP rights, acquiring companies holding relevant IP rights, and obtaining licenses of relevant IP rights. Purchasing IP and obtaining licenses is another way to align the company's IP portfolio with the company's sales pitch.

3 Industry-Specific IP Hacks and Recommendations

3.1 Artificial Intelligence

In the last decade, data-driven technology and greater computer power have led to what has been described by WIPO (World Intellectual Property Organization) as an "AI patent boom." The AI patent boom is happening worldwide and especially in Israel.

When applying for AI-related patents, make sure to acquire patent disclosure that will facilitate implementation of the invention on more than one model. Point of novelty in AI inventions may include novel features, novel pre-processing of data before it is fed into the ML model (e.g., novel training datasets), and novel architectures of ML models.

Include claims in the application for both the training and inference phases, and, if possible, for the user interface. For example, a client invented an AI product involving a search process. We filed for patents not only on the algorithms and the training and inference/classification phases but also on the interactive interface of how the results of the search are shown.

When talking about training, consider the structure and contents of the training data and/or how it is obtained. Consider intermediate phases, like pre-processing, embedding, or the like, which may be non-obvious.

Another recommended practice is formulating the description and claims to detail and elaborate on specific hardware configurations (if existent) dedicated for the training phase and specific hardware configurations (if existent) in the utilization/inference phase. These configurations may be different and unique.

Finally, when it comes to AI patents (and other software-related patents), it is important to understand how the start-up will detect infringements.

3.2 Internet of Things (IoT)

The technology that enables a smart home, smart office, smart car, and more is the ability to connect certain objects to the internet. When applying for IoT patents,

consider similar technologies for connecting objects, like pairing with Bluetooth and RFID technology.

When drafting the claims, focus on security, energy savings, data protocols, and processing location (IoT or Server-side). Furthermore, consider adding a claim for a kit and a method claim for installing a network of IoT devices. Also consider patenting the interactions between the devices, the servers, and the users, and not just the algorithms behind them. When considering similar technologies for connecting objects, try to identify features that differentiate the IoT implementation from the "common" or "known" other technologies. But if such differentiation can also be used in an inventive manner in the "other" technology implementations, this should be clarified.

3.3 Automotive and Smart Mobility

Over the last few years, there has been a significant increase in the number of Israeli start-ups operating in the shared mobility economy, fleet management, big data for transportation, connected vehicles, autonomous driving, and e-mobility.

The number of automotive patents filed to the *Israeli Patent Office ILPTO* increases each year. When prosecuting automotive and smart mobility related patents, make sure to cover specific advanced driver-assistance systems (ADAS) protocols. Furthermore, consider covering infotainment aspects, unmanned aerial vehicle (UAV) control, and semi-autonomous aspects of the technology. If applicable, consider an image-processing application, which may apply to other non-automotive cases. Take into account static versus dynamic, lighting, and other problems which arise in the automotive domain. Also, make sure to cover training, testing, verification, and validation of autonomous systems.

When it comes to smart mobility, since the full adoption of the new technology is unknown and varies between countries, make sure to include claims that will cover intermediate cases where only a part of the technology is actually applicable. For example, if the technology involves UAVs, the regulation and environmental infrastructure around the technology is constantly changing, so make sure to take into account situations where the technology cannot be fully implemented.

Furthermore, check local regulations and privacy matters, as they are a major issue in this industry.

3.4 Blockchain and Cryptocurrency

Blockchain-based technological solutions emerged only a few years ago and are now being used in various everyday life applications. Israel is home to hundreds of blockchain start-ups and R&D centers.

When drafting blockchain-related patents, draft the claims for the client side, server side, and the network as a whole. Take into account various smart contract

protocols and try to avoid using traditional financial practice words (e.g., transaction, funds, bonds, etc.).

Furthermore, since the basic technology behind blockchain is well known, the patentable aspects in blockchain products will be the adjustments or modifications made to that technology and its incorporation in other commercial solutions. We have examples of adapting blockchain architecture to support bidding, insurance, and even DNA data registries.

Even when the use case is financially based, such as for cryptocurrencies and financial transactions, focus on the technical solutions to a technical problem that arises. Since blockchains are a new technology, such technical problems that arose are unique to this technology and were not encountered in traditional currency/financial worlds.

3.5 Digital Health and Telemedicine

Israel has made digital health and telemedicine a national priority, with huge budgets to support start-ups in that field while encouraging collaborations between health organizations, research institutions, start-ups, and independent researchers.

When applying for a patent in digital health and telemedicine inventions, consider protecting the user experience (UX) of the product. The UX should not be mere presentation of data but be structured in a unique way to help the user do something technical, such as solve a technical problem. Described feedback loops and/or user interactions. Some inventions in this industry are aimed toward specific health-care regulations in specific countries. The application should be written with a focus on the best practices in writing applications in those countries, contrary to the general practice of "fit-to-all" applications.

Furthermore, make sure to check local regulations regarding limitations on medical treatment and privacy matters.

4 Learnings and Takeaways

Takeaways

- A typical start-up will go through certain stages in its life cycle; each has its own characteristics and challenges that directly affect the strategy for intellectual property in general and patents in particular.
- The start-up's IP portfolio is its most valuable asset. The IP strategy has to go hand in hand with the business plan and the stages of the start-up, from the inception of the company to its maturity, as demonstrated in the guidelines and real-world examples discussed in this chapter.
- Furthermore, the "Israeli way" of creating extremely successful start-ups involves a great deal of creativity, thinking outside the box, perseverance, and the ability to fail, learn, and repeat.

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Roy S. Melzer manages the Computing Technologies of Ehrlich Group in Israel. His department focuses on drafting and prosecuting patent applications for various computer-related inventions. Mr. Melzer is an expert at the prosecution of patents in Israel and the United States. He has substantial expertise in developing IP portfolios for start-ups and providing due diligence analysis and freedom-to-operate opinions.

IP as a New Value Driver for Sustainable Start-Ups

Sven Gensler, André Brosowski, and Philipp E. Hammans

1 Sustainability as a Value Driver

1.1 Today Billions of Dollars in Wealth Are Being Redirected

When Nathaniel Mayer Rothschild established a fund in 1885 to offer "commodious and hygienic homes" for the working class in East London – and a 4% return for investors – he became one of the United Kingdom's first investment impact managers (Naumann, 2020). But even with the fund's popularity, both for people living in affordable homes and for developers, it would take more than a century for the impact industry to gain momentum. The term "investment impact" was coined in 2007 and refers to projects intended to produce a positive social or environmental result. According to the *Social Impact Investment Network* (GIIN, Annual Impact Investor Survey, 2020), a non-profit organization, the industry is now worth $715 billion. According to the *Global Sustainable Investment Alliance* (PwC, 2020), $30.683 trillion of assets were managed under sustainable investment strategies in 2018. It was an increase of 34% from 2016 (Table 1).

Across the globe, the demand for investment effect is rising. Investors are keen to prove that they are generally a force for good – that profit is not their sole goal. A new survey of wealth managers conducted by the *Global Impact Investment Network* (Hand et al., 2020) showed that 86% of respondents said they risked investing due to client demand. In North America alone, over the next three decades, at least $30 trillion in income will be shifted from *Baby Boomers* to *Generation X* and *Millennials*, according to *Accenture* (2021). Younger investors significantly prefer sustainably motivated investment strategies and spend more on them. *Barclays*

S. Gensler (✉) · A. Brosowski · P. E. Hammans
Jenabatteries GmbH, Jena, Germany
e-mail: sven.gensler@jenabatteries.de; andre.brosowski@jenabatteries.de; philipp.hammans@jenabatteries.de

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_3

Table 1 Global sustainable investing assets in billion $, 2016–2018 (PwC, 2020)

Region	2016	2018
Europe	12,040	14,075
United States	8,723	11,995
Japan	474	2,180
Australia/New Zealand	516	734
Total	22,890	30,683

Note: Asset values are expressed in billion $. All 2016 assets are converted to USD at the exchange rates of year end 2015. All 2018 assets are converted to USD at the exchange rates at the time of reporting

(Barclay ESG Report 2019) found that investors' most important social and environmental causes are rooted in the 17 *Sustainable Development Goals (SDGs)* in a new study. In brief, a potentially disruptive convergence has started to occur between core SDGs and private investors' urgent interests. Schroders' (2018) *Global Investor Survey* of 22,000 investors found that three-quarters of respondents stated that sustainable investments had become more important to them over the last five years. It was driven by younger generations (those 18–44 years old) at 83% compared to 66% for those aged 45 and over. A 2015 *PwC* survey found that more than 70% of businesses were planning to engage with the SDGs, and 90% of citizens thought it was important that companies committed themselves to advancing the SDGs.

Similarly, a *CFA Institute* 2017 survey (OECD, Social Impact Investment, 2019) of 1,145 investment industry leaders found that 73% expect social, environmental, and governance factors to become more influential. The 2017 *Morgan Stanley Institute for Sustainable Investing* survey (GIIN, Annual Impact Investor Survey 2018) found that of 1,000 individual investors surveyed, over three-quarters reported interest in "investments in companies or funds which aim to achieve market-rate returns while pursuing positive social and/or environmental impact" (OECD, Social Impact Investment, 2019). Similarly, 80% of respondents reported that they were more likely to pursue sustainable investments if they could be tailored to their impact areas of interest. As much as $269 trillion – financial reserves owned by institutions and families worldwide – is currently open for investment. If just 10% of this were channeled to investments targets that enhance the environmental performance, it would deliver the support required to meet the SDGs, including promoting a transition to a low-carbon future.

1.2 The Global Impact Investment Market Is Growing Rapidly

The global impact investment market is snowballing and is increasingly attracting interest from mainstream commercial finance, including institutional investors, asset managers, and multinational companies. Trends indicate that impact investment is a growing market for new entrants and those already operating in the market looking to increase their portfolio commitments (see Fig. 1).

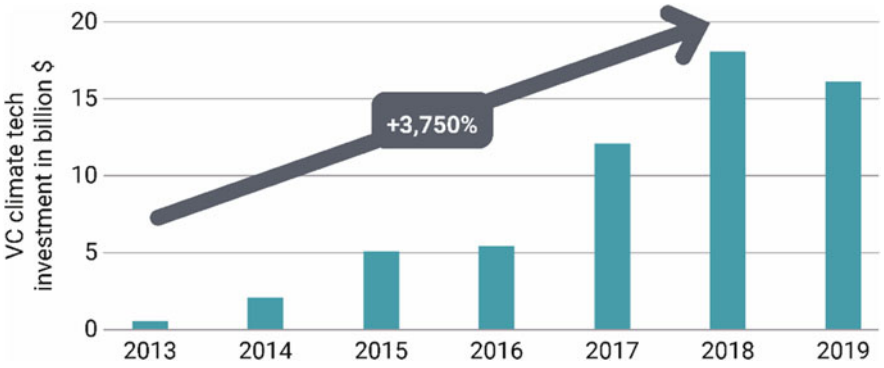

Fig. 1 Venture capitalist investment in climate tech in billion $ (authors' own illustration based on PwC, 2020)

Social and environmental impact investors provide financing for enterprises addressing various SDGs challenges and seek an explicit and measurable return. To do so, they often aim to support the piloting of innovative solutions to address sustainability issues more effectively and efficiently. At the same time, transparency is the cornerstone of a strong relationship with investors. A growing number of entrepreneurs are addressing SDG-related needs by creating sustainable business solutions. Companies address the challenging market through innovative products, services, and business models. Innovation is therefore a norm to transform businesses toward sustainability, while intellectual property (IP) can provide the basis for the necessary transparency. IP aligned with the globally agreed SDGs can increase the value of the company's IP and consequently the commercial success while at the same time creating a societal and environmental impact.

2 A Changing Investment Landscape

2.1 A New Investment Landscape Has Been Formed

As standardization increases and regulatory pressure builds, we will see a situation in which more capital is available to companies within a particular sector that are more sustainability compliant or more sustainability friendly. Against that backdrop, the whole situation catches a breath of fresh air since the consumers want and demand more and more sustainable products and production processes. As enormous consumer pressure builds, many expectations are raised around environment, social, and governance (ESG), the SDGs generally, and their values and purpose in particular. There is a greater need for better standards for ESG and the SDGs as a risk framework. The emergence of ESG/SDGs as a critical factor in markets across the United States, Europe, and Asia-Pacific has highlighted the emergence of regulatory reporting requirements and other stakeholder pressures. Although key strategic

drivers are still likely to be prioritized ahead of ESG/SDGs, we see governance continue to gain traction. That said, investors tend to play a significant role in driving outcomes, and we have witnessed a considerable shift in the last five years by private equity investors and sponsors. ESG/SDG principles are now generally baked into investment and value-added strategies.

Because purchasers need to be aware of the risks that they could be inheriting when they acquire a target or invest in a business, and given the increased importance of ESG/SDGs from a reporting standpoint, to gain an accurate picture of ESG/SDG-related risks and opportunities, acquiring companies need to have good data. Investors have some challenges assessing ESG/SDGs' metrics against appropriate standards. The reporting requirements tend to vary from market-to-market companies, generally reporting on different frameworks or standards at times with limited transparency regarding the direct link with financial performance. Rating agencies also appear to weigh other metrics in different ways. Implementing a uniform approach to measuring ESG/SDG factors should make it easier for investors to value assets, assuming one can recognize the correlation between ESG/SDG performance on the one hand and financial value creation on the other hand. While negative and positive screening has become increasingly sophisticated in the last decade, the SDGs provide a new opportunity to measure the ESG risk that companies bring to the portfolio alongside their real-world sustainability impact. Tools to benchmark corporate performance against the SDGs could be transformational. SDG-based scoring methodologies are needed to determine companies' contributions to the SDGs and to exclude companies or to increase allocations accordingly. A new complementary method to extant technology and innovation valuation methods to valuate new ventures should incorporate such SDG-based scoring methodologies.

2.2 Climate Protection as a Benchmark

There is no doubt that a focus on sustainability and green technologies has moved into the mainstream in the financial world in just a few years. However, it is hard for that capital to sort out a better ESG/SDG player versus a worse one since there is no standardization or consistent benchmark. The *German Climate Change Act* (BR, 2021), which was amended in 2021, has created a legal basis for achieving climate targets. Based on the latest results, Fig. 2 shows the status of target achievement in Germany. Since 1990, almost two-thirds of the target has been completed. Nonetheless, there are significant differences within the six sectors defined by law.

The target still to be achieved by 2030 requires savings of a further 301 million metric tons of CO_2-equivalents. These framework conditions create a high-pressure level, as there are only eight years left to achieve the national target. For this reason, corresponding objectives are embedded in almost all business strategy papers. Those who can significantly contribute to achieving the targets have excellent arguments for investors. IP-protected technologies in these core fields are becoming more interesting for impact investors since their investment could achieve a monopoly status in a critical demand situation.

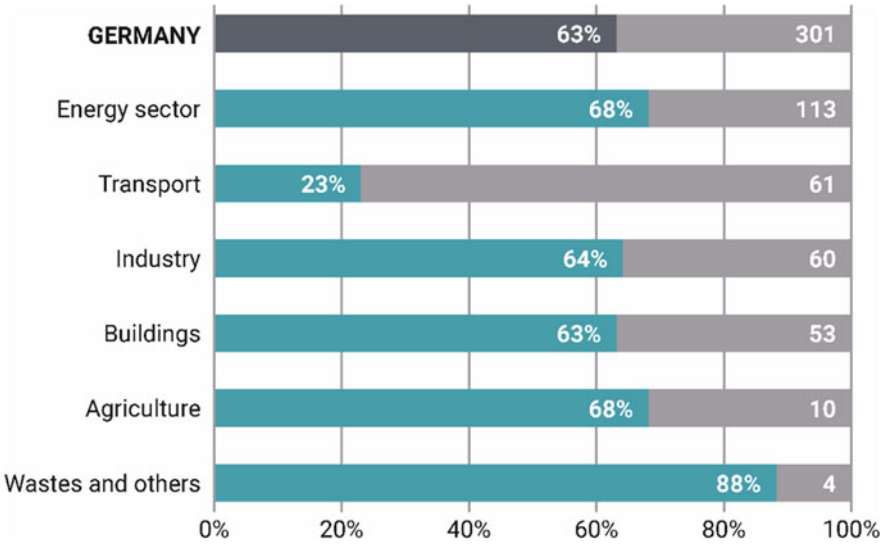

Fig. 2 Current achievement of climate targets for 2030 including million t CO_2-equivalents left (authors' own illustration based on BR, 2021; UBA, 2021)

3 Case-Specific Challenges and Risks

IP offers an economic opportunity to invest. Well-functioning international intellectual property laws and norms improve investor returns and promote inventions and creations. The competitive advantage created by innovation and monetized by the IP system encourages investment in new projects and the advancement of innovation. As a result, growth, development, and progress are accelerated.

To quantify the value of the IP and intangible assets, it is necessary to understand their nature and economic characteristics fully. It is essential to understand that IP assets' value must be considered as part of a business enterprise. Importantly, it must be understood that these assets do not create value by themselves. They may be the core at creating value, but they must be integrated with other assets to be economically exploited. Therefore, valuation projects always have particular and often unique challenges to overcome. Even though the approach and methodology might be the same, the actual valuation project will differ due to the industry, company, and IP portfolio characteristics.

The challenge is to map all important value-relevant influencing factors and to consider the intended use of the IP rights and how it is affected by the SDGs. Two aspects were particularly remarkable in this assessment. On the one hand, sustainable technology enables a long-term business case, allowing realistic milestones. On the other hand, the SDGs' substantial impact was particularly significant. Its market impact has a causal link to the economic benefit and thus influences the concrete future benefit. In detail, we will discuss that IP, in conjunction with the global SDGs,

creates value in business enterprises. The hypothetical license value based on the license analogy of the same technical field and product segment (base royalty rate for a reference case) is assumed with the results obtained. This base royalty rate is then adapted to match the conditions of the present case. We use valuation factors to account for future risks. The valuation factors reflect portfolio-inherent strengths and weaknesses. This approach corresponds to the current IDW (2015) standard version. All needed variables to conduct the economic valuation were compiled by either internal information, external data, or reference data used to calculate IP rights' monetary value.

3.1 Identifying the Valuation Factors

The value of IP rights is determined based on the discounted cash flow approach (DCF), which calculates the value of the IP rights by examining the future cash flows and calculating their discounted cash value in consideration of potential risks. An essential point in the valuation is the market causality. An IP asset delivers value if linked to a technology or product, generating revenue. This relationship indicates if the company's SDGs and services can be matched down to the IP asset level.

Technological valuation factors consist of technical cohesion, product-process correlation, technological competence, competition-related valuation factors, technological competition, forward and backward citations, and rivalry in the competitive environment.

The legal valuation factor is compiled by legal status, remaining lifetime, geographical coverage, ownership, contracts, and patentability. Questions about patentability, invalidity, and longevity must be summarized using inconsistencies in patent life cycle modeling, which might vary significantly between valuation projects. Product and technology life cycles influence these maintenance activities/motivations. Since 2019, the *German Climate Change Act* has demanded binding mitigation of greenhouse gases. The debate on its revision in 2021 highlights the need for consistent integration of the formulated targets into business strategies. To control these processes appropriately, continuous operational management must measure and improve emissions and other impacts on sustainability. Any company with transparent and understandable communication on this topic not only has considerable advantages from a legal perspective but can also use the results specifically to increase its market value. Against the background of the social debates on sustainability and political actions like the *European Green Deal*, a consistent and convincing focus on relevant sustainability goals in the business strategy will lead to competitive benefits. The critical point is to avoid redundancies within the factors. There might be overlaps within the technological, legal, and market assessment.

An effective progressive discount rate accounts for general economic and demand potential and uncertainties. The discount interest rate is calculated using the weighted average cost of capital (WACC). This economic aspect considers potential economic risks such as cost risk, consumer acceptance, business dynamics, and

competitiveness measures/competitor activities. Especially here, the SDGs came into play. They influenced the market acceptance and modeled the exploitation scenario, ultimately linked to its substantial effect. The SDGs are influencing factors that are modeling the exploitation scenario. A central aspect of that is the substantial impact in the market, the patent for value generation. The market impact is the prerequisite for economic benefit and, consequently, a concrete future financial benefit. The SDGs strongly influence the economic impact factors. For example, they determine the protected technology's market potential, strengthening the unique selling proposition. Precisely, the SDGs determine forecasted product sales.

Complementary goods can be, for example, technical and/or market-relevant know-how, as well as other necessary resources for the implementation of the technological invention or the planning of corresponding market access. The quantity and quality of such complementary goods influence the possible economic benefit and strongly depend on the SDGs, affecting the market acceptance. The SDGs also influence the economic effect of the complementary goods equipment.

Over the past year, we have evaluated many tech start-ups focusing on sustainability in the broadest sense. Success stories accompany this process. All projects have one thing in common: The SDGs influence the sustainable tech start-up's business model. The technology is usually developed with the fulfilment of the SDGs to build the heart of the business model, significantly impacting commercialization (see Fig. 3).

A business model comprises the actual realization path and the necessary means to operate a business in the market successfully, particularly the architecture of value creation, generating revenues, and the value proposition to customers and investors. Exclusivity takes place in all areas and thus attains an interdependent effect. The SDGs generate synergistic effects by interacting with other intangible assets, such as marketing strategies or R & D strategies, which influence strategic concepts.

Summarized: The compliance and realization of SDGs define the context of use, which simultaneously enables the concrete exploitation of the protected technology. In this respect, the SDGs have a regulative and contextualizing function in the actual exploitation scenario. The technical property rights' valuation factors attempt to achieve the most realistic future technological and economic scenario. The methodology uses the legal risk factor, the technological risk factor, possible synergy effects, and the financial risk factor to increase or decrease the assets' assessed future earnings to achieve a monetary value.

3.2 The SDG-Rating Tool

The valuation factors explained above usually range from 0.8 to 1.2. Values smaller than one reduce the valuation result, whereas values greater than one increase it. However, the measurement of sustainability in the sense of the SDGs has not yet been defined by international standards or regulations. Consequently, there are countless methodologically highly diverse approaches and results that are not comparable with one another. One way to address this challenge is to ensure full

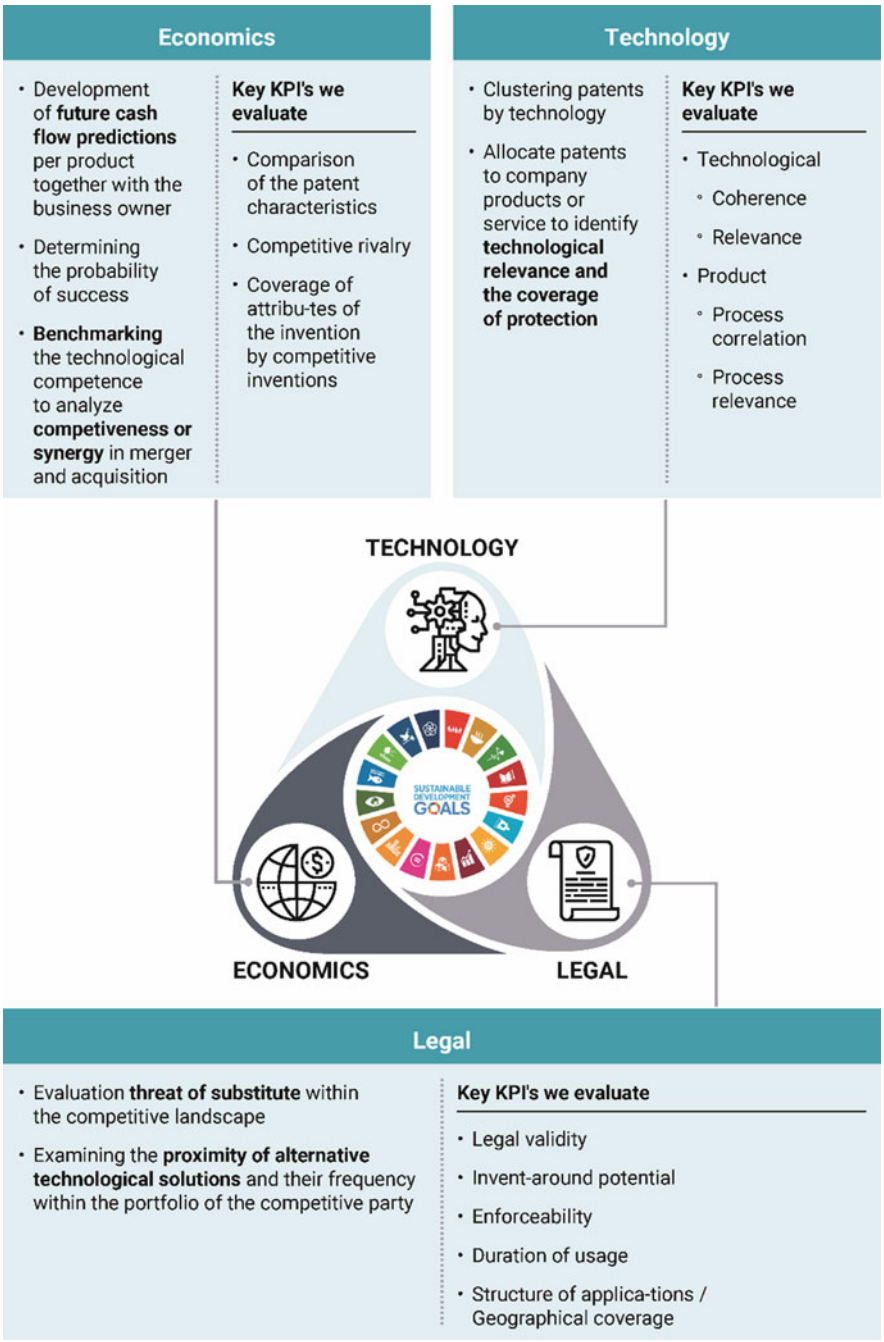

Fig. 3 IP valuation factors including the 17 UN Sustainable Development Goals (authors' own illustration)

Table 2 Matrix for SDG-valuation process (authors' own table)

SDG	Relevant	Sub-Goal	Relevant	Indicator	Relevant	Influence
1	Yes/no	1	Yes/no	1	Yes/no	0.8 – very low 0.9 – low 1.0 – medium 1.1 – high 1.2 – very high
...		...		...		
17		169		248		

transparency of the assessment methodology. Following the idea that a valuation is an expert's best guess, the following section explains how a systematic approach can be used to generate reproducible, quantitative, and thus comparable valuation results. The associated Excel tool "*SDG-RATING*" is available as a data attachment and can be used free of charge under a CC-BY 4.0 license. The aim of the tool is to generate a multi-criteria assessment factor that can be used to describe the sustainability impact of a company. The SDGs consist of 17 targets, 169 sub-targets, and 248 indicators. In this context, the methodological approach requires both SDG evaluation and SDG rating, which can be divided into three main steps:

SDG valuation:

- Step 1: Identification of relevant indicators
- Step 2: Assessment of company impact on the indicators

SDG rating:

- Step 3: Determination of a weighting of the sustainability dimensions

The SDG valuation can be performed by using the structure outlined in Table 2. First, it is necessary to decide which of the 248 defined indicators are relevant for the company to be evaluated (step 1). This automatically results in associations with the sub-goals and SDGs. Subsequently, the expected impact of the company on the indicator must be determined on a five-point valuation scale (step 2). The assessment can be done on a qualitative or quantitative basis. Due to the lack of international standards, the possible range is huge. For example, the saving of greenhouse gases (SDG 13) through entrepreneurial activities can be highly relevant. However, 5,000 metric tons may be irrelevant against the backdrop of climate targets for an entire country. As long as there are no defined reference systems or standards for this, the plausibility of the choice of factor is what matters most in this step.

Once all 248 indicators have been assessed, the SDG-rating scheme can be defined (step 3). Following Rockström and Sukhdev (2016), the 17 SDGs can be classified into the impact dimensions of Biosphere, Society, and Economy. Individual SDGs are assigned to these dimensions accordingly. The SDG tool allows a weighting of the three dimensions and, in addition, a weighting of the individual SDGs in the respective dimension (see Fig. 4). This determination leads to an individual relevance of an SDG within the company assessment. The previously

DIMENSION		SDG				SDG RATING				
NAME	WEIGHTING	#	NAME	WEIGHTING	*Check*	SDGs TOTAL RELEVANCE	SDG-VALUATION	SDG-SCORE	RESULT PER DIMENSION	OVERALL RESULT
Biosphere	20%	6	Clean water and sanitation	10%	*100%*	**2%**	0.9	0.09	**0.99**	**1.082**
		13	Climate action	50%		**10%**	0.9	0.45		
		14	Life below water	10%		**2%**	1.2	0.12		
		15	Life on land	30%		**6%**	1.1	0.33		
Society	40%	1	No poverty	10%	*100%*	**4%**	2.4	0.24	**1.19**	
		2	Zero hunger	10%		**4%**	1.1	0.11		
		3	Good health and well-being	10%		**4%**	1.0	0.10		
		4	Quality education	15%		**6%**	0.9	0.14		
		5	Gender equality	5%		**2%**	0.8	0.04		
		7	Affordable and clean energy	30%		**12%**	1.1	0.33		
		11	Sustainable cities and communities	10%		**4%**	1.2	0.12		
		16	Peace. justice and strong institutions	10%		**4%**	1.1	0.11		
Economy	40%	8	Decent work and economic growth	25%	*100%*	**10%**	1.1	0.28	**1.03**	
		9	Industry, innovation and infrastracture	25%		**10%**	0.8	0.20		
		10	Reduced inequalities	25%		**10%**	1.2	0.30		
		12	Responsible consumption and production	25%		**10%**	1.0	0.25		
All	0%	17	Partnerships for the goals	100%	*100%*	**0%**	No rating yet	0.00	**0**	

Fig. 4 Overview of SDG-rating process with an example (authors' own illustration based on Rockström & Sukhdev, 2016)

determined value from the SDG valuation is linked to the relevance of the SDG, resulting in a specific SDG score. These specific values lead to a score per dimension. Depending on the weighting of the dimension, an overall score is calculated based on this. This result finally represents the SDG factor for a reproducible and transparent company valuation.

4 Technology, Legal, Market, and Sustainability Model Risk in IP Valuation (Risk and Data Quality)

4.1 An IP Valuation Project Is Also an Assessment of Risk Potentials

According to its nature, every investment has specific risks associated with it. One of the investor's principal wishes is the comprehensive identification and reduction of risks. If you ask an investor about their biggest wish, the answer "to eliminate the deal risks" would surely rank within the top positions. A pre-deal IP valuation project is an optimal tool for risk assessment. The vital part of an IP valuation project consists of identifying legal, economic, and technical risk potentials within a company's intangible asset portfolio. As we have learned, sustainability and impact now form a newly established fourth risk potential dimension to assess. Those risk assessment efforts can be compared to a due diligence exercise focusing on intellectual property. In the end, the monetary value attributed to an IP portfolio is also a product of different risk factors.

4.2 What IP-Related Risks Are Relevant in an Investment Context?

In a knowledge economy, where intangible assets can contribute to a large portion of a company's value, IP-related risks must be taken seriously and assessed comprehensively. Several IP-related risk factors also influence a company's IP value:

- Suppose an IP portfolio mainly contains IP rights applications that are not yet granted. In that case, there is a severe risk that in the case of non-grant or claim scope reduction, a promising technology, product, or idea cannot be made exclusive. It results in limited commercial exploitability and, therefore, a reduced value.
- A lack of freedom to operate and the potential infringement of third-party intellectual property poses the risk of facing infringement lawsuits entailing high legal costs or damage payments. A prohibition against selling goods and services infringing third parties' IPRs will lead to severe revenue losses.
- If the so-called product-IP coverage is insufficient, the product or technology is not appropriately covered by IP rights. It causes a risk of counterfeits emerging. This risk potential should be assessed from a technological perspective (are all

features covered?) and a regional perspective (is the product protected in the relevant markets?).
- Unclear ownership of rights, for example, when there is more than one person or entity listed as patent assignees or if technologies are licensed out or used by multiple entities, always bears risk potential. It is always possible that additional stakeholders might interfere with technology use and exploitation or need to be considered for revenue appropriation.
- A risk that is not directly related to intellectual property but can also be assessed in a comprehensive IP valuation project lacks the market acceptance of the concerned product or technology. Suppose the product or technology does not meet the customers' expectations in terms of quality or price. In that case, investors cannot realize a sufficient return on investment.
- In recent years, companies' sustainability and environmental impact have become significant factors for investors and customers alike. High environmental impact and sustainability-focused business conduct are more prominent than ever in public perception and crucial for customers' product purchase decisions. As a result, the higher a venture's sustainability and impact, the higher investors' return on investment. Conversely, insufficient consideration or negligence of sustainability factors when choosing an investment target may increase investors' risks to realize the desired ROI.

The technology assessment provides an overview of the technology's relevance and protection coherence. It is also assessed whether the whole product, including the production process and the subsequent distribution, is covered by IP rights, such as product and process patents and a product or service trademark. The IP rights are clustered per technology and allocated to products or processes to identify their technological relevance and protection coverage.

The economic assessment sheds light on future cash flow predictions based on market conditions and the competitive situation. To reduce the risk of investing in a company not acting sustainably or environmentally friendly, a particular focus can be laid on sustainability by incorporating the degree of contribution to the 17 SDGs into the assessment. Companies, products, and technologies that do not consider sustainability factors or are even detrimental to SDG fulfillment bear a higher risk for lack of market acceptance. In addition, the quantitative contribution to one or more SDGs is also of high importance. If a specific SDG is highlighted while the actual contribution is quite limited or not measurable, there is an increased risk of credibility.

5 Learnings and Takeaways

In 2013, nearly $418 million was invested in early-stage climate technology ventures. Overall venture capital, on the other hand, increased by more than 3,750% in 2019 to $16.1 billion. These assets, which include IP, provide a considerable competitive advantage and future revenue. Consumers are becoming more

conscious of their social and environmental footprints, acting as demanding customers or attentive investors.

In 2007, the term "investment impact" was established to describe initiatives intended to have a beneficial social or environmental impact. According to the Social Impact Investment Network, the business is currently valued at $715 billion, a non-profit organization. Investors want to show that they are typically nice people who aren't just looking for a quick buck. In summary, a potentially disruptive convergence between fundamental SDGs and private investors' pressing interests has begun to emerge. The worldwide impact investing sector is exploding, attracting mainstream commercial finance players such as institutional investors, asset managers, and multinational corporations. Social and environmental impact investors fund businesses that solve specific SDG challenges and seek a transparent and verifiable return. In just a few years, a focus on sustainability and green technology has made its way into the mainstream of the financial sector. However, because there is no standardization or uniform benchmark, it is difficult for that capital to distinguish between a better ESG/SDG player and a poorer one.

Tools for comparing business performance to the SDGs might be game-changing. Market-to-market enterprises' reporting obligations vary, and they often report on several frameworks or standards, with minimal transparency regarding the direct relationship to financial performance. Corporations' contributions to the SDGs must be determined using SDG-based scoring techniques, and companies must be excluded, or allocations increased proportionately. These assets may provide a significant competitive advantage as well as future revenue. When an IP asset is tied to a technology or product, it generates money. This connection shows if the company's SDGs and services can be traced back to individual IP assets. If you ask an investor what their greatest wish is, "to remove deal risks" will almost certainly be on the top of the list. A pre-deal IP valuation exercise is an excellent way to analyze risk. Identifying legal, economic, and technological risk potentials within a company's intangible asset portfolio is an important aspect of an IP valuation process. Such risk assessment efforts are comparable to a due diligence process focused on intellectual property. Finally, the monetary value assigned to an IP portfolio results from several risk considerations.

IP rights are grouped by technology and assigned to items or processes to determine their technological significance and protective scope. The technology assessment gives a broad overview of the technology's applicability and protection consistency. The economic valuation provides insight into future cash flow projections based on market circumstances and the competitive landscape. An IP valuation project includes many components and features of IP due diligence. An investor receives a full risk assessment and analysis, especially when sustainability risk considerations are included in the valuation approach.

Takeaways

- IP valuation considering the 17 UN Sustainable Development Goals (SDGs) as parameters can provide a future-oriented method as a crucial measurement for impact investors.
- A monetary valuation of intangible assets is always a best guess. It is important to document relevant valuation facets and to achieve maximum transparency and traceability.
- A pre-deal IP valuation project is an optimal tool for risk assessment as the vital part of an IP valuation project consists of identifying legal, economic, and technical risk potentials within a company's intangible asset portfolio.

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Dr. Sven Gensler holds a Master of Law (LLM) with a Dr. rer. nat. in Neurobiology and Cell Biology from the University of Heidelberg, Germany (dissertation at the Max Planck Institute for Medical Research), with extensive national and international patent law and IP management knowledge. He is an experienced patent professional, business manager, and market intelligence analyst with long-term experience in large biotechnology organizations, intellectual property consulting, and renewable energy. During his career, he has worked closely with IP attorneys, R & D, and business leads to create and protect existing and new business through business strategy, corporate development, and corporate financing engaging with new industries and IP portfolio creation. As an intellectual property consultant, he has supported many start-ups. In addition, he is an expert in intellectual property, innovation, technology, and know-how valuation. Dr. Gensler has lived and worked in Italy, France, the United Kingdom, and Germany and is now calling Munich home.

Dr. André Brosowski is the Chief Sustainability Officer at Jenabatteries GmbH. For more than a decade, he has been working in the field of impact assessment, valuation of resource availability for a sustainable bioeconomy, and multicriteria geodata analyses. In this context, he has formed and led an interdisciplinary working group in a federal research center. During his career, he has developed and coordinated numerous national and international research and consulting projects, worked as an adviser for several federal ministries and the GIZ, and in addition to his scientific work, he also founded a spin-off to combine his research with entrepreneurial work. He holds a diploma in Geography and a PhD in Economics and Management Science from the University of Leipzig, Germany.

Philipp E. Hammans is the CEO of Jenabatteries GmbH, one of the most sustainable and scalable large battery systems in Europe. He is a technology and innovation enthusiast and strategist with a long international track record (over 20 years) in IP, IPRs, technology, and innovation management and consulting. He was previously Global Head of Innovation & IP at JENOPTIK AG, Head of Technology & IP at Clyde Bergemann Power Group, and Lead Consultant at Dennemeyer IP Consulting. He holds degrees in engineering, economics, and law (M.Eng., M.Bus., Pat.Eng., LLM) and is a trained M & A, process, and project manager, as well as qualified in innovation psychology. He was the lead (impartial) appraiser in many different projects with international reputations and visibility.

Mining IP: A Story of Start-Ups in the Global Mining Industry

Dallas L. Wilkinson and John Walker

1 The Mining Technology Revolution

The mining industry is a large global industry which fuels significant innovation each year as the demand for more materials, in particular critical minerals, increases while navigating the challenges and demands of operating in a rapidly changing world intensifies with a "never seen before" transparency.

Mining houses strive to compete in an industry which is seeing significant demands for new technology and embracing global trends, including:

- Environment:
  - Decarbonization (reducing carbon output to Net Zero by 2050)
  - Carbon capture (capturing carbon from processes to render it inert)
  - Climate change and global warming
  - Rehabilitation of sites post-mining
- Energy:
  - Efficiency (efficient use of all aspects of energy use)
  - Transition to green energy (energy which is renewable)
  - Alternate fuels, electrification of fleet and equipment
- Digitization:
  - Big data including data analytics and application of sensors to grow data sets of critical information
  - IoT – data generation, curation, storage, and use for decision-making
  - Machine learning, artificial intelligence
  - Creation of digital twins (a digital model of a physical process)

D. L. Wilkinson (✉) · J. Walker
Dennemeyer / Enhanced Performance Business advisory, Sydney, NSW, Australia
e-mail: dallas.wilkinson@epba.com.au; jwalker@dennemeyer.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_4

- Automation and robotics:
  - Automation of processes, systems, and procedures using equipment purpose built to ensure efficiency
  - Application of robotics to reduce repetitive work
- Environment, Social, and Governance (ESG):
  - Stricter and more comprehensive expectations from a much wider range of stakeholders, including more vocal communities around mines and traditional land owners
  - Tightening of statutory regulations (e.g., more legislative control on environmental aspects of mining, including rehabilitation, exploration, and operation)
  - A generational change
- Geopolitics:
  - The dynamics of global politics impacting mining, including exploration, mining, and mining rights, especially in relation to investment
  - Overlay of regional politics and the interplay between regions potentially restricting international activities of global players and commercialization of technology
  - Changing trade policies with changing governments
  - Impacting the ownership and exploitation of IP rights

A more detailed analysis of these trends is outlined in references such as: Top 10 business risks and opportunities for Mining and Metals (EY, 2022), Mining and Metals Scenarios to 2030 (WEF, 2021), Global Mining Outlook (KPMG, 2022), and Tracking the Trends – Redefining Mining (Deloitte, 2022).

As the demand for innovation rises, the mining houses are partnering more frequently than before with suppliers of technology – the *Mining Equipment Technology Services (METS)* sector of the mining industry to supply this technology and drive innovation and disruption. The generation and application of technology and subsequent creation of competitive advantage for the METS company as well as the mining houses have elevated the importance of the role of intellectual property across these sectors. As a result, mining houses are more reliant on METS companies now to partner with them rather than their traditional supplier role. Collaboration is also becoming more important to METS companies that require access to mining sites to more extensively evaluate, rapidly develop, and demonstrate, tailor, and apply technology. Many METS companies are conscious that they have narrow but deep expertise in a specialist area and need help through partnerships to extract value across the value chain – a situation which is positively acknowledged and respected by the mining community. Solutions may also be required to be delivered by several players. In addition, the cost of R & D is increasing as well as the access to critical, scarce skills and resources, so collaboration has become a much stronger and more viable method of rapidly developing and deploying technology. Collaboration also introduces some significant challenges when intellectual property is considered, especially for small to medium-sized enterprises (SME) and in particular start-up companies that need to collaborate to remain viable but potentially risk losing control of their valuable technology and IP. This presents a dilemma of delivering

project outcomes for the larger mining company while resolving conflicting commercialization strategies with partners, which may involve dilution or loss of background IP or project IP or failure to achieve acceptable return on investment (ROI). Some of the major IP-related challenges with collaboration include ownership and rights and terms of use, as well as confidentiality, publication, and the like.

2 Operational Framework of the Australian Mining Industry

Australia is a leading player in the mining industry, which makes a significant contribution to the Australian gross domestic product (GDP). Globally, Australia is one of the largest exporters of coal, iron ore, bauxite, alumina, critical minerals, and many other resources. IP Australia's report titled "Hidden Gems – a Patent Analysis Study on Innovation in the Australian Mining Industry" (2019) indicates that Australia has the largest identified resources of nine major mineral commodities and is in the top five world locations as a producer of 20 important commodities, including gold, bauxite, iron ore, rare earths, mineral sands, lead, zinc, and coal. Another report, "The Australian Mining Industry: More than just Shovels and Being the Lucky Country" (IP Australia, 2015), shows Australia as having the world's largest reserves of nickel and uranium. Mining is therefore very important to Australia's economy.

Mining is by far Australia's single biggest export industry, and resource exports account for around 60% of Australia's total export revenue, or over 10% of Australia's total GDP in the 2019–2020 financial year, with over AUD240 billion.[1] Also, in excess of 45% of all Australian exports pertained to minerals exports. Over 1.1 million full-time jobs have been estimated to be supported by the mining and METS sector in Australia with the sector directly accounting for almost 500,000 jobs (Zakharia, 2021).

The magnitude of this industry creates high demand for the development of innovative and specialized products, processes, and solutions. The METS industry, which services the mining industry, also services other industries and is an important part of the Australian economy. This sector is attributed with revenues in excess AUD100 billion with over 300,000 people employed. Over 65% of METS companies export from Australia to other mining economies and almost two-thirds are involved in collaborative projects (Austmine, 2020).

To understand the roles of the METS sector, an understanding of the structure of the mining industry in Australia is required. The mining companies that own and operate the mines form the most dominant group in this industry. In Australia, *BHP* and *Rio Tinto* are good examples of mine operators. This group is extracting resources from the ground as well as conducting exploration of new mineral deposits and their subsequent preparation and treatment. The METS sector then comprises many categories, including companies that are large international mining equipment

[1] https://www.minerals.org.au

suppliers (e.g., *Caterpillar*, *Komatsu*, and *Liebherr*), large mining design and engineering project consultancies (e.g., *Worley* and *Jacobs*), and traditional product and services/technology application providers (e.g., *Orica*, *Incitec Pivot*, and *Weir*), and, more recently, the modern digital native companies and those that are crossing industries from other technology-thirsty industries, such as space, electronics, software, automotives, and agriculture.

Finally, another group contains research bodies, generally publicly funded, including universities and Commonwealth Scientific and Industrial Research Organisation (CSIRO). Forming a subset of this group are Cooperative Research Centres (CRCs), which are research-based organizations (generally comprising a consortium of entities from research and industry) that receive government funding. The CRC *Ore* is an example of a mining industry focused CRC whose aim is to transform the minerals sector by deploying innovative world-class technology to effect a step change in value across the whole-of-mine system optimizing resource extraction.

Within this framework, METS companies play an important role in the mining industry. Their "clients" might include the mine operators themselves or other METS companies, as well as customers from other industries where the technology can be applied or developed. In fact, in many cases, METS firms might collaborate or form consortia with any of these groups to provide tailored solutions. While METS firms might undertake their own research and development programs, it is not uncommon to undertake either contract or collaborative research with the public research entities previously identified.

The types of activities that METS companies are involved in center on supply technology, as well as services and solutions to the mining industry. Their main areas of operation include engineering design and project management services, equipment supply and maintenance, consultancy services, and basic products encompassing everything from consumables to highly technical and complex products, services, and solutions.

METS companies span a wide range of disciplines across the mining value chain, including asset management, exploration services, safety systems, IT systems, data analytics, software communications and control equipment, environmental services, remediation services, analytical services, instrumentation, materials handling, drilling and blasting, load and haul, crushing and grinding, geotechnical, ground support, equipment parts, and equipment servicing. It is estimated that around 80–90% of the METS firms in Australia are Australian owned and a large proportion of these are SMEs. Recently, there have been many new organizations, with many in the start-up phase attracted to this segment through supplying non-traditional products/services arising from the global trends sweeping across the mining industry, such as those listed above, but in particular, digitization, data generation and analytics, automation, energy alternatives, and ESG. The underlying global competition in the mining industry therefore drives innovation in this METS sector in a wide range of technologies, services, and solutions.

While there are no specific figures on IP usage by METS companies themselves, and given that most METS companies are SMEs, a report by *IP Australia*,

Table 1 Mining Support Services patent filings by Australians by technology type

	Category	Sub category	Sub total (%)	Total (%)
Support	Automation	Automation	0.3	0.3
Services	Environmental	Biological treatment of soil	68.7	1.5
		Environmental		37.5
		Reclamation of mining areas		0.7
		Technologies related to metal processing		7.1
		Technologies related to mineral processing		8.9
		Treatment of wastewater		1.9
		Treatment of wastewater – metallurgical processes		8.7
		Waste disposal		2.4
	Transport	Containers	31.0	3.3
		Control		2.6
		Conveying		5.4
		Hauling		3.1
		Hoisting		5.9
		Infrastructure		2.8
		Rail		3.4
		Shipping		1.0
		Vehicles		3.3

Based on IP Australia (2019)

"Intellectual property rights and enterprise growth: The role of IP rights in the growth of SMEs" (IP Australia, 2021), provides some useful background. This report indicates that SMEs account for about 57% of the nation's GDP. However, in 2017, only 4% of SMEs held registered IP rights, and 90% of these rights were trademarks, around 7% of these were for patent rights, and about 3% had filed for registered design rights. On the surface, these figures suggest that SMEs (and thus METS firms) are working on a trade secret dominated IP strategy but highlight the need to consider more carefully registrable IP rights and stronger protection options.

Interestingly, the geographic spread (or impact) of Australian-based METS patents is illuminating. The number of country filings is generally an indication of the value of the invention (see Table 1).

Applicants need to file patent applications (irrespective of the filing route) where they seek patent protection, and these applications are indicative of the target markets for their inventions. *IP Australia* undertook an analysis of patents in Australia in the mining sector over a 20-year period and found some interesting facts. With the Australian patent as the reference point (with a filing ratio of 100%), the following countries emerged as the next important countries or targets of interest: *USA* 56%, *Canada* 40%, *EPO* 33%, *China* 33%, *South Africa* 24%, *Brazil* 16%, *Japan* 15%, *Russia* 11%, *Chile* 5%, *India* $< 4\%$ (see Fig. 1). Without more detailed analysis of every application, it is difficult to be too prescriptive, as different

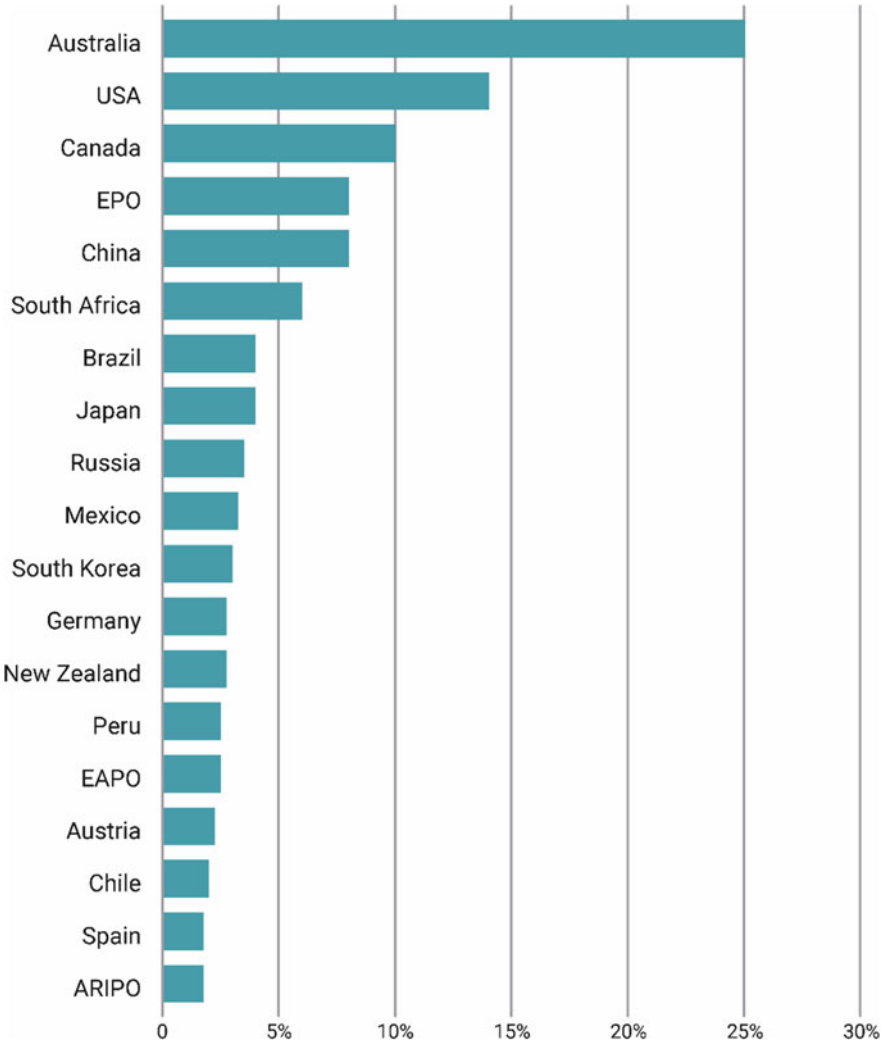

Fig. 1 Jurisdictions in which Australian innovators seek patent protection in the mining sector (authors' own illustration based on IP Australia, 2019)

countries may focus on different parts of the mining value chain. On the surface, two issues emerge: First, the METS companies do not seek protection internationally as much as they might. Secondly, some strong mining countries are extremely low in their participation rates. A good example is *Chile*, one of the world's largest copper suppliers. This low rate of patent filing by Australian innovators might also be due to lack of awareness of the Chilean patent system. Further information on IP and innovation in the Australian mining and mining services sectors can be found in

Chapter 12 of "Global Challenges for Innovation in Mining Industries" (WIPO, 2022).[2]

Finally, one aspect which is noteworthy is that mining technology (i.e., METS companies) is now becoming a legitimate investment class for private equity and other investors; in particular, the cashed-up retirement savings funds and private investment houses. This ability to attract investors more readily is starting to impact the METS sector with new entrants growing rapidly, the number of start-ups burgeoning, merger and acquisition activity increasing, and consolidation of groups themed by technology. METS companies can add significant value to their company with a well thought-out strategic approach to their IP portfolio. This is becoming more important, as large METS companies are continually looking to acquire new technology platforms to their business in order to become more relevant and to capture more share of spending from the mining houses; mining houses, in turn, seek to rationalize the number of their suppliers.

3 Case Studies

Two SME companies (considered start-ups) which operate in the METS sector have been studied to understand the role that their IP has played in their success and their associated IP strategy. Both companies are starting to expand operations internationally, and their IP strategies are becoming increasingly important. One company has recently attracted investment while the other operates an earn, invest, and grow approach.

Case: SoilCyclers

The first METS company reviewed, *SoilCyclers Pty Ltd* (SoilCyclers), has based its business around "know-how" and trade secrets rather than registrable IP. This company has been operating for over 10 years and has won several industry awards. They are focused on mobile soil recycling with applications particularly in the mining industry but also in the construction and waste industries. SoilCyclers are mixing specialists, thereby ameliorating topsoil, amending subsoils, and remediating soils to generate cost-effective, environmentally-friendly solutions for their clients. Their services include topsoil amelioration, geotechnical soil amendments, perfluoroalkyl and polyfluoroalkyl substances (PFAS) soil remediation, acid sulphate soil remediation, asbestos contaminated soil remediation, waste reduction, landfill mining, mobile composting, tailings and mine overburden repurposing, and the treatment and removal of soil in fire ant zones.

[2] https://www.wipo.int/econ_stat/en/economics/cup_series/mining-industries.html

As a result, SoilCyclers has become sieving, aeration, and blending specialists, with the ability to remove waste and change the physical, chemical, and biological properties of soil to meet specifications for onsite reuse and/or sale.

The founder of the company did not have a technological background but rather a business background with strong entrepreneurial desires. With an exposure to the mining industry, customer problems were identified and solved, leading to the development of a sustainable and profitable business. The founder undertook a number of market surveys and then consulted widely across the sector before entering the mining industry. However, an IP assessment was not a consideration at that early stage.

This business, by its very nature, requires intellectual effort and expertise and is not overly capital intensive. As a result, the business could be developed progressively by the founder in a self-funded mode. In the early stages, the development of SoilCyclers was funded fully through income derived from services delivered.

As the company grew, the protection of know-how, confidential information, and/or trade secrets was considered fundamental to the firm. Accordingly, the IP strategy developed is focused primarily on trade secrets. By the nature of the business, results of SoilCyclers' efforts can be readily seen or viewed by others. For example, the results of a successful remediation program are publicly available. Accordingly, while all aspects are not necessarily publicly available or accessible for reverse engineering, the outcomes can, at least in part, be copied by competitors. This has two principal IP implications: (1) the need to maintain confidentiality to the maximum extent; and (2) the imperative to maintain ongoing development so the company retains its technology leadership and differentiation from its competitors – known or potential. Therefore, the company has found a comprehensive non-disclosure agreement (NDA) / confidential disclosure agreement (CDA) to be an important protection mechanism to reduce risk and control leakage of technology and commercial aspects.

There are several aspects to this trade secret strategy due to the nature of the business and due to the nature of the technology and processes. When approaching a potential client, either as part of a marketing campaign or a request for proposal or quotation situation, SoilCyclers needs to provide a certain amount of information to attract the client but not "give away" its technological know-how. Accordingly, the company must always be mindful of the balance of showing the potential client what is achievable versus revealing how to achieve the desired outcome. An NDA is always used to help protect any IP and mitigate risk.

Another integral part of the business is the need to work together with collaborators. Satisfying a client's needs often requires several activities to be completed, and SoilCyclers' know-how and trade secrets are just one part of the solution. This company has clearly defined confidentiality provisions in its arrangements with its collaborating partners, but it prides itself on careful partner selection at the outset as an added "level of protection," as well as conducting site reviews and inspections to ensure technology is being managed accordingly and

employees are adhering to IP policies and protection practices. The management of confidential information can be made more challenging, as collaborations on projects frequently involve not only SoilCyclers and its trusted collaborators but potentially other parties on a project (e.g., the mine owner themselves, contractors, and even an intermediary mine project manager). Setting these elements in place can be a challenge for a small company. The more complex the relationship (or set of relationships) involved, the more complex the legal interactions and obligations, which results in significant costs, often to the point of being uneconomic!

Trade secret adoption and subsequent protection introduces its own set of challenges with mine sites. On the one hand, the client (the miner) is paying for a service with a desired outcome but may wish to deviate from the agreed scope and agreements inadvertently (or deliberately?) sharing sensitive know-how (IP). On the other hand, SoilCyclers wishes to maintain its IP (in the form of a trade secret) for as long as possible. This aspect can be further challenged when the issue of publication arises. The mine may wish to publish the results of its new remediation activities to alleviate ESG pressures and appease shareholders/stakeholders. This is managed by labeling any reports provided by it as CONFIDENTIAL and requiring any publication by the mine or other partners to only contain general (i.e., non-scientific/non-technical) information with SoilCyclers reviewing and approving any proposed publications. Technology leakage may not be identified until after the project has been finished, so the NDA being applied has clauses that extend beyond project lifetimes. Industry networks can be used to help identify possible breaches of IP given the specialist nature of the technology.

The foregoing confidentiality issues need to be considered when an international expansion strategy is adopted. While SoilCyclers has restricted the majority of its activities to Australia at present, they have started to explore international opportunities. However, the company recognizes that many of their solutions are universal and therefore facilitate the adoption of an international expansion strategy especially with international customers who can sponsor the technology across their international operations. Therefore, it needs to be prepared, on an IP protection basis, to enter arrangements internationally and understand the risks and mitigation strategies available. While SoilCyclers remains geographically central and small in size, the IP risks can be easily managed; however, as the footprint and employee numbers grow, in particular internationally, the task and challenges faced in managing the current IP strategy escalates, thereby requiring continued vigilance and attention.

As SoilCyclers has developed and its business has grown, the founder's knowledge of IP and its importance has grown too. This has largely been a result of obtaining advice from experienced professionals with a practical understanding of the business as well as experience specifically related to trade secret management. This support is provided on a continuous but "as needed" basis, and these professionals informally form part of SoilCyclers' team. So, in addition to gaining expertise on trade secret protection and its management with external parties – collaborators, suppliers, clients, and other associates – the company has

been able to develop its own internal trade secret policies and procedures, such as employee obligations and documented policies. Employees have strong confidentiality clauses in their contracts as well as IP clauses relating to ownership, which provide another level of protection. IP awareness training tailored to the METS industry has also assisted the understanding by employees of their obligations as well as the importance of the systems and processes they undertake.

As the world moves to focus more on ESG, decarbonization, and climate change, this business is in a strong position to extract more value from its IP, generate more IP (disruptive and incremental), and expand its footprint further geographically, both within Australia and internationally. The speed to innovate, grow skills, and invest becomes paramount in delivering business performance as well as keeping watch on the developing market segments and ensuring that their IP is not claimed, breached, or emulated is critical. Collaboration is potentially the key to rapid innovation – expanding the current collaborative arrangements and developing more technology – but the IP challenges associated should not be discounted and remain a key focus for this business. The IP systems and protection processes that have been developed will become more important to the company's success and the success of its clients, so keeping a strong strategic focus on IP integrated within their business strategy should generate significant returns and fuel further growth. ◀

Case: 3ME Technology Holdings

3ME Technology Holdings (3ME) is engaged in the electrification of vehicles for the mining industry and several other industries. This company is a heavy-vehicle battery manufacturer that designs and produces energy-dense, lithium-ion battery systems in a modular format to power mining and military electric vehicles (EV) and equipment, as well as applications in the marine industry. These state-of-the-art battery systems are designed to enhance performance, safety, and sustainability while delivering an ESG, decarbonization, and climate change benefit, which the market is keenly embracing. 3ME is a leader in empowering the clean energy transition of specialist vehicles and power solutions. The powerful, scalable, lithium-ion battery systems are designed to replace the diesel-powered engines in large industrial vehicles used in these industries, thereby supporting the quest of "net zero" the mining industry is vigorously pursuing.

3ME is focused primarily on the development and integration of battery electric vehicle (BEV) and energy storage systems for heavy-duty and specialist applications. Its key capabilities include specialized battery module design and assembly; the development of specialized vehicle control unit (VCU) software profiles; programming of sophisticated battery management systems (BMS); rapid prototyping and integration of its technology and world-class EV components into a BEV system; and custom developments (in conjunction with international partners) on battery cells, chargers, motors, and other power

electronics. The combination of hardware coupled with software has provided a unique solution and valuable IP.

3ME's batteries' advanced safety features and high performance are designed specifically for use in harsh mining environments and can be retrofitted into a range of vehicles from small utilities to very large loaders. For example, its pioneering battery system has been successfully retrofitted into a typically diesel-powered 20-metric-ton underground loader. Another advantage of this battery system is its potential for integration with onboard sensors and communications systems.

3ME, which might be best described as a heavy-vehicle battery manufacturer, has been the recipient of a number of significant investments through Australian Government backed business growth funds. The strength and value of the IP portfolio was also a key factor to attract this substantial, company-changing funding. In addition, 3ME has also won many awards, all recognizing its leading technology. It was recently named the most innovative mining and agricultural SME of 2021 by a leading Australian financial newspaper.

Just like SoilCyclers' founder, the founder of 3ME did not have the specific technical background but rather identified an opportunity. At an early stage of the business, a patent attorney was enlisted. This attorney was identified through the founder's lawyer. It was important in the "early stages" that the patent attorney understood the business and the strategies and objectives of the business, as it was critical that the attorney had a full appreciation of the technology strategy and the commercial environment. This understanding was important on a "business level" but equally important on a personal level.

3ME identified the need to protect its intellectual property through all forms – patents, trademarks, copyright, designs, and trade secrets. This was different from SoilCyclers, where its IP was primarily through trade secret protection. Just like SoilCyclers, the awareness of IP protection, development, and commercialization and related issues by its senior management was seen as being important in the overall management of intellectual property within the firm, as well as its interactions with external parties (e.g., clients, suppliers, and collaborators). Management was involved in an industry association mentoring program (Austmine – Australian's leading METS industry member association),[3] which highlighted the need to pay particular attention to IP through the technology development cycle; it was followed by attendance at an IP masterclass tailored to the METS industry (METS Ignited – The Australian Government industry growth center focused on the METS sector).[4] These programs were seen as a precursor to the development of detailed IP policies and procedures within 3ME. Similarly, this experience identified training needs and priorities on IP matters within the company for all staff members. As part of this awareness, the education on IP issues for new employees can be introduced and implemented.

[3] https://www.austmine.com.au/

[4] https://metsignited.org/

Like most METS firms, 3ME collaborates with other companies at the research and other levels. Contracts relating to these collaborations are deemed essential and clauses in these are critically assessed. Non-disclosure agreements (NDAs) are an essential part of such collaborations. Ensuring clear, detailed, and unambiguous scopes and definitions to any collaborative development programs has been crucial, as is the declaration of background IP to ensure that there is no erosion of its position. Developing scenarios for project outcomes has also been considered increasingly important at the outset of these programs to ensure that the technology ownership is clear and the rights to use are not compromised. Similarly, employment agreements are an important part of 3ME's IP protection. Certainly, in the case of new employees, access to confidential information is granted on a "need to know basis." As an example, employees working on hardware development are not necessarily provided with details on software development and vice versa. Similarly, those working on a particular market segment, such as mining, are not generally privy to detailed information in another market segment, such as military. Trade secret management was also seen as a critical component of software protection.

Periodically, external experts have been used as contractors, and it has been important for 3ME to enter into contracts with such personnel to ensure that any IP arising out of the contract is owned by it, and there can be no negotiation on this aspect.

This company identified the potential for the technology globally very early on in its development. Once it was determined that it needed a global business strategy, a technology strategy was developed, which in turn led to an IP strategy. A key element in this planning process was to align its patenting process to confirm timing of the business milestones. Because of the multi-industry nature of this business, part of the process was to recognize the application of the technology in the different industry sectors, such as mining (METS) and military (defense) as well as marine.

IP budgeting was important, as it was seen as critical to have the funds available to allocate to the necessary protection of technology. The need to always balance risk versus reward and technology lifetime versus cost of protection is considered important to this company. As a start-up, this was deemed critical and clearly related to cash flow. IP was prioritized on occasion to other technology adventures so as to lock in the advantage and form a strong base for the company to continue.

3ME took the view that practical IP advice was very important, especially in relation to commercializing IP. Similarly, IP must be kept "front of mind" so that value is created (as distinct from destroying value). IP has been considered a long-term investment. Because of its reliance on IP, 3ME allocated specific responsibilities to a staff member with accountability for IP – including policies, strategy, and implementation, plus identifying new developments and technology within the company to protect. This ensures that IP is always included in the decisions and strategies of the company and not a forgotten force.

By taking a proactive approach to its IP, 3ME has now established itself as an emerging force in the electrification of vehicles in some large industries and has been provided the opportunity to expand into further industries to deliver significant growth – both economic as well as technological. The climate to embrace clean energy, deliver ESG benefits, and other industry trends (listed above) will propel the success of this company while maintaining a solid base of IP. The management of this company continues to build an IP-focused culture at the "grass roots" level that creates and safeguards IP which is aligned to strategy. Focus is the key message for a fast-growing technology company, together with continued virulence on IP creation and protection. ◄

4 Learnings and Takeaways

The two case studies presented from within the METS sector deliver solutions to very different areas of the industry but are both reliant on technology and thrive due to a focus on and an understanding of IP. The generation and protection of IP has allowed these organizations to continually grow by maintaining a strong awareness of IP across their organizations from owners/board to junior employees. Key insights from the case studies include:

- Awareness training is a common mechanism used to raise awareness – formal or on the job – and to reinforce employment obligations. Employee agreements provide a base level of protection within the companies, while non-disclosure agreements (NDAs) support external protection.
- NDAs are a key feature of the systems which are adopted by both companies to help focus the attention of their customers, suppliers, and other stakeholders to the novelty and unique technical solutions that they offer. NDAs are applied with clear scopes and extended timelines beyond the project lifetimes to ensure that technology and commercial leakage are managed.
- Regardless of the IP strategy adopted, the alignment of this strategy with the business and technology strategy has resulted in ensuring that both companies can deliver growth and increase their technology leadership.
- Both companies have a reliance on trade secrets, either as a primary IP protection methodology or jointly with other formats, such as patents and trademarks. The benefit of having a responsible person focused on IP is clear, providing the organization with the confidence that IP will always be part of the discussion and kept "top of mind." Registers of IP have been used to identify, codify, and manage this IP.
- Collaborative partnerships have also been featured as an important component for delivering technology, and therefore solutions, more rapidly to customers. This collaboration presents significant challenges and risks to ensure that background IP is not lost, and technology arising from the projects are not diluted, and clear rights to the IP are established.

- It is clear that IP matters associated with collaboration need to be part of any METS company's IP strategy working in the mining and METS industry, particularly as mining houses become more reliant on METS companies to supply them with leading-edge technology while they focus on operational excellence to remain cost competitive as well as the impact of ESG and other trends. This is also exacerbated by the current shortage of critical skills in the mining industry necessitating a further reliance on METS companies as strong business partners.
- *SoilCyclers* and *3ME* both emphasize the need for recognizing the importance of IP management at an early stage and the need to obtain sound, practical advice that is aligned with the organization's goals and strategies.
- Consideration should be given periodically throughout the technology development, and therefore IP development life cycle, to the international application, protection, maintenance, and exploitation of the IP.
- A good IP advisor(s) who understands the industry and takes the time to understand and work with the company is an important factor in protecting and managing its IP and facilitating successful, sustainable growth. These advisors also provide an auditing capability and ability to inject best practices to support the company's IP aspirations.
- Proactive IP management is important to protect the company's assets and to ensure that the commercial arrangements are consistent with its IP and other intellectual assets. This approach will enhance the prosperity of the company and should create strong, intangible asset growth, which will lead to higher company valuations. This is particularly appealing for SMEs in the METS sector due to the sector's acceptance as a legitimate investment class which provides options for their future growth and investment.
- Success is bolstered by building an IP-focused culture at all levels of the organization (starting at the owner/board) that understands, creates, and safeguards IP which should be aligned to strategy.
- Focus is the key message for any fast-growing technology company, together with continued attention to IP creation, protection, and monetization/commercialization.

While the marketplace for METS firms in Australia is such that many can survive and prosper within the boundaries of Australia, the significant opportunities that are available outside Australia's enormous mining market can be attractive. Embracing the international market may not be a choice but a requirement when working with international customers once successful application of the IP has been demonstrated at a local site. For those companies where registrable IP is critical to its business, a clear international filing strategy with a realistic IP budget allocated over the IP lifetime is essential. When the company has an IP strategy centered on trade secrets, it becomes critical to replicate its trade secret strategy internationally while recognizing the different legal rules and cultural differences that will vary across jurisdictions. A thorough understanding of risk associated with an international expansion is required, generally for each country/jurisdiction, to ensure success and not jeopardize the companies' valuable IP. Both companies have recognized

the value in seeking relevant and practical IP advice in foreign jurisdictions and use their trusted local advisors to assist in this process. Establishing a risk appetite or tolerance as part of the IP strategy formation is also highly recommended. This risk tolerance should be consistent and included within the overall business risk framework and contained within the business risk registers with periodic reviews conducted.

Takeaways

In summary, as the world's demands for critical minerals and materials intensifies due to increasing pressures to address global trends such as decarbonization, the adoption of alternate green energy, and ESG requirements, the METS sector and its renowned innovation strength is well positioned to benefit. A robust IP strategy for start-ups is critical to capture this value, as highlighted from the two case studies presented in this chapter. The clear message is that IP is a valuable asset which needs nurturing and must be actively managed throughout the entire technology life cycle and interconnected commercialization phase.

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Dr. Dallas L. Wilkinson is a recognized thought leader with the ability to lead the design, development, and delivery of multi-dimensional cross-functional solutions bringing together strategy, business process, organizational design, and change management to create true value. Dr. Wilkinson is a highly customer-focused, strategic international leader growing businesses and people by applying and commercializing technology with more than 30 years in the Global Mining Services sector. He has extensive international experience gained through working in more than 60 countries in roles spanning R & D, technology support and management, sales, marketing, business management, general management, strategy, safety, risk, manufacturing, operations, and business turnarounds.

Dr. Wilkinson has served on boards for over 20 years across the world, including those for non-profit and commercial entities. He is currently a non-executive director and Chair for Austmine (METS industry association), the Co-Chair of Licensing Executives International Committee, and Advisory Board for Chemicals, Energy, Environment and Materials. He also holds various directorships within the Dennemeyer group. Dr. Wilkinson has a PhD in Chemistry as well as an MBA (Technology Management) and is a graduate of the Australian Institute of Company Directors, a Fellow of AusIMM, a Fellow of the Institute of Quarrying, and a member of Professionals Australia and the International Society of Explosives Engineers. He has recently moved from the role of Managing Director for Asia Pacific for Dennemeyer Intellectual Property Group to Principal and Owner of Enhanced Performance Business Advisory.

John Walker is a registered Australian Patent and Trademark Attorney, as well as an IP management specialist and technology commercialization specialist, with almost 40 years of experience. This experience has included working in the Materials and Resources Industry with BHP as an advisor on all aspects of IP protection, development, and commercialization. He later managed Australia's largest patent portfolio at CSIRO across all industry sectors – including mining, agriculture, biotechnology, and physics, among others. Mr. Walker established Dennemeyer & Associates in Australia and is currently a specialist IP Consultant with Dennemeyer. His career includes senior management roles in licensing, commercial and business development, strategic planning (with BHP), and intellectual property management (with CSIRO).

Mr. Walker has a Master's degree in Engineering and a degree in Economics, as well as a Master's degree in Intellectual Property Law. He is a Fellow of the Australian Institute of Company Directors (AICD) and a Past President of the Licensing Executives Society Australia New Zealand. He served for several years as Secretary of LES International. Mr. Walker has additionally lectured at various Australian universities at the postgraduate level in the areas of technology management, IP management, research management and innovation management.

IP and Start-Ups in the Context of Florianópolis, the Silicon Island of Brazil

Thiago Rafael Ferreira Marques
and Andressa Sasaki Vasques Pacheco

1 Florianópolis, the Brazilian Silicon Island

Intellectual property (IP) is a theme that many companies are unaware of or find to be a very complex process. In *Brazil*, it is a theme inherent in the legal sector but is little discussed and seldom debated in management and engineering areas. The perception of a complex and time-consuming process makes organizations not look for ways to protect their trademarks or even their inventions.

This is a reality in traditional companies, so what will this reality be like in new organizations that are more agile and connected to new market demands? These are the start-ups, which Souza et al. (2020) characterize by the use of new technologies in their processes, bringing more efficiency to the business and often using technologies to ensure the execution of all production stages. Corroborating this statement, Neves (2015) highlights that the "activity of a technological start-up is closely linked to technological innovation. In this follow-up one has to know how best to protect these technological advances and simultaneously obtain income from them."

For Dias and Mazieri (2020), the environment of start-ups is characterized by uncertainties and information asymmetry, and these companies need funding so that they can grow and scale their business models.

T. R. Ferreira Marques (✉)
Senac-SC, Florianópolis, Brazil

Zucchetti, Florianópolis, Brazil
e-mail: thiago.marques@zucchetti.com

A. S. V. Pacheco
Universidade Federal de Santa Catarina, Florianópolis, Brazil
e-mail: andressa.pacheco@ufsc.br

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_5

In this case, intellectual property management is one of the avenues by which to check the *quality* and *reliability* of start-ups. Patents can influence a start-up's ability to attract venture capital funding (Dias & Mazieri, 2020; Neves, 2015).

In this context, understanding how this signal (patent) and others related to it are evaluated and considered for decisions by venture capital (VC) investors can become important for entrepreneurs when planning their actions. Patents go beyond signaling the technological quality of a start-up. The objective of this chapter is thus to investigate the relationship between the patent holding of start-ups and the reach of venture capital investments (Dias & Mazieri, 2020).

Souza et al. (2020) add that this is an area on the rise in Brazilian business law. In Brazil, several regions have stood out in the development of start-ups and innovation ecosystems.

One of the regions in the spotlight is the state of *Santa Catarina*, where, according to Vissotto (2021), start-ups have provided great financial and technological advances. This scenario is so relevant that it has even given its capital (Florianópolis) the nickname of "*Silicon Island*." Behind only the states of São Paulo, Paraná, and Rio Grande do Sul, Santa Catarina ranks fourth in terms of having a promising system, being the state that created the most start-ups between 2015 and 2019.

These numbers in Florianópolis are even more impressive. There are five start-ups for every thousand inhabitants, and other cities in the state are following the same line of performance, making the state of Santa Catarina gain national prominence (Vissotto, 2021).

The entrepreneurial nature of the city is provided by an innovation ecosystem with the performance of several important segments, such as companies, universities, public organizations, and associations. In this framework, this chapter aims to present a view on intellectual property and start-ups in the context of Florianópolis, the Silicon Island of Brazil.

2 The Complex Scenario of Intellectual Property for Start-Ups in Brazil

IP is a strategy for protecting ideas and innovations. It can be through industrial property, copyright, and *sui generis* protection. In this chapter, industrial protection stands out and is mainly related to trademarks and patents.

Souza et al. (2020) report that patents can bring *quality indicators* that allow venture capitalists to make the decision to invest in start-ups. The authors also add that due to their characteristic of working with technology, start-ups can use patent registration as an important tool for obtaining competitive advantage, preventing copying, improving their success in attracting investments, and increasing their chances of being acquired by another company or making a successful initial public offering in the stock market.

Neves (2015), in his research, states that technology start-ups do not value brands as much as large companies do, at least at an early stage, because they usually do not have considerable recognition or visibility in the market. The author also argues that

the IP management strategy of start-ups should be based on patents, until the stage when a start-up starts to gain some prominence in the market it enters. Souza (2020) complements this statement by indicating that patent registration allows start-ups the assurance that their creation will not be copied or sold without their authorization.

The most common theories say that inventors choose to patent their inventions for higher-than-average returns, since by patenting they prevent others from producing, using, or selling these products. Another easily accepted fact is that society itself benefits to some extent from this patent system because patents act as incentives to innovate and close a market gap. The above-average returns associated with holding a patent act as compensation to the researcher for the resources expended in creating that invention. Without this "guarantee," patent holders will not spend the time and resources to research, develop, produce, and sell new products and technologies (Neves, 2015).

In addition, Dias and Mazieri (2020) point out that most research shows that start-ups with a higher number of patents are more likely to obtain venture capital funding. Another finding of theirs is that most studies evaluate the effect of patents on the attraction of venture capital at a given time, focusing on the amount of venture capital raised by the start-up in a given period.

The authors also emphasize the importance of entrepreneurs' knowledge of *quality* signals, and it is possible to state that patents are a quality signal in the investment decision (Venture Capital) (Dias & Mazieri, 2020).

For Neves (2015), it is clear that patents are useful and have several associated benefits, both for inventors and for society in general. But in the context of start-ups, there are some difficulties: Start-ups sometimes do not yet have any income because they do not yet market a product (development phase), so the idea of protecting something that does not yet generate revenue, or even show evidence of its value in the market, may seem somewhat strange. It is usual that start-ups are focused on research and development, which can result in the invention of several products or processes in a short time, and finally the financial issue because few start-ups allocate resources for IP protection, allowing only the patenting of a small number of inventions.

Despite its importance, the time and resources spent on intellectual property management are considerable. In research conducted in Portugal, the wait time is 18 months, with the possibility of another two months to oppose the application. Thus, it is necessary to select the innovations that justify protection, both for economic reasons and for simple business strategy (Neves, 2015).

Rocha and Machado (2018) corroborate this data in their research, concluding that only a quarter of the companies consider asset protection as an essential part of the business, which can be explained by the dynamism and speed of changes in the industry.

In his research with Portuguese start-ups, Neves (2015) concludes that patenting costs are more determinant in maintaining IPR and mainly in the internationalization strategy but are not considered as a determining factor for Portuguese start-ups. In addition, the poor knowledge of the IP protection system is a reality of several

countries, and the waiting period between the IPR application and the design is probably the biggest "weakness" of the system.

Rocha and Machado (2018) analyzed intellectual property management in *Brazilian fintech* start-ups. In their results, they highlight the following: The intellectual property management of the group of companies surveyed has a grade of 3.0 on a scale ranging from 0 to 5.0, which indicates an average systematization of practices; it is also noteworthy that 25% of the start-ups have one or more applications or patents granted, and 92.6% of the companies have one or more trademark applications or registrations. Furthermore, we verify the systematic search for partnerships (37%) and the systematization of technological prospecting (96.3%), and we also emphasize the reduced percentage of start-ups that adopt the constant practice of evaluating their portfolio of intellectual property assets (28.6%) and that 30% of the companies deem that the protection of intellectual property is not an important part of the business. The *Overall Intellectual Property Management Degree* for the collected sample was 3.0, which indicates a medium degree of maturity of systematization of intellectual property management practices. This suggests that, despite being start-ups, they already have a solid strategy and are on a path to high systematization of IPM. Given the peculiarities of the industry, intellectual assets become a crucial part of the business (Rocha & Machado, 2018).

This fact is corroborated by Dias and Mazieri (2020), who report that start-ups are more likely to register a trademark than a patent when they operate in less concentrated markets, with B2C (business-to-consumer) customers, and when they receive early venture capital funding.

Rocha and Machado (2018) also provide data on the practices regarding the registration, maintenance, and *valuation of intellectual assets* in Brazilian *fintech* start-ups. The data found point out that 25% of the fintech start-ups surveyed have one or more patents in force or applications filed, while 42.9% have one or more software registrations or applications filed. The most systematic result relates to trademark registration: 92.5% have a trademark registration or application; 35.7% declared that they have one or more products or services that can be patented, registered in software, or protected by industrial secrets; 35.7% adopt systematic practices of adequacy with the market reality and follow-up of the processes in the *National Institute of Industrial Property (INPI)* in Brazil; and 28.6% systematically evaluate the portfolio to make decisions. This dimension obtained a grade of 2.6.

The legal aspects dimension refers to the structuring of the legal area and the use of specialized services. In this dimension, it is observed that 50% of the companies have a legal area or legal counsel that is capable and specialized in dealing with specific issues of intellectual property (Rocha & Machado, 2018).

Finally, Rocha and Machado conclude in their research that in relation specifically to intellectual property management (IPM), it can be inferred that fintech start-ups have a medium degree of maturity and systematization of IPM practices, pointing to strategies that are on their way to becoming more solid and structured. This statement is based on the measurement of the Degree of Intellectual Property Management that, for the group of companies participating in the research, presents a grade of 3.0, on a scale of 0 to 5. The degree found points to IPM practices that are

still carried out in a timid and unsystematized way, which is nonetheless understandable, since the companies are young and almost all of them are undergoing or have undergone some kind of change since their planning (Rocha & Machado, 2018).

Despite the noted importance of protecting intellectual property, *Brazil* manifests a reality distinct from other countries in the world. Due to legal insecurity, enormous costs, and registration periods that can exceed 10 years, Brazilian entrepreneurs register far fewer patents than those in other countries in the world.

Even international companies with research and development projects in Brazil have difficulties in intellectual property operations in the country. "Brazil is an important market in the global context, and we always register our products in the country," says *Jorge Ávila*, senior director of *Qualcomm* in Brazil and former president of the *INPI*. "For safety, we always file our patents in the U.S. It's the way to escape the legal insecurity created by the delay in Brazil" (PEGN, 2017).

Thus, Brazilian start-ups tend not to actively seek solutions focused on intellectual property, given that the time it takes for registration in the country is frequently unfeasible for the fast and scalable operation of a technology company. There are many cases, as mentioned by *Eduardo Mattos*, entrepreneur of a start-up in Florianópolis, in which the delay for the acceptance of a patent application is so long that the company that made the registration has often ceased to exist during this period. Given the effort, time, and money spent in Brazil on this type of activity, start-ups prefer to take the risks associated with not having a patent for an innovative product, seeking to focus on developing and scaling the business.

3 The Florianópolis Ecosystem

Although the political and legal scenarios are not ideal for Brazilian start-ups to thrive, some cities developed a strong innovation ecosystem. Cities such as *São Paulo* – the biggest city in Latin America – *Belo Horizonte*, and *Florianópolis* are creating spaces for the development of technological entrepreneurship.

Florianópolis was known for many years for its natural beauty and tourism. The city has now gained a new nickname, Silicon Island, and is already being recognized internationally. Leipnitz and Lóssio (2021), in "*Bridge to Innovation*," report on the prominence of Florianópolis in the entrepreneurial ecosystem (see Table 1).

This scenario is not restricted to Florianópolis but rather contemplates the state of *Santa Catarina*. According to data from the *Association of Technology Companies* of Santa Catarina State (Tech Report, 2020), Santa Catarina's technology has strengthened every year, with more than 80,000 people, including entrepreneurs and employees, who make this sector one of the most prosperous and solid economic activities of the state, representing 6% of the Santa Catarina GDP. The technology sector in Santa Catarina has surpassed that in *Minas Gerais* and *Rio de Janeiro*, becoming the fourth biggest technology pole in the country in terms of invoicing, with more than R$17.7 billion, which represents 5.9% of the Santa Catarina GDP. It accounted for 12,138 companies and a growth of 7.7% in 2019.

Table 1 Reports on Florianópolis

Report	Authors
A mature innovation ecosystem needs the contribution of the agents of the Triple Helix (Universities, Industry, and Government) to provide talent, technology, and investment (Angel Investors, Venture Capital, and Corporate Venturing) for the development of start-ups from their conception to their mergers and acquisitions plan. Start-ups become the source of the future in the ecosystem as a key element for the disruptive innovation of already structured companies. Florianópolis, as the epicenter of the Innovation Ecosystem in Santa Catarina, with all the agents of the ecosystem sharing a single vision, and with consensus in the actions that contribute to the effective development of the economy and the knowledge society, is at this moment an international reference of Innovation Ecosystem for entrepreneurs who can take advantage of this economic and social environment.	Josep M. Piqué, president of La Salle Technova Barcelona (Ramon Llull University) and former president of IASP – International Association of Science Parks and Innovation Areas.
I have spent my entire life in Silicon Valley, and I am often asked what the secret of Silicon Valley is. Why did a valley in California flourish and become the global economic center it is today? The reasons are diverse, but two factors often mentioned are the great universities and the hospitable climate of the Bay Area – both things that Florianopolis has in abundance. While visiting Floripa in 2019, I met several key players in the ecosystem and realized that one of the secrets of the city has been the commitment of the entire community to foster an ecosystem that benefits everyone in the local economy. It takes smart, passionate, talented people to create a global hub for entrepreneurship and innovation. Cities with a great lifestyle, like that of Santa Catarina's capital, have a distinct advantage in attracting the kind of talent pool that a center of innovation and entrepreneurship requires. I've been lucky enough to have visited most of the world's entrepreneurship and innovation hubs, from Austin to Tel Aviv, from Berlin to Helsinki. After a week in 2019 in Florianopolis, I am fully convinced that this beautiful island city will be one of the world's centers of innovation and economic development in the 21st century.	Bret Waters, from Silicon Valley, professor of Entrepreneurship at Stanford University and mentor at the Miller Center for Social Entrepreneurship.

(continued)

Table 1 (continued)

Report	Authors
Today the competition is not between innovative organizations, but between innovative ecosystems. Florianópolis has built from scratch an enviable innovation ecosystem that is a reference in Latin America. Ecosystems help develop innovations that contribute to growth in job creation, wealth creation, and a vibrant knowledge-based economy. When there is collaboration among companies, universities, start-ups, government, and development institutions, there is commitment to common growth. In Florianópolis, the main success factors of the ecosystem are guided by leadership, governance, and an agenda around common interests. The city has built an ecosystem that is equivalent to a Ferrari, which is still in second gear. Once the third and fourth gears are engaged, one can expect Florianópolis's innovation ecosystem to join those of cities such as Boston, San Francisco, and Tel Aviv.	Hitendra Patel, consultant and global leader in the field of innovation. Founder and CEO of the IXL Center, based in Boston, USA.
The innovation ecosystem of Florianópolis populates the national imaginary as one of our best national references in terms of innovative and entrepreneurial environment and transformation of the territory from values proper to the society and economy of the 21st century. And this imaginary is grounded in reality and in a collective construction, which knew how to articulate very well the actors of the quadruple helix: academia, business, government, and civil society. Continuity in policies, a shared vision of the future, leadership, qualified people, good communication, and the courage to transform society and the economy through innovation and entrepreneurship. These were and are the critical success factors that transformed Florianópolis into a source of pride for all of us who work in the national innovation ecosystem. May the Florianópolis model be the bridge to the future not only of the region, but of our country, generating a better future for our people and society. With knowledge, creativity, and courage.	Jorge Audy, superintendent of Innovation and Development at PUCRS and TECNOPUC and former president of Anprotec and IASP Latin America.

Table compiled by the authors based on Leipnitz and Lóssio (2021)

The growth of the number of tech companies founded in Santa Catarina is enormous, as in the timespan of only five years, the number of active tech companies almost doubled, as presented in the graph below (Tech Report, 2020, see Fig. 1).

The productivity of technology companies in Santa Catarina also stands out, with revenues of almost R$80,000 per worker, the second highest in Brazil (ACATE, 2020). In terms of education, Santa Catarina is the second state in Brazil with the greatest percentage of students in higher education in courses focused on technology skills. There are 34,700 enrollments and about 4,000 students in the course completion phase.

In 2019, the technology sector in Santa Catarina generated 3,400 new job openings. The Greater Florianópolis region was the state's leader, with roughly 1,000 new job openings, with Florianópolis being the city with the highest density of companies per thousand inhabitants in Brazil, and the 16th city with the highest volume of companies.

Although Florianópolis is still well known in the country for tourism, the evolution of the technology ecosystem has completely repositioned the city's economy, the result of a work that has been developed since the 1980s. Willerding et al. (2017) demonstrate the major milestones for the structuring of the sector in recent decades (see Fig. 2).

Those milestones represent incubators and accelerators (e.g., *MIDI*, *CELTA*), technology centers (e.g., *Parque Alfa*, *Sapiens Park*), government foundations (e.g., *Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina – FAPESC*), and innovation-related laws (in 2009 and 2012). All the institutions cited not only were a staple at their foundation, but they still remain relevant to the ecosystem to this day.

In this Florianópolis scenario, we will highlight two of the main active ecosystem's entities – *UFSC* and *ACATE* – and their actions regarding intellectual property and start-ups.

The Federal University of Santa Catarina (UFSC)

With a history of 60 years, the *Federal University of Santa Catarina (UFSC)* has the "mission to produce, systematize, and socialize philosophical, scientific, artistic, and technological knowledge" and to this end offers various activities in teaching, research, extension, and innovation. It has five campuses: Araranguá, Blumenau, Curitibanos, Florianópolis, and Joinville; around 50,000 people circulate in its spaces daily (UFSC, 2021).

Its commitment to excellence and solidarity makes it reach high levels of qualification, confirmed by the latest national and international rankings, which highlight:

- *UFSC* is among the 11 best universities in Latin America, according to Times Higher Education (2021). More than 1,500 universities from 93 countries were evaluated in 13 indicators that measure an institution's performance in four areas: teaching, research, knowledge transfer, and international perspectives.
- *UFSC* is the fourth best federal university in the country, according to the Folha University Ranking (Folha, 2019). A total of 197 institutions in the country were

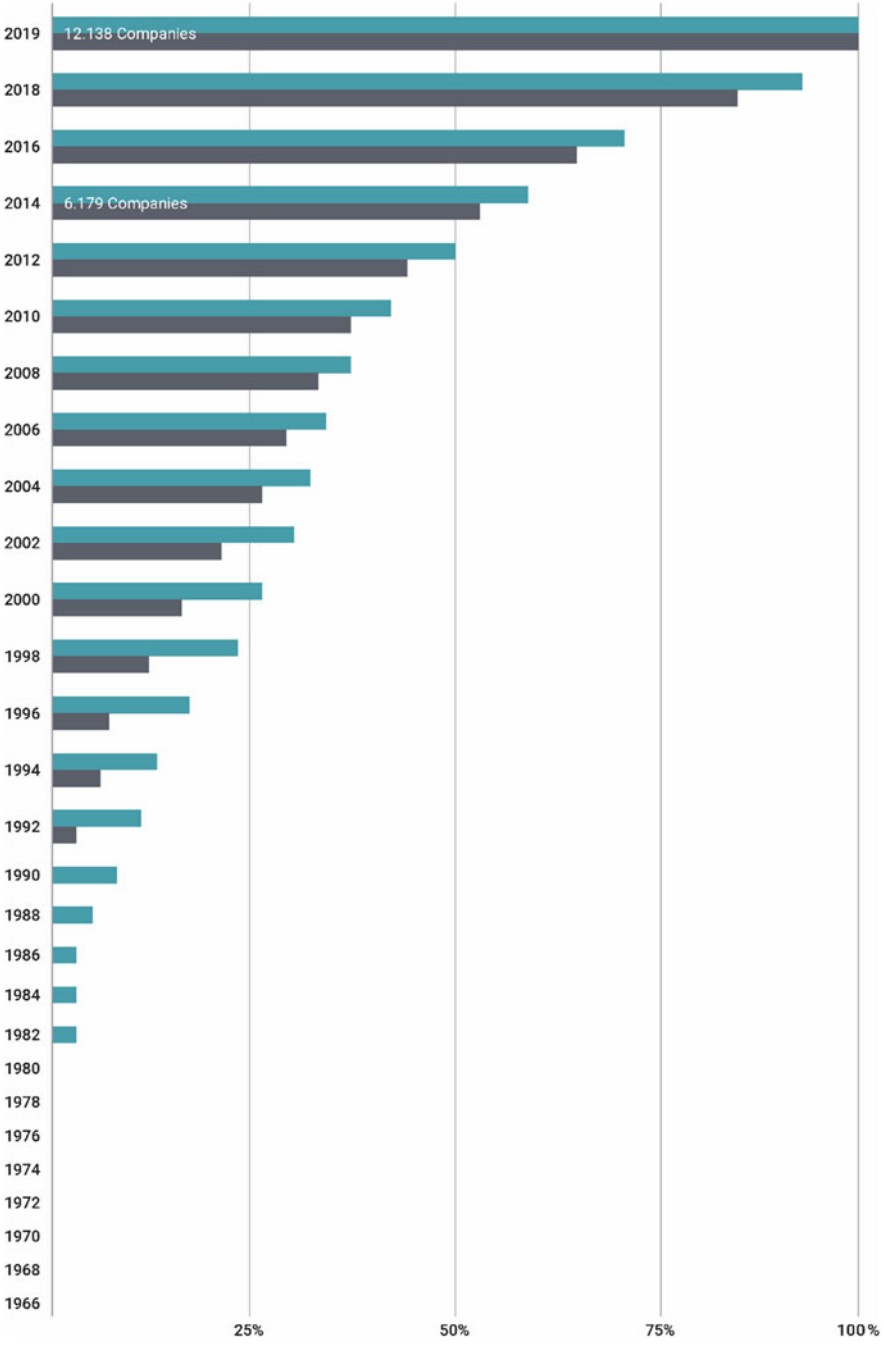

Fig. 1 Growth of the number of tech companies founded in Santa Catarina (Tech Report, 2020)

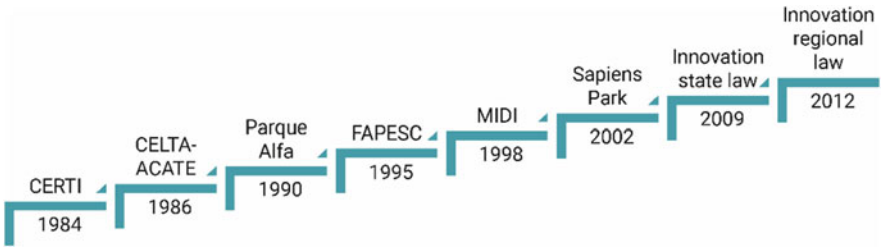

Fig. 2 Major milestones for the structuring of the sector in recent decades (Willerding et al., 2017)

evaluated, including public and private ones. In this context, *UFSC* also stands out as the seventh best in the country and second best in the South Region.

- In addition to expanding within the country itself, *UFSC* has been internationalizing through cooperation with educational institutions around the world. There are currently 349 agreements with 38 countries.

The intellectual property activities are carried out by *UFSC's Secretariat for Innovation (SINOVA)*. The main objectives of the Secretariat are to protect the intellectual creations resulting from academic research, mainly through patent deposits, as well as to seek its transference to the production sector of goods and services. *SINOVA* aggregates several competencies necessary for the protection and licensing of the research and technologies that are developed. Within the University, the Secretariat establishes a network of contacts with several departments and researchers from different disciplines. Likewise, the Secretariat fosters the entry of companies into this network so as to establish a connection between the academic world and the market (SINOVA, 2021).

This service is provided not only to professors, students, and technicians, but to any interested party, which the University calls an "independent inventor" (normative ordinance no. 2/2020/SINOVA, July 7, 2020):

Art. 1 – For the effects of this Ordinance, an independent inventor is considered a natural person, not holding an effective position, military position, or public employment, who is an inventor, breeder, or author of an invention. Art. 2 – UFSC, through the Innovation Office (SINOVA), will support the independent inventor, by means of I) Guidance on the technical feasibility of the object of their invention; II) Guidance for transformation of the invention into a product or process; III) Guidance for intellectual protection; IV) Guidance for constitution of a company that produces the object of the invention; V) Guidance for technology transfer to already constituted organizations.

On its website, there is a lot of information covering the following categories: Intellectual Property Information; Technological Information Bases; Cultivars; Industrial Design; Copyright; Geographical Indications; Know-how; Trademarks; Patents; Computer Program; Integrated Circuit Topography; Secrecy Defense; IP Glossary; Partnerships and Technology Transfer; Patent Search; Forms for Protection Request and Library.

In addition to the information on its website, it provides face-to-face and virtual attendance to the community to answer questions and assist in the intellectual property processes.

As for the costs of the process, *UFSC*, through *SINOVA*, is responsible for these costs as a way of supporting and encouraging the development of research at the University and to value the importance of protecting it. The costs include monthly payments to maintain the patent application at the *INPI*, for filings made in Brazil, or other organizations responsible for dealing with intellectual property for filings made in other countries, in addition to *SINOVA*'s legal expenses and standard activities to carry out the actions of the project in question.

From its data panel, which was recently released, it can be determined that the University currently has 553 assets deposited in Brazil and 111 in other countries (UFSC, 2022).

In an interview with an employee in the sector, it was found that the patent process is still less sought after by entrepreneurs and start-ups that seek *SINOVA* because it is a more complex and time-consuming process; in some cases, it is due to people's lack of knowledge.

The interviewee also underscored the importance of trademark registration for start-ups because many invest in entering the market without having their trademarks protected. This process, like that for patents, is guided by *SINOVA* and takes about seven months. It is a faster process and essential for the protection of a new start-up, which can see its marketing investment lost if it loses its trademark. This fact is corroborated by the authors presented in this article.

The Association of Technology Companies (ACATE)

Another important player in the Florianópolis innovation ecosystem is the *Association of Technology Companies of Santa Catarina State (ACATE)*, an institution created with the sole purpose of representing the interests of all tech-based companies in the state. *ACATE* is an entity that supports start-ups and companies of all sizes and from various segments that make up the ecosystem of the technology sector in the state of Santa Catarina. Located in all regions of the state through the innovation and technology hubs, the association assists more than 1,400 businesses through innovative programs that generate opportunities and provide benefits to members.

In April 2021, *ACATE* marked its 35th anniversary. Its history began with the administration of the *IT Industrial Condominium (CII)*, which housed the first technology companies in Florianópolis with the goal of strengthening the industry and supporting new emerging businesses.

In 1998, an incubator called *MIDITEC* was created. To date, it has helped more than 120 companies, representing about 15% of the companies in the technology sector in the capital of Santa Catarina. In synergy with the growth of the technology market throughout the state, the association also expanded in the 2000s through awards and the creation of programs, such as the *Business Verticals*.

In 2015, *ACATE* inaugurated the *Primavera Innovation Center (CIA)*, which maintains the roots of the institution and brings together companies of various

sizes in one space, where they exchange experiences and opportunities that strengthen the technology ecosystem. In addition, the *CIA Primavera* provided the expansion of events and projects that assist in the development of the technology sector in Santa Catarina.

ACATE's representativeness continues to grow: The share of member companies in the sector's revenues rose to 67.9% of the total, which constitutes a gain of almost 4 percentage points from the 64% share in 2018. Positive results are also seen in the productivity of member companies compared to other companies in the sector. Considering the revenue per worker, the productivity of the members is about three times higher than the others.

ACATE offers all its members a wide range of services, often with discounts or for free. Ranging from consulting services to agreements with health insurance plans, the institution supports technology entrepreneurs in their development.

Among the services provided, consulting and support for patent registration are also available. According to the executive director of *ACATE*, *Gabriel Santos*, the association offers events, lectures, and conversations with professionals, aiming at developing knowledge regarding the processes and laws that govern patents in Brazil. For companies that are part of the association's incubator, there are consultants specialized in start-ups to support the business that is beginning to think strategically about its intellectual property. Santos also cites the offer of agreements with patent offices across Brazil, making it easier for entrepreneurs to contact expert lawyers providing specialized services.

ACATE additionally advises entrepreneurs to seek out the innovation centers of local universities, especially the aforementioned *UFSC*. Many times, undergraduate students' projects have innovation potential, and even before reaching the incubation stage, future entrepreneurs can have access to support tools to patent their solutions at the university.

Eduardo Mattos is also an *ACATE* associate and emphasizes that much of the Brazilian businessperson's resistance to patents comes from a lack of knowledge about how the process works and patents' strategic importance to the business. He mentions that joint actions between universities and private institutions are essential for the creation of a collaboration network for the entrepreneur who seeks to protect their business.

Finally, the executive director of *ACATE* mentions that the corporativism promoted by the institution facilitates the learning process between experienced and novice entrepreneurs, and part of the knowledge related to both the difficulties of the process and its benefits can be acquired through the relationship between mentor and protégé.

4 Learnings and Takeaways

Start-ups are nascent companies, mostly technology-based, that need speed and exponential growth to survive in the market. Companies that operate in the Brazilian reality suffer from slowness, high costs, and a lot of bureaucracy to be able to register

a patent for their strategic innovation. Brazilian laws get more and more complex, and the average time to accept a patent only increases, from six to more than 10 years on average. In this context, the usual behavior of the entrepreneur is to focus on their business, which makes Brazil a country with a production of patents well below its real capacity for innovation.

Reforms in public policies would be an immediate answer to the problem, given that it is the legal insecurity of the country that puts entrepreneurs in a complex situation. The revision of the patent laws, the processes of the National Patent Office, and the costs associated with filing a registration are essential points for the improvement of the current scenario.

While macroeconomic issues remain unresolved, it is up to the entrepreneur to analyze the issue strategically, seeking support to make the right decision regarding the intellectual property registration process.

Despite the difficulties and numerous barriers to building intellectual property value for start-ups, the added value created through patent and trademark registration is still extremely relevant. Whether for protection against competitors or to increase the value of the company for possible investments, it is important to consider intellectual property as a strategic element of the business.

In the context of developing countries such as in Brazil, where legislation is extremely complex and the process is costly for the company, one possibility is to seek support from the institutions in the city's ecosystem, such as universities, accelerators, incubators, and other entities.

Takeaways

Although strategic for business in general, IP legislation complexities and high costs drive away start-ups from patents and trademarks, especially in developing countries.

In this context, most of the start-ups will choose to focus on creating a strong market share position as a first line of defense against the competition, ignoring the legal aspects for the time being. Despite the fragility of the position that the company puts itself in with this decision, the ratio between cost and benefit related to the process of registering a patent turns out to be inefficient. Despite the high investment, there is still a serious legal risk connected to both the registration time and the sustaining of the patent in relation to legal proceedings.

In such scenarios, companies may seek help from established entities in their local ecosystem, which could be represented by accelerators, incubators, universities, and others. Entrepreneurship-related organizations can support the process both with a strong knowledge base and with connections to specialized companies and mentors with experience in similar cases.

The connection with the local ecosystem facilitates the understanding of the importance of legal protection of the innovation and can bring immediate

(continued)

benefits to the start-up seeking this support. Finally, it is essential that entities participating in the ecosystem actively seek knowledge, connections with experts, and experience with intellectual property to provide the necessary support to local companies.

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Thiago Rafael Ferreira Marques is a Professor of Business Administration at Senac-SC, Brazil. He holds a PhD in Business Administration with a Marketing Emphasis from Fundação Getúlio Vargas – São Paulo (2020), an Msc from Federal University of Santa Catarina (2013), and a BBA from the Federal University of Santa Catarina (2010). He currently works as the Chief Marketing Office for Zucchetti – Brazil. He has had experience with software development companies since 2006, being an active member in the start-up ecosystem in Florianópolis. He has also coordinated multiple executive education programs in Silicon Valley and has been a visiting scholar at Technische Hochschule Ingolstadt (THI), Germany, since 2016.

Andressa Sasaki Vasques Pacheco is a Professor of Administration at the Federal University of Santa Catarina, Brazil. She holds a PhD in Engineering and Knowledge Management – Federal University of Santa Catarina (2010), as well as Master's (2007) and Bachelor's (2005) degrees in Business Administration from the Federal University of Santa Catarina. In addition to her faculty role in the Postgraduate Program in Administration and the Postgraduate Program in University Administration, she coordinates the Academy project to foster entrepreneurship at the University. She has extensive experience in Administration, with an emphasis on University Management, Materials Administration, and Entrepreneurship. She is also a member of the INPEAU research group – Institute for Research and Studies in University Administration.

Part II

The Investor's View

For us, it starts with IP, and it ends with IP.
—Todd D. Dollinger
Chair and CEO
The Trendlines Group

"IP Is Paramount:" The Significance of IP in Early-Stage Start-Up Investment Decisions

Ulf G. Schaberg

1 Why VC Investor Views on IP Matter for Founders

Access to capital is one concern, if not the main concern of founders at the outset of the journey of building and growing a new company, striving to turn ideas into products and services to the customers' benefit; venture capital (VC) is an important source for capital, particularly during launch and seed, early development, and expansion of businesses (Dubiansky, 2006; Hsu, 2006). "To be financed or not," as others coined it in Shakespearian existentialism, is a critical hurdle entrepreneurs need to take (Häussler et al., 2009).

Founders are facing a plethora of questions which may quickly become overwhelming during the foundation and establishment of a new company. Priority topics reach from imminent technical questions in relation to development and improvement of products or offerings down to the basics of running a business, including financial, human resources (HR), accounting, tax, and legal issues. Whenever start-ups will eventually be targeting global markets, questions in relation to intellectual property (IP) and particularly international legal frameworks for registering intellectual property rights (IPRs), including patents, marks, and designs are,

Disclaimer: The opinions expressed in this article are personal opinions of the authors and interview partners, respectively; they do not purport to reflect the opinions of any organization, company, or employing entity they are working for or involved in.

U. G. Schaberg (✉)
Intellectual Property Business Partners, Fideris, Switzerland

AO Foundation, Davos, Switzerland

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_6

without doubt, not only topics of high complexity but also associated with relatively high (consultancy) costs.

Prioritization while facing many pressing issues is a key to success for every entrepreneur. The question arises: What is the priority of IP during early stages of company creation? And how does it help founders more specifically in taking the financing hurdle?

Convincing investment decision makers is, obviously, a very practical objective for early-stage founders and start-up managers. A number of well-prepared studies and reports exists elucidating these questions, which have helped in providing objective data and insights (Dubiansky, 2006; Häussler et al., 2009; Ipsos, 2013). Investment decisions are prepared and made, however, by investors and fund managers – that is: by human beings.

Experience and conversations during the work with wannabe founders and start-up teams on the one hand, and decision makers in the areas of private equity and venture capital on the other hand, have given rise to the author's impression that sometimes a lack of understanding of mutual expectations exists, particularly in relation to IP. Founders looking for funding, as well as intellectual property (IP) experts supporting start-ups or VC funds, can very likely improve their chances for funding and their performance by taking into account the investors' view and by respecting investor expectations and preferences. Instead of trying to gain insights from the attempt to obtain further objectivized data, this contribution aims intentionally at hearing the investor's voice directly.

Three experienced investors and VC fund managers agreed to participate in a series of open interviews which are summarized in this chapter, only gently edited to increase readability. The conversations touched upon the typical issues broadly relating to intellectual property a founder may be asking, building up their enterprise and eventually preparing a VC pitch:

- How important is IP for my start-up?
- Will patents or trademarks help me in attracting investors?
- What will investors want to see?
- Are other patents important, or should I deal with it later?
- Do I have to learn anything about IP myself?
- Should I rather choose cost-effective IP expert advice?
- In a world of digital business, isn't IP neglectable today?

Listening to investors' direct thoughts and views, warts-and-all, may provide valuable insights for founders, their diverse collaboration partners, and also to IP advisors involved in early-stage start-ups in one way or the other. The interviews are rather complementary to objective studies, and inherently far from presenting a representative and objective truth.

It is the interviewees' and author's wish to help in improving early-stage start-up dealings with IP issues and their interactions with VC decision makers who are able and willing to provide access to necessary capital.

2 The General Importance of IP for Investment Decisions

How important is intellectual property (IP) for start-ups? Or more specifically, does it influence your decision as an investor to invest in a start-up company?

Todd Dollinger Intellectual property, for us, is paramount. If we don't see existing IP, or the road to the establishment of strong IP, we are not going to invest. It's very simple, it's binary, we will have to believe that.

Ulf Berg Of course. My partners and I, we go like a cruise missile on the patent and IP situation before we invest. That's absolutely clear. We look at the patents, and it's important to us to check out the affinity of the people in the company we're looking to invest in and their understanding of IP. The impression I try to get in each case is how much activity there is in the IP area. That doesn't necessarily have to be associated with high cost. It's about intellectual quality. A lot of brainpower is necessary. From my point of view as an investor, that is one of the important issues, that a sensibility exists, to deal with this area intellectually and to follow it closely. It is not enough to work on IP purely as a matter of duty.

Why is IP important? And are there differences in relation to technology or industry sectors?

Todd Dollinger We only invest in two areas: health and food. And it is important to realize our ambition: We are not looking to build billion-dollar companies. We are "company creation investors" principally. In our field, we have to have the expectation to be able to create strong IP. And the reason for this is very simple, which is: A potential buyer is not going to buy a company from us if we never filed a patent. So, for us, it starts with IP, and it ends with IP.

The situation for a potential buyer when they are looking at one of our companies is that they are really going to dig into our patents. If they think the patents are very weak, meaning that anybody can basically do what we have just done, it will either turn them off completely, and that is very likely, or they might decide, well, we will just do it ourselves. There is the fact that, due to our structure and because we are early stage, we can do things enormously faster than they can. And they know that, there's nothing subtle about it. So, there is a reason to acquire something from us if they believe that they can fix the IP – but they do not want to fix IP, they want real and strong, defendable IP. Markets, people, and tech/IP are the holy trinity of the start-up investment world; it takes all three to succeed.

Ulf Berg That is correct, and there are differences in the various sectors. In the orthopedics sector, I would argue that only in exceptional cases a patent position may only be reachable. In the pharmaceutical sector it is different in the sense that even in late phases like phase II, you still have to protect the findings that come up then. We know that the patents to come will still play a very important role. We have been working with one company for five years now, and only after three-and-a-half

years we filed one of the most important patents. That is, of course, a great achievement.

Craig Cooper That's right. In the Medtech field, without any IP or any patent, an exit to an acquirer may be almost impossible. When we look at successful exits, it is clear that the IP position, the value of a start-up's IP, and the way in which they continued to develop and improve their IP position and portfolio beyond seed and series A rounds had a fundamental bearing on the exit at the end of the entire journey. We do not have the benefit of making a comparison, of course, of what would have been the value if the IP portfolio looked differently. But it is clear that it plays a very strong role. It is critical to keep that in mind as an investor from the beginning.

Todd Dollinger And here's an interesting aside: We have just finalized our tenth exit, so we are rather practiced in selling companies, and they tend to be early-stage companies with early revenues or even pre-revenue. Something that is very common is that, when we are in the due diligence phase on the sale of a company, there's going to be a phone call from the other side, and they are going to say: Well, we've already spoken about your IP, and we told you that it looks pretty good and that we were satisfied. But we have done another review, and we have decided that your IP is crap. That word is not typically used; still, that's the message they are trying to send. And that's a negotiation tactic; it is very common. It is an argument to negotiate on the price that, at such stage, was already on the table. They will come with arguments why the IP is of little to no value. Most of the time that has been done, we brought the attorneys and principals to one table and talked it through. It is a common attack, and you must be prepared to defend it. That's why IP is paramount.

We will not invest if the IP is not already strong or can be made strong. It will have enormous value in the sales price of a company.

Craig Cooper It should also not be underestimated that even the acquirer doesn't get a zero-risk product. In many cases there will still be investment needed, beyond the acquisition cost, and that will likely not decrease, for example in Medtech with regulatory requirements increasing with the EU Medical Device Regulation. If the solution is then additionally easy to copy or the IP easy to circumvent, then the risk is even less worth taking.

3 Priority of IP in the Overall Investment Decision

What importance or priority does IP have for the overall investment decision? There are certainly many other factors that play a role in your decision whether you invest or not?

Craig Cooper Let me take a step back. Our assessment process is fairly typical for a VC fund, a typical funnel. We want to be as wide as possible in the beginning, to

access all possible opportunities within our scope. We want to be the go-to investor in our field. And within this field, we want to attract every opportunity into our funnel.

The process consists of three steps. The first is a high-level introductory assessment. At this stage we are usually making an, I guess fairly bold, assumption that they have all their ducks in a row on the legal and IP side. It is a necessary assumption at that point because it is a quick first assessment of other key areas.

We will look at market opportunity, product or service, and team. In general, those are the key areas a start-up needs to satisfy pretty early on and pretty quickly. The founders need to instill a lot of confidence into us as an investor at a very early stage in those three areas.

If that is the case to our satisfaction, we move on to the next stage which is a deeper dive, still before term sheets or negotiations on terms. We look more closely into the commercial side of the business, financials, product, legal, and indeed, IP. That's typically the time when we try to establish the details behind the IP position.

And the third stage, after we sign a term sheet, is formal due diligence, looking under the hood in more depth, into documentation, patents filed and their status, more from a formal legal perspective.

Todd Dollinger Let me also take you through our due diligence process, which can take anything from nine months to 90 seconds.

First and foremost, there's market for us. That's the be-all and end-all. Sometimes it is a problem for the founders, particularly when they are scientists, engineers, or MDs, that they want to talk about the science and technology, while we want to talk about the market. And market, that's all we're looking at in the beginning. The key question is: Is there an unmet market need? And what is it? That's the first and biggest barrier.

The second due diligence point is people. In our model we are bringing the companies into our facilities for two years, often much longer. They are literally living with us. We need to find the right people that we can work well with, that can play well with others, and that we believe can drive an idea forward, from a concept to a product.

Thirdly, it's technology. Obviously, that ties into the IP issue. Here's what I mean: If we think you are great and you come to us with something that we think is a real market opportunity, and we think that the concept and the technology look good, then we will probably want to run with that. Because we think that with our skills and your skills, even if there will be a problem in the development, we will be able to work it out. That's the three issues: Market – people – technology and IP.

We also know something you don't know – and by the way, that is an IP aspect as well – there is a really good chance that the idea that you brought us, after we fell in love with the market and we fell in love with you, that that technology is not the best possibility, and we are going to wind it up within the course of the first year, and take the whole technology concept that you brought and throw it into the trash. And we're ok with that! [*Laughing.*]

And that obviously means in such cases that the original IP got flushed down with it at that point. And we're ok! Because most of all, we want to see the market opportunity, and we want the right people. Then we can work on the technology. And that's why technology is tertiary in our investment decision, and right with it the intellectual property. But, let's be very clear here – whatever the technology base is for the company, there is no value without IP – we can't use core IP without being able to get patents and with core patents developed, build an IP fence around that.

Craig Cooper If we believe in the team, indeed. If we receive a deck with a product idea where we already know the market, we will not be thinking about IP in the first place. You are absolutely right; the team is fundamental. If we believe they will come up with a solution even if you throw the initial idea away, that's feasible, and then the original IP doesn't play a role.

And the other way round, even if there is a huge unmet need and the product seems promising, if there are any red flags around the team, that would be a clear reason to stop the conversation, before even getting to questions around IP. Because in the end, we are investing in people above all else.

When we think about the three stages – introduction, deep dive, and formal due diligence – if we talk about IP, that second stage becomes the most important one for the question: Do we proceed or not? In the first stage, it is an assumption in favor of the founders that everything is in order, and in the last phase of formal due diligence, we don't even want to be there unless you know that everything should be pretty solid. Otherwise, it would be an enormous waste of time and resources.

That's why it will most likely turn out to be that middle phase, as we dive deeper into the nuts and bolts of the company, in which we would like to gain a clear understanding of the IP situation. We want to be sure at that stage that they have a solid basis, as far as IP is important for the strategy and product.

One of the studies that was conducted about investor decisions suggests that "having at least one patent application reduces the time to the first VC investment by 76%" (Häussler et al., 2009). Do you find yourself in this statement, or would you rather disagree?

Todd Dollinger That's a fascinating number. Well, let me get back to what we said before. We think that if you bring us what we believe is a great idea, we recognize the fact – which we may not initially discuss with you a lot – that there's a good chance that in the first year or so, we are going to jointly decide to move in a different technology direction, for exactly the same market, but that the technology isn't quite right. So, the answer is for us that bringing a filed patent application is not a critical issue. It's not unusual that somebody comes to us with a completed and filed patent application, but it is also not unusual that we are just talking about an idea, and we are fine with that, too.

In terms of the total world of investors and certainly dollars invested, the world that we play in is a very small percentage, of course. But in our cases, I don't think it would make a big difference for deciding "yes" for the investment, and I think it

would make a very small difference in terms of decision time, how long it would take us to decide to invest whether you provided one or more patent applications or not.

Ulf Berg I would say it depends primarily on the industry. In areas such as pharma, biotech, or Medtech, the existence of patent applications plays a very strong role. But you can also mirror this statement of the study in another way: If my partners and I sit in a room and listen to a company, and after an hour-and-a-half we realize that there are no patents, but it's in a patent-heavy sector, then it's already very likely that they won't get any money. Then we look at each other, and then the decision is usually already made: negative. That leads to the percentages that the study reports.

That's why I said before that it's important for us to find out how near the topic of patents is to the founders, and how seriously it's taken. If you then notice that it is not taken very seriously, it is definitely a warning sign. Whether it's the existence of a patent, or the affinity for the topic and the conscious cultivation of this field: Without that, they will get no money.

So, you can also phrase the statement with the reduction of 76% in the presence of a patent exactly the other way around: If the founders or the CEO have an affinity for the topic, then they will very likely also have a patent.

4 What Founders Need to Know About IP

Talking about the conversation with founders or start-up teams: What do you expect from founders in terms of IP savviness?

Ulf Berg The most important point is what I call the "laugh test" or "smell test." I invest in people, not patents. You come in and realize they have done their homework; they can talk about the topic at a normal level. I expect founders to think about IP very early. They have to think very early about the opportunities that already exist, as well as those that will arise later from new insights.

Craig Cooper It's a fair question, and it applies not only to IP but across a range of areas. Many founders have a technical background. If the team is slightly bigger, they may have brought in a wider range of competencies, but at earlier stages the range will be fairly narrow. Then the founders embark on this wonderful journey of building a company, which means they will have to acquire new skills pretty quickly or get that skill and expertise from outside.

We do not expect that they are fully equipped to manage all these areas today. That is fine. If they were, they probably would not need investment, or they would be further advanced then they are when they come to us. It would be surprising to come across a case in which there are no holes in it in one way or another. This could be, for example, IP, it could also be financial planning, it could be legal, or regulatory, or something else.

But: What they will have to demonstrate is a broad ability to execute. That is a must-have capability that the team will have to convince us they possess. They must be able to understand the bigger strategic picture. And for IP, they must be able to

understand where the value lies, and in relation to their value proposition, that they have a clear approach to IP. They need to understand their strategy and why it is the right strategy. And by the way, also the importance of this IP approach when it comes to an eventual exit.

It's easier said than done that founders must be able to give you the bigger picture. To be able to do this, you will have to understand quite a bit about IP, also on a more detailed level. Is that right?

Craig Cooper They do. Definitely. It's about the way they present themselves and the company, and the IP position and all other aspects of the business. We try to understand if they can explain the decisions they have made so far. It does not have to be perfect yet in the IP area. But they need to be able to explain it. Do they have more patent filings they need to make, and why did they decide not to do it yet? Do they have to change the geographical scope in the future, or why do they think they don't?

Ulf Berg Exactly. When I ask about FTO, they at least know the word and can explain it to me. If someone doesn't know what I mean by FTO, that's a warning sign. And if they can't explain the coverage of the patents to me, then it stops very quickly. Then you think about whether you should invest at all, and if so, whether it would be better with a different CEO; while, under normal circumstances, you wouldn't change the CEO with the investment.

Craig Cooper But it's these types of questions. You mentioned FTO: Do they understand what that means, have they got a clear sense of the landscape, whatever that means in a particular case, do they know what needs to be checked, and what has been done to that point, was that thoroughly done?

And on the protection side, which aspects of their products and technology have they started to protect, and why have they taken that approach? It will be a conversation around that. It can still be imperfect, but if the founders show no awareness for boxes not yet ticked, in the IP field as well as in other fields, that definitely raises a red flag.

Ulf Berg Eventually, when you get near to the investment decision, you sometimes invest a whole day's work in IP due diligence, sometimes even two. I always try to reach a precise understanding of the coverage of the claims and the families, as well as the searches conducted for the applications, and also on the freedom-to-operate situation. Those who clearly haven't done their homework, unfortunately, will not realize that until months or years later. And finally, the process is important, to what extent is a strategy with patent families being pursued, what geographical coverage is targeted, and all these issues.

If I ask these questions and a founder can't answer them, for instance doesn't know what I want from them, then that already shows that I either have to make improvements, if that's possible, or I'm simply at the wrong address.

And finally, it is still an issue that the founder must present it to me – as an investor. What I don't like is when a founder just tells me a patent number in a presentation slide, in the sense of, "you can read the rest yourself." That rather shows me that the person has no love for the subject. A founder has to put a lot of brainpowers into it.

And in this context, it really does play a role for us: How is the quality of the IP consultant? We ask very often and very early who the patent attorney is. And I do have a strict discipline to get second opinions. And unfortunately, it is not uncommon for us to change the patent attorney to one of our regular attorneys. The issue is simply too important.

The consulting patent attorney is a due diligence aspect for you?

Ulf Berg Yes, definitely. Look for the quality of the patent lawyer! You don't have this know-how yourself. And if you don't get excellent advice in the IP area, you're out, very quickly. Every founder should know that.

There is an example that I think is very enlightening for people working in start-ups, which is the *Singer* patent example of a patent claim: "A machine for sewing, characterized in that the needle has its hole at the tip." Full stop. Such a claim has elegance. *Goethe* is purported to have once said: "My dear friend, I had no time to write you a short letter." That is similar. In writing patents, you must take the time and think it through to get to the point, in that case, to the hole. That's a very good example of someone who really understood the invention. It's necessary to decide which feature is needed, and which one is not, and what is the essence. And it's that ability for abstraction that gives you the basis to get good patent protection. My patent attorney recently highlighted a feature, I wouldn't have even thought of that as a feature. So, you really have to make sure that you have an agile advisor who can be controversial. For me, that's what makes a good patent attorney.

And it starts already with the ability to communicate with the patent attorney. And vice versa, the patent attorney must also be able to bring themself to the level of the recipient of the communication. One of our patent attorneys even argues with the managing director if he or she has negotiated something wrong in his eyes. But that's the level of passion, that's the kind of interaction you need in this field. Unfortunately, I meet too many patent attorneys who are too formalistic.

5 The Level of IP Due Diligence for the Investment Decision

Does IP or specifically patent valuation play a role in the investment process, in your investment decisions?

Todd Dollinger I am going to give you two different answers to the question. The most important answer is the principle in economics that the value of something is that what a willing buyer is going to pay to a willing seller in a free market. That is how a value is set. When we sell a company, or when we bring an investor into a company, we are always looking at the value of the company. The truth is, that value circles enormously around the IP.

If you are selling a company that has got $20 million of revenues, there are other ways you can look at this, which may then also include the market presence that you have, the relationships that you have as a corporate entity, etc. When we sell a company, the oldest company we have ever sold was less than ten years old, the company with the greatest revenue we ever sold was a few million dollars in annual revenue, so I will tell you without question that all of the value of a sale in our cases is associated with the IP.

Then you must see that all valuation independent from a buyer is prone to be flawed. A buyer will integrate what they buy into their current sales and marketing system, the company will operate under their quality system, and the products are going to be manufactured by manufacturers that the buyer already certified. So, we will have to fit into that, and those are all valuation points for a buyer as well.

We could say the valuation is about the product, but I will tell you that I believe it is exactly the same thing as saying it is about the IP. If a buyer believes that they could just copy us, then they say, well, shall we buy this company or should we just make it ourselves? It will take them some period of time to make it, of course, while we already have it in production files, which is likewise IP, in a broader sense. It is about the IP, that's all it comes down to.

The second part to your answer is that IP valuation is indeed an important tax and accounting topic. An acquirer will want to list almost the whole purchase price as IP. So, from their point of view, they are looking at it as an IP acquisition, an asset acquisition, and they want to be as close to 100% IP as they arguably can. That is, however, a secondary tax and accounting issue at the exit for the buyer.

Looking at another aspect of IP strategy, third-party patents: How do you as investors approach the question of freedom to operate (FTO)?

Todd Dollinger We don't do formal FTOs before we make an investment. We will look at the space to understand what's out there, but we are not striving to reach a formal FTO opinion. We don't think that's worthwhile before we make an investment, in part for the very reasons that the technology may change a lot. We want to have a good overview of what the IP landscape is, and we want to understand the IP landscape as that overview may cause us to decide to not proceed in an investment process. But we are open to technology changes, and in fact we even encourage it after we make an investment. That's why we are not so concerned about FTO. We do take a look into how active an area is, what's going on, in order to get an idea of the patent landscape and where we think we want to play. But not a formal FTO.

Craig Cooper Indeed. Some start-ups will have done an FTO analysis in a more formal sense, others not. It is not a requirement for us, either. If we move toward investment and final, formal due diligence, we are going to go deeper into this topic, that is for sure.

Todd Dollinger We are happy if you come to us, sit down in the office, and talk about your idea. It is not unusual that somebody has already filed a provisional

application, and still, in most cases, we will later go over it and think about what needs to be changed. Again, that is not the top concern for us. Everything is driven by our experience that there is a really good chance that the technology is going to change substantially in a very short period of time. To the extent we perform an FTO, it is limited and informal; later, together with the new company's staff, we will review more formally.

Craig Cooper If we jump, if I may, all the way forward to the exit, freedom to operate will play a significant role for potential acquirers or future partners and collaborators. When those conversations begin, unlike with us as VC investors, IP will come up quickly. And that is never a surprise to us.

And that is why we expect founders to have taken a rigorous approach to IP. They have to know what they are talking about; they should have some sort of perspective on the path forward and they should understand the importance of this, that it is going to become important.

What you explained to us here, is that also true for companies at later stages of their development, say, at middle and late rounds of VC funding?

Todd Dollinger No, this is different, you are quite right. What I have been talking about applies to companies during their first few years. We hope that within 12 to 18 months we will be firmly planted on the technology side, and to then have clarity of direction. Sometimes we do make changes well after that. Our ambition is, though, to achieve proof of concept within the first one-and-a-half years for something that we think makes sense.

If we are looking at a company that is already four years old, for example with one of our venture funds, we would have very different expectations. We would expect to be reviewing existing IP, talking to the other investors that are already in the company, and they will share their due diligence with us as well.

6 Building the Company's IP Position During the Portfolio Phase

How do you involve yourselves in the IP aspects of your portfolio companies? Are you directly involved, do you bring your own IP experts, or would you rather leave this to the team to drive?

Ulf Berg It depends. In one case, yes; as a rule, less. In *Switzerland*, you can still play a much more active role as a board member. You can do that, but you can't always. You probably have to pay much more attention to ensuring that the management is supported by the right, highly qualified specialists. In the case of consultants just as much as in the case of the other board members, who then take over the management together. In one case, for example, I brought in a former division head from the pharmaceutical industry as a member of the board of directors, which brings a completely different drive.

Craig Cooper We are an active investor. We work with partners with deep, specialized Medtech expertise. And that means that we bring, in addition to capital, significant added value for the start-ups where we invest, including on IP.

Todd Dollinger For us, there is no aspect in our companies that we are not involved in. We are normally involved in all discussions constantly. We are talking about the technology, we are talking about the IP, establishing it, strengthening it, it's regular conversation and we see the critical importance of it, because we are thinking about the end game, about when we will be in front of a potential buyer reviewing all of this, what are they going to say? Others might be involved in these conversations with us and management team; for instance, as seems appropriate to the moment, we may bring in other VCs or strategists to lend their voice and experience to a situation. Of course, IP counsel is constantly engaged in these matters.

Ulf Berg Absolutely. Already at the time of the investment decision, it can very often be the case that we set "requirements" for what we expect in the future. That can be that the topic of IP is prioritized more, whether it is a better FTO, or a more systematic approach to patent families, or the planning of future patent opportunities. You can plan that if you do it right, future patent applications don't just appear from nowhere.

Todd Dollinger Interestingly, the entrepreneur is always in love with their invention. That's fine! We are fixed on serving the market – technology should be improved and adapted as required to be in service to the market. Still, one of the things that we are testing before making an investment decision is whether we think that you are flexible enough to walk away from this thing that you invented and move to a new technological approach. So, we are testing, explicitly and implicitly, to make our judgment as to whether or not you are open to change, open to better ideas. This is critical in company creation investing because we know that there is a reasonable chance there's going to be a change – somewhere between substantial and complete change to the original technology. That's our experience with companies that are successful.

Once we have IP, once we have the concept, then we are always looking to build a fence around it, looking to make it stronger. That's not a day-1-only project, it is an ongoing project that's constantly discussed.

7 Influence of Contractual IP-Related Aspects on the Investment Decision

Contractual aspects are another typical due diligence area, for example ownership or licenses in relation to IP. Do they have an influence on your investment decision?

Craig Cooper Unfortunately, we as investors tend to take a black-and-white approach. There are too many companies to assess, too many opportunities to review. The key is to dedicate as much time as possible to the cases that matter, probably around 1–2% of all cases. The danger is investing too much time on companies that don't make it to investment.

That is why, when we come to the question of ownership, it may be a crude approach, but for a company to tick all the boxes, we want them to own their IP. That's not an assessment of value or quality; that comes later. We strongly prefer not to have discussions about to whom royalties must be paid, or rights to some markets but not others. When you see a situation where this university owns this and that other company owns that, you start to be a little bit concerned. These settings can be problematic.

I said it is unfortunate because maybe it should not be that black-and-white, maybe quality of IP should matter more, but our preference is clear. Similarly, the terms of the relationship could be assessed in more detail. Is it generally a bad thing that royalties will be a drain on cashflow? The most accurate answer is: It depends on the context. But is it preferable that there is no drain on cashflow? Clearly yes. In all cases in which we invest, the ownership position is clear. If IP ownership is unclear, that alone might not be the reason why we do not invest, but it contributes to the decision.

Todd Dollinger At the end of the day, particularly in medical devices and probably true across industries, if there is an encumbrance including a royalty, the potential acquirer will at least during the negotiations request from us to resolve it. The point will always be raised, whether it will be successful or not depends on the particular circumstances.

Now, you may settle on something in which indeed a royalty is still attached to it. But during exit negotiations, licenses and royalties are a problem area in your negotiations, that is guaranteed. It will bring you grief. If you can get rid of royalties on day 1, and if you only have equity partners, there is no question that that is the easiest path for the investor and the easiest path to exit. I would encourage everyone to try to go down that path from the beginning; equity relationships make for better partnerships than situations where a company has equity holders and royalty recipients that may not be fully aligned.

It is a negotiating goal for us at the beginning when we are talking to anyone: We don't want royalties. We do accept it from time to time, but then we will want to negotiate that we have a buy-out right at change of control. The worst-case scenario for us is that we will have to deal with it when a potential buyer knocks on the door and wants to buy the company, and they will put pressure on us to make the royalty go away.

Craig Cooper I have a case in mind, which passed all initial gates: The market opportunity was clear, their solution was strong, the founders were on the right track and made a good first impression, and the technology looked effective; but the IP was owned by another company. There was a clear story behind this and why it panned out the way it had. But it became apparent that there are many open questions

on ownership and use rights. It was not a reason for rejection per se, but it raised a number of red flags. We are far more comfortable in cases where there is clarity on ownership of IP.

Some universities prefer licenses to start-ups or even their own spin-offs; the rationale behind this is that if the start-up fails, they want to be able to have a second chance; they don't want to put all their eggs in one basket.

Todd Dollinger When we talk to the head of technology transfer of a university, we will accept the fact that a royalty is desired over equity. But what we will do is to push hard that it takes equity instead of royalty because it is very easy to deal with. If the university takes equity, they will be diluted along with us under new investments. So clearly, it is in the company's best interest, but there is a really good chance that the university will refuse this model and insist on a license- and royalty-based model. What we will then try to negotiate is a buy-out right, that in a case of change of control, the university will give up the royalty and will get a part of the exit in return.

Ulf Berg I don't see this as a big issue. We recently had a similar case in the pharmaceutical sector with two German universities. We can live with that. *ETH Zurich* and the *University of Zurich* have very clear rules on this as well. But the contracts are balanced, in my view. Sometimes you can't get around that. On the other hand, subsequent patents are then very important.

Todd Dollinger We do have situations in which the IP owner insists purely on royalties, with no obligation to sell us the IP, to cancel the royalty. In which case, I agree, we will have to negotiate at the end. Because in most cases, the buyer will ask us to make the royalty go away. Indeed, there is one exception: Royalties continue to be accepted in the *pharma* field. In *medical devices*, it is a real issue in my view. The seller will almost always turn to us to make it go away; that is the problem.

Ulf Berg Well, I cannot confirm the distinction of the sectors in this case. In principle, of course, this can be problematic. But then we talk to the people. I can't speak for all universities in general, but in my experience, a solution can usually be found, and there is a willingness to convert such licenses into equity.

Craig Cooper We can also frame this another way: Something we always look at in general is the question of dependencies and relationships. In a sense, that applies to IP and ownership and royalties and so on, but also applies to partnerships: To what degree is the start-up dependent, in any way, on a partner?

We want to take a step back, also away from IP, and assess the start-up as a whole and get to the bottom of all such relationships. If there are dependencies, it may be a red flag, depending on the circumstances. And if ownership of key technology is with another company, if there are strings attached in terms of royalties or grant-back clauses or whatever, it is potentially a red flag as well. On the other hand, such relationships can also be an advantage, for example if there is in addition access to know-how or experts or key opinion leaders or market channels or whatever. So, it

depends on the overall relationship and the context. It is not always good or bad, it depends. But we want to get to the bottom of it so as to fully understand it.

Talking about relationships and encumbrances: A growing number of investment banks are supporting start-ups. IP is sometimes used as collateral, as security for loans. As an investor, how do you view this setup?

Ulf Berg We recently had such a case. First, the IP was used as collateral so that in a worst-case scenario, the bank would get hold of it. And secondly, there was a clause involved that in case of an exit, the bank would receive a certain percentage per year of the loan term as a fee, in a sense, interest. To say it simply: This would have made the company unsellable!

First of all, you should never give loans to companies that are in the venture space because the risk is equity. That is a fundamental mistake. In this case, we then decided to just pay back the loan, and so we were able to sell the company a few months later. But that would have never happened otherwise. Try negotiating that with Americans and, on the other side, with a bank with such onerous conditions – you just can't do that.

In another recent example, we had a construct with shares and shareholder loans. The loans were subordinated and structured very well, neatly and very correctly. American investors don't understand why you are doing that. Impossible. We now had to rebuild that, all into equity shares and no loans. Even if it's all theoretically and legally feasible: You just have to accept the realities with high-quality investors or buyers.

We recently had a case in which a start-up had involved a German investment bank. The opinion was that this was quite normal, and that it is being done more and more, including a collateral on IP.

Ulf Berg It may well be that this is being done more often. I can only tell you: We do not invest in companies to which a bank has given loans. The risk must be equity. Don't give me loans! Period.

8 IP and Digital Business Model Start-Ups

We talked a lot about IP in the classical industry. How is your investor view on IP in software-based innovation or start-ups with digital business models? Are there differences, in relation to patents and other types of IP?

Todd Dollinger For our investments today, it is a minor matter. We are looking to get more and more involved in things that relate to *artificial intelligence*, to AI. Whereas I like to refer to AI sarcastically as the technology that used to be known as *software*. We do have software elements to a number of our devices. But it is not important for the value; it's a necessary element but not the key asset.

The only exception we see to that is something that we don't invest in. Companies that are going to go fast to market particularly in the *consumer products* field, where you are trying to acquire millions of customers within a year or two. Then it's all about the market approach. Then perhaps they will be able to defend themselves by the capital they bring to bear, and by strength of market presence. We don't invest in things like that. Not because we're opposed to it, we just don't.

Craig Cooper It depends on the problem and the solution. In *digital health*, the cases we see are typically consumer-focused apps and solutions. In many cases these solutions aim to address lifestyle and behavior. For example, tools to support rehabilitation or nutrition, helping patients comply with treatment regimes and coaching behavioral change. And it is correct, in such cases we take a different perspective on IP compared to classical *Medtech*.

Gaining traction fast is the typical digital approach, whether in digital health or other areas, attracting users as fast as possible. And we see many companies entering these spaces. At first glance, it appears that they are all doing similar things. But to navigate the lack of strong protection, the issue of being relatively easy to copy, the need to create a niche that is somehow unique for each of them is a major challenge.

An example: We saw a digital health company that integrates their app and the digital side with real-life coaching. That is one school of thought, distinguish yourselves by engaging a network of experts. Another school of thought is, no, you definitely do not want to do that, as it has a major impact on your business model, on scalability; what the market wants is pure digital, nothing else. And there are other aspects by which these businesses are trying to tweak their competitive position. But in digital health, the jury is still out on this, from an investment perspective.

There have been some big exits, less in *Europe*, more in the *U.S.*, but not yet many. It is a younger sector. We do not yet see the activity that you see in the classical medical device sector, and not the hive of activity that you see in the wider digital space.

Ulf Berg It's true that patents are not necessarily needed in this area. I am involved in two cases in which the know-how and the know-why play a central role. In these cases, it is speed that matters most. In one example, with the help of a holographic lens, we can have a surgery performed by a resident surgeon, and they reach the level of an experienced chief surgeon. The programming ran a year-and-a-half ago. *Speed-to-market* is the most important thing in such cases. Our surgical process is the difficult thing here, you need 20 very good people. But if you have them, you can copy it within two years. And the big players like *Microsoft* or *Google* or even the *Chinese* could easily put 40 people on it. That's just the reality in the software-based innovation sector. Speed is of the essence.

Craig Cooper For one company in our portfolio, their software links with existing hardware. For them, classical IP is not the key issue. It is a good question, how they carve out their niche and protect it.

One, they focus on specific user groups and customers, as in their space some focus more on *nutrition*, others on *sports* and *wellness*. Another aspect is partnering, with the leading hardware producer. In other words, this contractual partnership and access to know-how is itself a key asset, combined with carving out a specific niche, which is difficult to copy. So, there are a number of opportunities for such businesses to make themselves hard to replicate, even without a traditional IP approach.

Freedom to operate (FTO) from a patent perspective has become a growing challenge in the area of software and digital innovation, not only due to the sheer numbers of patents in this area. Are you wary that this increases the risks for you as investors?

Craig Cooper Yes, but, as investors, we are in the game of risk. And our greatest failure would be not to invest, or in other words, to let others do it. Procrastination, dwelling on this issue, failure to make decisions, and missing interesting opportunities is the bigger mistake. An investment going south, that in itself is not failure. It is part of what we do. If the market opportunity is big enough, if the solution works, if the team is great, we will be able to deal with it.

The argument I heard was that early investors are less likely to be at risk because they have good hope to exit before it's big enough to be sued.

Craig Cooper If we go back to the relative lack of acquisition activity, then this hope may be misguided. And in addition, a potential acquirer might indeed look at such risks differently. But, in theory, it's correct.

Digital health is, in terms of widespread acquisitions, a work in progress. Can we draw a clear line from the IP aspects you describe to this? I do not think so, and other digital sectors prove the opposite. So, it is likely a more complex situation. But there is the aspect that the big players in Medtech are used to looking at opportunities in a traditional sense, in which IP is clearer and plays a significant role, potentially making it difficult to attract attention for some digital health cases. It is a mindset thing as much as anything else. Yes, there is risk and there are different types of risks, but it is also about mindset. This may be part of the reason why exits are and may continue to be challenging.

9 Investor Views on Branding and Trademarks

Turning to another type of IP: branding and trademarks. Do they sometimes influence your investment decisions?

Craig Cooper Trademarks are pretty low down on our list. The key thing is to discuss patents, particularly in the classical medical device space. And for our investments, which are early stage, it is usually too early to lose sleep on branding, naming, or trademarks.

Todd Dollinger I smile because for the entrepreneur, this is an area of great emotion. And, it is of interest to me, just because I enjoy it. At the early stages, however, I ascribe no value to it whatsoever.

The fact is, the companies that have acquired our companies have sometimes taken over the brand names for our products how we put them out, but it was just because it was already there. I don't think it added any value. I even don't like it when our companies talk about registering trademarks and spending money on it, even though it's small money. I'm not worried about $500 spent, I just don't see the value of registering trademarks, not in our field.

What I would write in a chapter if I was writing a start-up guide, and I wanted to be honest with the entrepreneur, is this: If you are building a billion-dollar business, then be concerned about trademarks. If you are looking to exit the company within the first decade, then don't spend more than $100.

Ulf Berg I wouldn't always agree with that. On the one hand, there are still IPOs, when you go public with a start-up as an exit. Then the brand is being maintained, and it has to be a proper brand.

Todd Dollinger As I said, a lot of the names we created were kept, but I think it was just for convenience reasons. If a company is doing a $100 million worth of business, you want to be able to solidly protect trademarks when there's value to it. But if you are selling a start-up to a company that has hundreds of million dollars' worth of business, it will be no issue to them to communicate to their customer base that the name of our product will change and will now be part of their product lines.

Ulf Berg Well, if you keep it, it's because it has already become a well-known brand. My partner, for example, restructured a company and got it up and running again. And it had a name that was actually impossible to pronounce and that I can't even remember. As part of the project, they changed the name, and that name change was certainly one of the major contributions to recognition in the market.

I'm looking at a company right now that's already at investments of 100 million, but still a start-up. They have managed to develop and establish a brand name that is essential for acquiring customers and for interacting with partners. I would even go as far and say that I almost don't care what technology is behind it; the brand is important from top to bottom and back. There may well be cases like this, but it's certainly not every day.

Craig Cooper It is clear that, as they get closer to going to market, they need to develop their brand to carve out their space, their identity. There is no question about it. Particularly in the digital space, brand recognition and awareness are important for gaining traction and growing the user base. When it comes to an exit, this will play an important role. At an early stage, nevertheless, it is unlikely to have a fundamental impact on the investment decision, and particularly that this would be a go/no-go aspect is unlikely. Not impossible, but unlikely, knowing that if they have investors' capital behind them, and resources, and a bigger team, these things can be addressed.

Of course, assuming they have already developed their product, and they have a company name and a product name, and identity, it would be good to hear that they have secured some things around that, so that box is ticked. But it is more a nice-to-have, especially if they are still pre-revenue. And most of our cases still have plenty of other work to do, before they are even close to going to market. How do you see this?

Ulf Schaberg Well, it's your investor decisions, but I tend to agree with your views on a low early-stage importance of trademarks.

My main advice is most of all that founders should avoid sailing too near to other brands. Like using two yellow bows for a new burger chain or something like that. Not everybody listens to this advice. Some are very keen to using something similar to established players or market leaders, instead of being creative and developing their own new brand for their preferred buying persona. In my view, this creates unnecessary risks for conflicts and infringements.

My advice is always: Make sure that you have freedom to operate in the trademark space. Don't use anything for no good reason that may cost you money later, because you will very likely get into a conflict with the big legal departments, and you will have legal expenses and maybe even have to do a rebranding, which will all cost money. Be creative, clear the FTO, and you can spend your time and resources on other, more valuable things.

Craig Cooper Makes a lot of sense, I cannot disagree with that. If I look at the companies we are currently assessing, they have not made such mistakes, like sailing too close to a recognized brand. But definitely, that is a very good point.

Todd, Ulf, Craig: Thank you very much for these insightful conversations!

10 Learnings and Takeaways

If You Search Serious VC Funding, Take IP Seriously

Venture capital (VC) is a crucial funding source for early-stage start-ups. Convincing VC investors and fund managers is a valuable option to unlock access to early capital. Focusing here on the early stages of company creation with technical innovation, the interviews with investors demonstrate an obvious truth, namely that founders looking for VC funding better take into account investors' views and preferences.

Easier said than done. One impression left from not a few interactions with investors and funds on one side, and start-up managers and founders on the other side, is this: Investor decisions remain every so often an enigma. The "rationale" for negative decisions often includes elusive grounds like lacking chemistry, a spark not ignited, or too many red flags raised; nobody can tell you which number of red flags will kick you out of the race. Be that as it may: The respectable track record of successful investors belies these respectless remarks. It remains a challenge, nevertheless, for most start-up founders to deliver a great pitch.

Not raising red flags, in general, as well as around IP, is an important measure in this context; and that is achievable if IP is taken seriously – as seriously by the founders as it will be taken by investors, and eventually, by a potential buyer. The investor views presented here allow to sum-up at least the following conclusions:

1. *IP is an essential piece of the puzzle to convince VC investors.*
   It is highly important to render the start-up's product or offer unique, at least difficult-to-copy, and intellectual property – whether software code, know-how, or patents – will be a critical element to achieve this goal. Successful follow-up funding and eventually an exit via IPO, or sale to a company, will require that competition or a potential buyer cannot just imitate the start-up's solution.
2. *IP is no. 3 priority in early funding decisions, rising higher toward exit.*
   Market opportunity and team are the most critical factors in an investor's decision. IP follows as the third priority, closely intertwined with the product, or offer. The importance of IP will rise even higher when it gets to exit negotiations. In traditionally patent-heavy industries, funding without patents, or at least a presentable road to patent protection, will be difficult to get from VCs.
3. *Founders should think about IP early.*
   Start-ups are thus well-advised to set-up their strategy with a view to being not easy-to-copy, also with a view to an investor's exit, and be aware of and use IP wherever it helps. The fragile nature of IP demands to think IP first. The necessary start-up publicity combined with wrong timing can easily destroy IP. More than in other fields, Goethe's wise words apply to IP: If you miss the first buttonhole, you will not finish buttoning.
4. *Unclear IP ownership and use rights will raise red flags.*
   Full ownership of ideas, inventions, and all other IP by the start-up itself are the investor's clear preference. Start-ups should not forget to have all founders' IP transferred to the start-up company; founders leaving at later stages may otherwise endanger the venture as a whole if that leads to a battle over ownership. If taking licenses is unavoidable, for example in case of university spin-offs, clear contractual arrangements are key, preferably including buy-out options in case of an exit. As a rule, investors will in most scenarios prefer transfer of IP against equity over royalty-based licenses.
5. *IP basics are a must, advanced knowledge strongly advisable.*
   Laying the IP foundations for their company will require that start-up CEOs and CTOs have at least the basic, preferably an advanced, understanding of IP. Being able to present all IP matters with passion to investors and to explain it in understandable language in connection with the business model will be a great plus. Well-chosen external IP advisors and patent attorneys may make a difference for an investor if they can understand the start-up's strategy and limitations, and particularly if they can talk plain business language, not only patent "legalish."
6. *Formal IP valuation and FTO analysis are not expected.*
   Formal valuation or FTO analysis can be expensive, particularly if prepared by external IP experts. It is a great insight to learn that such formal analysis is not expected by most investors for the pitch; they want to get their own impression.

Founders must, however, have an excellent understanding of the value proposition of their IP as much as knowledge of the competitor and patent landscape, for the start-up's strategy just the same as for convincing investors.

7. *For the digital start-up, speed is of the essence.*
   Platform innovation and digital solutions follow different rules. Patents may be less relevant, as speed to market matters most. Other ways to defend the niche chosen, however, and distinguishing from competition to avoid being easy-to-copy are then even more important. It is not possible, in my view, to leave out IP options in general, and even a patent may still be a valuable option to consider.
8. *Trademarks rank low.*
   Branding and particularly trademarks are, at early stages, of low relevance for the investor's financing decision. These are often topics which may be addressed after funding together with the investor. Being creative and staying away from competitor and well-known brands is always advisable to avoid conflicts and raising red flags for investors without gaining anything.

How to Get IP Wrong

Business strategy is a complex topic. In today's knowledge economy, intangible assets including IP account for 80 to 90% or more of the business assets of an enterprise (Sullivan, 2000). At the start-up level, IP could reach almost 100%. Without taking intangibles and IP into account, the attempt to create a winning strategy is prone to result in a bad strategy, to use the terms of Richard Rumelt in his book *Good strategy – bad strategy* (Rumelt, 2011). Let me illustrate this with a bad strategy example.

A founder called me one day when I was working as a consultant to support him on a technical self-defense toy he had "invented"; he was looking for help with development contracts and with the filing of an "international patent". Experienced in business, he had already created the name and branding, registered a trademark in the *European Union (EU)*, registered a limited company, and had an engineering company produce the technical drawings for production and patent purposes. I suggested to start with a little bit of research and then to continue our conversation.

The research uncovered, to my regret, multiple patent applications and granted patents on the "newly invented" toy's features, and finally, one with all features identified in the drawings. Checking out the patent applicants' companies in a simple internet search, it was with growing incredulity that I found three companies offering such devices, and then almost identical tools on *Amazon* and *eBay*.

Confronted with the search results, it turned out that the founder had not yet done such market research. This is an extreme example, it is a real one, and not the only one I have experienced over the last decades in which founders could have done much better if they took IP a bit more seriously.

How Founders Can Get IP Right

Getting back to Richard Rumelt, he particularly appreciates the complex nature of strategy, and IP is a complex topic as well. For finding a good strategy despite

complexity, Rumelt proposes to gradually climb up the "hierarchy of objectives" in the process (Rumelt, 2011, chapter 7) .

He illustrates this with an analogy to a helicopter pilot and its required hierarchies of skills: First learning the basics of flying such a complex machine, constantly coordinating all the controls, making it automatic. "After you can fly, then you can learn to fly at night – but not before!"; and only then, Rumelt continues, you can start learning to land on a mountain or on a rolling, pitching deck of a ship, and so forth. "When I work with a small start-up company," he explains, "their problems often revolve around coordinating engineering, marketing, and distribution." He elaborates that such a start-up should first learn its way up the ladder of hierarchies of skills before, for instance, developing international operations.

Intellectual property can be approached in a similar fashion, working up the ladder of IP savviness along the way (see Fig. 1). Here's my suggested approach:

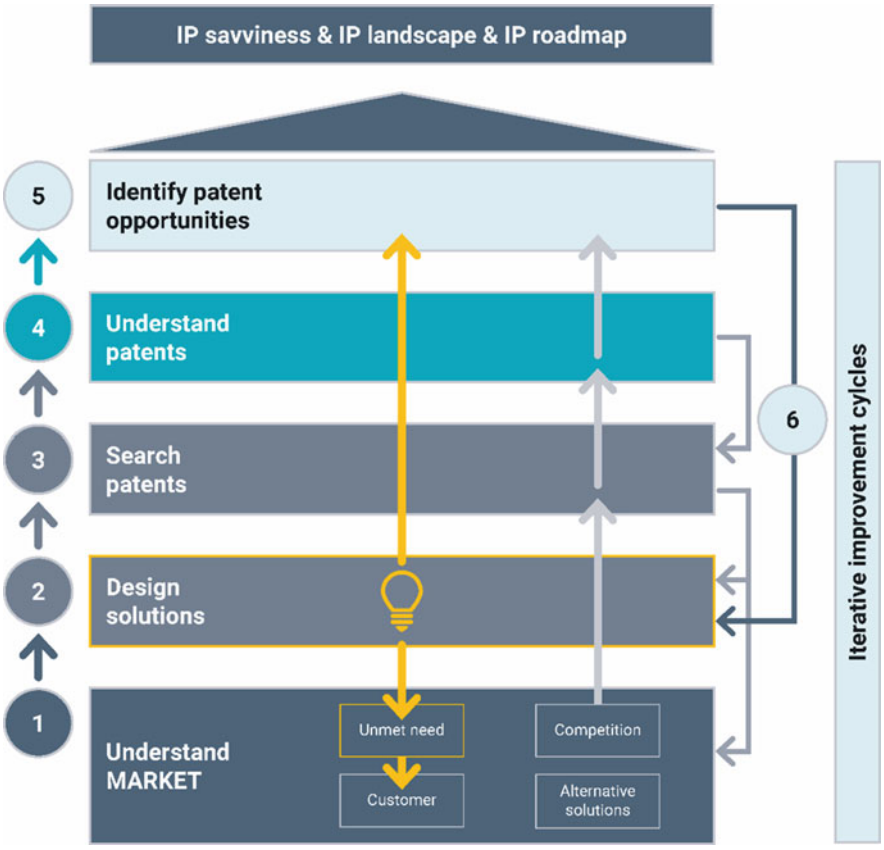

Fig. 1 How founders can get IP right: IP savviness, IP landscape, and IP roadmap (author's own figure)

1. *Understand the market.*
   Market is the most important topic. Most important for the business in general as well as for investors. Knowing the customer, identifying its problem, the "unmet need" is key for every business, including market sizes and all the figures. It is inevitable to do research about competition and existing alternatives, first from a market and business perspective. Investors have stressed that this is all they want to talk about in the first step, so market should be founders' primary concern. It will help with the IP as well, as you will see below.
2. *Sketch a solution.*
   Many founders start with the solution. In real life, ideas for start-ups are often triggered by finding a solution in the first place, like a new technology or an interesting new application of a technology. That's ok. Founders should, however, then immediately turn to market analysis, including existing alternatives and competitors. Too many researchers or founders I have met are so enthusiastic about the clever technical solution they have discovered that it is difficult for them to accept if they find no valuable market opportunity. After analyzing the market, founders can turn back to their solution with confidence, or if necessary, refine their initial idea in view of special customer needs, or existing competitor alternatives and so forth.
3. *Find competitor patents.*
   After you know the market and you have a sketch of the solution matching market needs, you are prepared to turn to IP. The easiest first step is to perform a simple search for patents of identified competitors in a free, public patent database. Simply searching for identified competitors will often do the job, sometimes with a few additional limitations. If you don't know how to search, there are numerous tutorials online, even on *YouTube*. In the first search, don't aim for completeness; my proposal is to identify at least a handful of patents that appear relevant in the first step.
4. *Understand patents.*
   Now, in the next step, you can start *understanding* how the identified patents work. If the patents are pretty incomprehensible, it means you will have to learn something about patents. With a team of founders, I have seen more than once that IP is delegated to one founder, in most cases the CTO. The CEO should, however, be able to understand the business implications.

   The uninitiated technical expert or researcher will try to understand what experiments have been done; patent experts start first at the end of the document, the "claims" which define the scope of protection. All patent offices as well as the *European IP helpdesk* offer online training for free (www.iprhelpdesk.eu) – like YouTube does. If you find any competitor patents, it is inevitable to understand them.

   If you do find a patent that looks pretty much like your solution, it might lead you to an actual competitor product that already exists in the market, or it might tell you that your solution is not novel. Then you will have to turn back to steps (1) and (2) for another cycle and improve your understanding of the market and, potentially, redesign your solution.

5. *Identify patenting opportunities.*
   After this, you will have defined and possibly redefined your solution, you understand the basics of patents, you will have identified some competitor patents, and you will understand their claim language and approach. It will give you a first feeling of the landscape, and also, if there is a white spot to land on with your own patent application.

   This will provide the perfect starting point to engage a patent attorney for filing a (provisional/ priority) patent application, if it is decided to do this before pitching to investors. If investors are approached before filing, founders will have a clear picture of the landscape and a potential road to IP to present. This will avoid the notorious red flags – we learned from the interviews how important that is.

   Not a few patent attorneys would disagree with me here and argue that that expert guidance is vital already at the earliest stages, that it can be dangerous to start with only half-understanding patents. I agree to the risk, yet I would still defend the approach. Founders should not consider themselves IP experts and do everything themselves; that is a mistake. Patent attorneys may consider, however, that founders' financial resources are scarce at the beginning, and even if not, that the interaction with the patent attorney will lead to considerably better results – and more efficiently (at less consulting costs) – if the client already has a first picture of the competitor patent landscape and a basic understanding of patents.
6. *Improvement cycles.*
   Approaching each step first with a shallow dive, and then gradually returning to them in cycles to further improve each aspect, is the best approach in my view. The elements influence each other, and approaching this as an iterative process, not aiming at getting it perfect in the first round, appears to be more efficient.
   (a) Searching competitor patents is the easiest way to start, getting an idea of at least a few relevant ones.
   (b) Understanding the basics of patents with relevant examples for the technical field and solution in question will be easier and be accompanied by a higher incentive.
   (c) Relevant patents may provide additional insights for the first solution concept, or even show that it needs improvement to avoid competitor patents; or at the least, you will have these patents and questions already available for building up the view of the IP landscape.
   (d) Additional rounds of patent searching may then be useful, after understanding more about patents, using other search strategies. For example, using the "similar patents" algorithm many patent search tools offer today will potentially provide you with additional relevant patents – and may uncover unknown competitors, allowing to complete the understanding of competition and market.
   (e) Vice versa, new knowledge about the market gained over time will allow you to quickly complete the patent landscape by additional searches.
   (f) Step by step, you are gradually building up and improving:

IP knowledge, a good picture of the IP landscape, and a roadmap for patenting opportunities, all relevant for your business. And that is what investors expect from start-ups in a pitch.

A Final Remark Many conclusions and recommendations are phrased and presented here as a help for founders to convince investors. The underlying truth is, obviously, that IP is important for venture capitalists just because they are convinced that IP is fundamentally important for a business, for every business. The gist of this whole article, while it would have been a bit short as a contribution, has already been expressed by Todd Dollinger in his first answer during the interview, and actually in the first sentence: *IP is paramount*.

Takeaways

If you want VC funding, take IP seriously:

- IP is an essential piece of the puzzle to convince VC investors.
- IP is no. 3 priority in early funding decisions, rising higher toward exit.
- Founders should think about IP early.
- Unclear IP ownership and use rights will raise red flags.
- IP basics are a must, advanced knowledge strongly advisable.
- Formal IP valuation and FTO analysis are not expected.
- For the digital start-up, speed is of the essence.
- Trademarks rank low for investors at early stage.

To get there, work up the ladder of IP savviness along the way:

- Understand the market.
- Sketch a solution.
- Find competitor patents.
- Understand patents.
- Identify patenting opportunities.
- Dive shallow first and improve in iterative cycles.

Acknowledgments We would like to sincerely thank Todd Dollinger, Ulf Berg, and Craig Cooper for their time and dedication to the interviews as well as willingness to share their insights openly; special thanks are given to my esteemed patent attorney colleague Louis Lagler of RENTSCH PARTNER AG in Zurich for his great support of this project, and Martin Bader for the initiation of this contribution and his patient and valuable involvement.

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Ulf G. Schaberg is passionate about all aspects of intellectual property. He is a German and European Patent Attorney with 20 years of experience in the field. After studying biology at the University of Munich and working as a research fellow in academia, he started his IP career in large and medium-sized law firms in Germany. He worked for more than 10 years in the industry, holding positions in BASF and Syngenta, as Managing Patent Attorney, Global Head IP Operations, and Global IP Business Unit Lead, and afterwards established his own business and management consultancy, providing coaching, IT tools, project and change management support focusing on IP strategy design and IP Asset Management, helping operations from universities over SMEs to large corporations and VC/PE funds to have their intellectual assets under control. Today, he is responsible for IP at the AO Foundation in Davos, Switzerland. Mr. Schaberg was a frequent speaker on IP and is a visiting lecturer at CEIPI – University of Strasbourg on topics including IP, transfer pricing, and risk management.

Todd Dollinger is the Chair & CEO of the Trendlines Group, headquartered in Israel. Trendlines invests in and incubates innovation-based MedTech and agrifood technologies. Trendlines invests through its incubators: an Israeli government-franchised incubator, two Singapore-based incubators, an in-house innovation center, Trendlines Innovation Labs, and with its two funds. As intensely hands-on investors, Trendlines is involved in all aspects of its portfolio companies, from technology development to business building.

Ulf Berg is an active and very experienced investor. He is a member of the Board of Swissmem, Chairman of the Board of Directors of EMS Chemie Holding AG, the American Midland Cogeneration Venture LLP, the Danish Kommunekemi AS, and a partner in the investment company BLR & Partners Ltd. He holds a PhD in Mechanical Engineering from Denmark's Technical University, worked for ABB for over 20 years, was CEO at Carlo Gavazzi Holding AG, SIG Beverages Int. AG, and Sulzer AG, where he most recently served as Chairman of the Board.

Craig Cooper leads the Diabetes Venture Fund, addressing one of the major health-care challenges of our time by investing globally in early-stage diabetes technology. He previously ran the investment and commercial arm of the AO Foundation, facilitating, identifying, investing in, and supporting disruptive health-care innovation globally. Over 25 years, he has led people and projects across industries, throughout Europe, the Middle East, Africa, Asia, and the Americas. He is a mentor and coach at the European Institute of Innovation & Technology, and advises early-stage businesses and social ventures on raising capital and going to market.

The Role of IP and Intangible Assets in Tech Private Placements: An Investor's View

Praveen Shah and Pallavi Shah

1 Preface: How IP Can Shape Industries/Impact Businesses

Five true stories set the stage for our paper. While the first four are famous, only a few may know the fifth.

The first two are about patent disputes from either side of the 20th century. They shaped the telecom industry. The next two are about trademark disputes from the 21st century. They impacted technology and automotive businesses. The fifth is a roller coaster ride which one of the authors (Praveen Shah) experienced in the dot-com boom and bust. It affected (at least the coauthors') fortunes, both business and personal.

1.1 David Beats Goliath Using Patents

In the 1870s and 1880s, *Alexander Graham Bell's* tiny start-up used patent infringement lawsuits to keep the telegraph company *Western Union* – the industry Goliath back then – out of the telephone industry.

This victory was not a foregone conclusion. The U.S. Supreme Court upheld the priority of *Bell's* patents dating back to March 1876 by only one vote. Had a single

Founded in 2002, the Silicon Valley boutique firm Mobity LLC is a strategic advisory, IP transaction broker, and venture incubator/accelerator headquartered in Mountain View, CA, USA (Silicon Valley). www.mobity.com

P. Shah (✉) · P. Shah
Mobity LLC, Mountain View, CA, USA
e-mail: pshah@mobity.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_7

justice ruled the other way, *Western Union* and not *AT&T* (successor of the *American Bell Telephone Company*) might have become the world's largest telecommunications monopoly.

1.2 David Becomes Goliath and Bullies the New David with Patents

More than 100 years later, the shoe was on the other foot, but the results were very different. Internet upstart *Vonage* was taking valuable market share away from the descendants of the *Bell* Company through its disruptive VOIP service offering. From 2000 (its founding) to 2005, *Vonage* had signed up 1.2 million subscribers. Its customer base was growing at 300% per year.

However, this time it was the incumbents *AT&T*, *Sprint*, and *Verizon* which held all the critical patents. Through a trilogy of lawsuits (*Sprint vs. Vonage*, October 2005, ultimately settled for approximately $80 million; *Verizon vs. Vonage*, June 2006, settled for approximately $80 to $120 million, and *AT&T vs. Vonage*, October 2007, settled for approximately $40 million) they were able to bully *Vonage*.

The total *Vonage* had to pay its competitors in patent infringement settlements was a quarter of its annual revenue at that time. Naturally, *Vonage's* marketing budget collapsed, and the subscriber growth slowed. Its share price, which had gone through with an IPO in May 2006 at $17 per share, plunged to about $2 per share. *Vonage* faced the risk of getting delisted from the New York Stock Exchange.

1.3 An iPad (Name) That Cost $60 Million

The Chinese firm *Proview* had registered the name *iPad* in 2000. In 2009, *Apple* bought the global rights to the trademark "iPad" from the Chinese firm *Proview*'s Taiwanese affiliate for $55,000.

However, *Proview* argued in a Guangdong court that this affiliate did not have the right to sell name rights in China. They also sought an injunction. Although the courts denied *Proview*'s injunction request, *iPads* were temporarily removed from the shelves in some parts of China to prevent *Apple* from selling *iPads* in China. The courts asked the parties to settle. *Apple* was forced to pay $60 million to *Proview* to buy the iPad name rights in China.

1.4 Ford Won't Let Tesla Market a "SEXY" Product Line

Tesla founder and CEO *Elon Musk* wanted to name the four models of cars *Tesla* produced as *Model S* (the original five-door sedan), *Model E* (four-door fastback sedan), *Model X* (midsize crossover SUV), and *Model Y* (compact crossover utility)

Fig. 1 Elon Musk's tweet – Now you know why Tesla's product line spells "S-3-X-Y" (figure redrawn by the authors)

in an attempt to market his product family first as *SEX* (the Model Y would launch later) and later as *SEXY*.

However, to *Ford* executives, a car named *Model E* sounded too similar to *Henry Ford's* iconic *Model T*. *Ford* and *Tesla* had entered into a contract back in 2010 when *Ford* demanded, and *Tesla* agreed, to not register or use the *Model E* trademark. Later, *Tesla* sought to trademark the name *Model E*, and *Ford* objected.

Musk found a workaround, sort of. In 2017, he tweeted it (see Fig. 1).

1.5 Sorry, Juliet. A Rose Is Not a Rose If by Another Name

> What's in a name? that which we call a rose
> By any other name would smell as sweet;
> William Shakespeare, Romeo and Juliet (Act 2, Scene 2)

While the first four stories are famous, this one is known to only a few who lived through it. In the late 1990s one of the authors of this chapter, Praveen Shah, had founded and led one of the four business lines of a cloud services firm.

As its VP of Strategy, Praveen was responsible for this firm's strategy, fundraising, investor relations, and IPO preparations. It had doubled its revenues and profits annually for five years in a row. It had raised $27 million mezzanine venture capital at a $200+ million valuation. Now, at the peak of a once-in-a-generation dot-com boom, we were eyeing an IPO with a roughly $700 million valuation.

Unfortunately, the business name of this company was too long to be a viable website URL. It comprised two standard English dictionary words, which made it difficult, if not impossible, to trademark it. Customers, partners, and potential recruits could not guess or easily remember the URL of its website. All short URLs easily derived from the company name were already taken.

Naturally, investors and underwriters were nervous. Everyone knew this problem had to be fixed sooner or later. The cost of any fix would only grow after a lucrative IPO and associated publicity. Our investors, underwriters, and board members all universally demanded that we fix this problem before announcing our IPO.

The marketing department chomped on the opportunity to rename the company. This was a dream project for expensive brand consultants. We did not know then that

we had opened Pandora's box. Our attention got sucked into picking the perfect new name. In hindsight, we needed to stay focused on the business. Everyone got involved in this fun project. Six months later, the company launched its redesigned brand name and identity with big fanfare.

When we held our Org meeting, NASDAQ was already buckling. By the time we were ready to file S1,[1] the dot-com boom was a full-blown dot-com crash. The IPO window was gone. Worse yet, some shareholders' expectations had gotten anchored to a valuation number that was no longer realistic. Unfortunately, they held substantial equity and control of the board. The company subsequently got multiple acquisition offers that polarized its shareholders. Some felt that the offers were good enough to take the lucrative exit. Others argued doing so would be aiming low, and we should hold off for better times to return. In the end, the board rejected these acquisition offers. Key employees left. Praveen left in 2002.[2] The firm slowly withered. Years later, it shut down.

What if, in an alternate universe, this company chose a different name when incorporating? In that universe, did it IPO sooner? Did it have approximately $100+ million in cash sitting in the company bank account, ready to deploy, when their dot-com crash happened? Did it use this cash to acquire other good companies available at fire-sale prices during that crash? Unfortunately, this author did not get to live in that alternate universe.

2 Introduction

We examine the role *intellectual property (IP)* and *intangible assets (IA)* play in technology private placements. We take the viewpoint of an investor. We also supplement it with the perspectives of various other stakeholders involved in launching, financing, operating, scaling, and exiting technology ventures.

To provide actionable insights our readers can use on their next deal, whether as an investor or an investee, we attempt to engage and educate our readers through illustrative case studies based on our combined six decades of relevant and personal experiences. We also draw upon the collective wisdom of the hundreds of seasoned investors, business owners, entrepreneurs, and senior Fortune Global executives we have worked with, learned from, and helped.

[1] S1 is a regulatory filing required for an IPO in the United States. Org meeting is the internal kick-off meeting of all stakeholders to begin this process and associated IPO preparations.

[2] Praveen founded Mobity LLC (a Silicon Valley boutique strategic advisory, IP transaction broker, and Silicon Valley venture incubator/accelerator) in 2002 right after leaving this firm. He continues to lead it to-date.

2.1 What Are Private Placements?

FINRA (the Financial Industry Regulatory Authority) defines a *private placement* as an offering of unregistered securities to a limited pool of investors. SEC (Securities and Exchange Commission) *Regulation D ("Reg D")* rules govern such transactions (FINRA, 2020). An investee company raises capital by selling shares of its stock (equity) or other interest in it such as warrants or bonds (debt) to accredited (and in some cases non-accredited) investors without having to register these securities with the SEC first.

The market for private placements is big. SEC data show that Reg D offerings raised $1.5 trillion in capital in 2019 while registered public offerings raised only $1.2 trillion over the same period.

2.2 What Are Technology Private Placements?

We define *technology private placements* as private investments in deep-tech business models, IP-centric businesses, and technology industries[3] where the investee is not a lifestyle[4] business.

As shown in Fig. 2, IP comprises six different asset categories: copyright, design patents (aka design rights or industrial designs), geographical indications (aka appellations of origin), trade secrets, trademarks, and patents. Patents are only a subset of IP. However, in many (but not all) situations, patents are also a predominant part of IP. Hence, people often use the term "IP" interchangeably with the term "patents."

IP can be an important factor in investors' and their potential investee's decision-making before, during, and after technology private placements. However, IP may not be a factor in other private placement situations. The marginal value of external funds may not generate a return above professional investors' minimum expectation in a lifestyle business. Or IP may not be a driver or a predictor of success for an investable business in the eyes of its investor or investee.

2.3 How (or If) an Investor Will Value an Investee's IP Depends

There is no "one-size-fits-all" answer to the role IP does (or should) play in an investors' or their investee's decision-making during a private placement. It's ditto, for that matter, when they launch, operate, scale, and exit (and not just when they

[3] We often see IP-centric deals in non-technology industries, including in construction and many others. One such deal hinged on IP in the design and manufacture of flooring products. If IP was a key decision factor, we define it as technology private placement.

[4] A lifestyle business is unscalable. Its SAM (segmented addressable market) is small. If successful, it can comfortably feed its owners, operators, and a small number of employees. However, it cannot deploy external investment capital well.

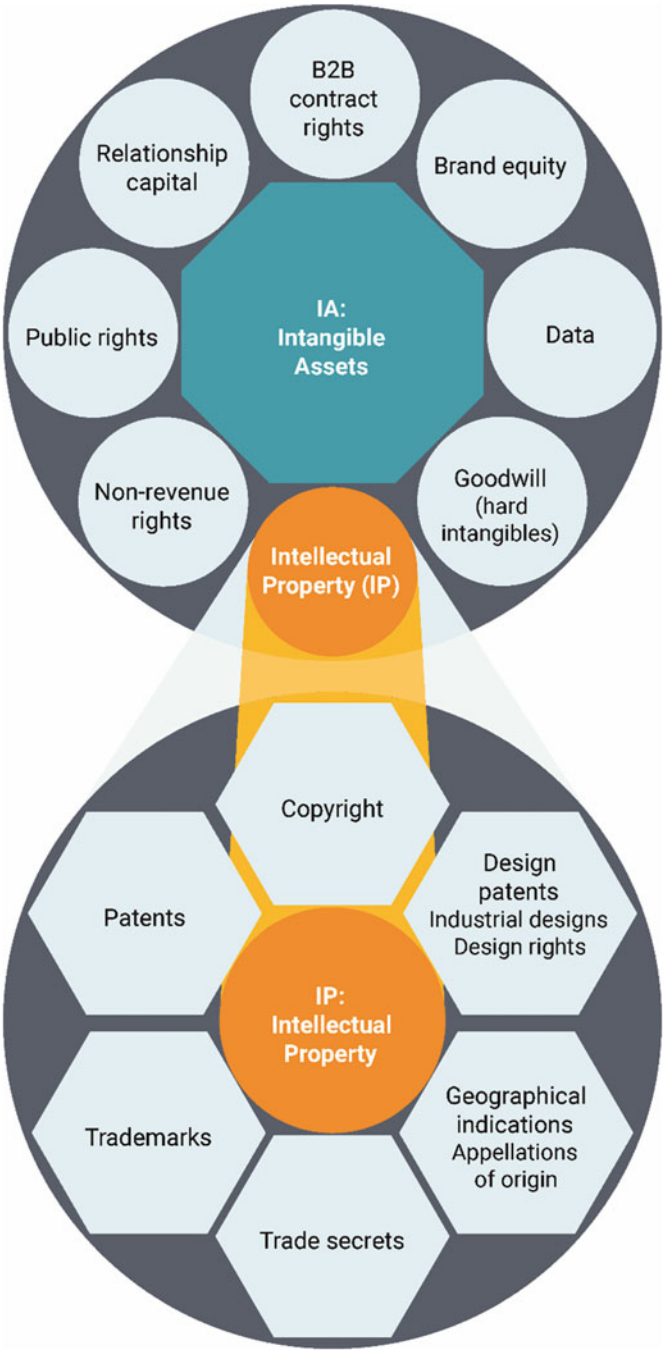

Fig. 2 Comparing IA and IP (diagram by the authors based on the eight categories of IA, Ponemon, 2019, and the six categories of IP, WIPO, 2021)

finance) their ventures. The business models, budgets, capital needs, competition, governance structures, industry and regional characteristics, and stakeholder expectations and motivations of the diverse businesses that seek capital through private placements and all the different investors who provide it vary substantially.

Hence, the fundamentals of IP strategy are universal, but the specific strategies and tactics an investor or investee should adopt in a given situation inherently depend on the situation.

Many factors affect the extent to which the IP is a meaningful driver (or predictor) of future success. They include its industry, business model, the nature (and location) of its competition and customers, the stage of its maturity, etc. In some situations, IP can be minor or even irrelevant to a business or its investors, either on an absolute basis (IP is not that relevant) or a relative one (the non-IP components are much more predictive). For example, patents are often crucial when investing in pharma or biotech but not in software, for a variety of reasons. The software industry moves too fast for IP litigation to offer meaningful protection. When speed matters more (such as the overwhelming benefits of being the first to validate product-market fit or win the user adoption race), patents can be a poor deterrence. Most software gets obsolete fast. More often than not, it must be periodically rewritten anyways to stay current and can be easily rewritten if necessary or work around a patent problem. Silicon Valley VCs seldom give significant weight to patents except in niche situations such as investing in a deep-tech business. Instead, they assess the commercial viability and investability of their investee through other factors such as product-market fit, team, market size, etc.

Most investors would rather see direct signals of traction and success, such as customer orders, revenues, and profits. However, in the early stages of a business, such direct signals are often lacking. High opportunity costs do not allow an investor to wait for them to emerge. Investors must decide based on incomplete and uncertain information using only proxy and indirect signals.

The capital and governance structures of many VC (venture capital) and PE (private equity) funds are such that they can't afford to misread indirect signals. Most investors have stories about acting too soon, too late, investing in a train wreck they should have seen coming, and passing on a *"hundred-bagger"*[5] they could not have seen coming. Investors mitigate these risks through due diligence. However, the skills required to conduct rapid yet effective due diligence are limited in supply.

Hence, especially in the early stages, investors look at the IP of an investee business as a proxy signal to help accelerate (or short circuit, often in a "no") their due diligence. IP also helps them set a fair valuation. Most importantly, VCs invest in the team, not in the product. IP can be a good indicator of the technical caliber of the team. As the investee business matures, IP will play (and, will also be expected to play) many more and bigger roles, both offensively and defensively. Our case studies discuss some such roles later.

[5] *Peter Lynch* coined the term *Ten-Bagger* for investments that return their principal 10 times. VC outcome distributions are so skewed that winners can be (and need to be) a *hundred-bagger*.

3 Intangible Assets Include and Matter more than IP

Per the industry definitions (see Fig. 2), IP is a subset of intangible assets (IA). IP alone is too narrow a focus for technology private placement investors and their investee candidates. For both, IA are a far better proxy signal of future success.

IAs are applicable in more situations than IP. IAs are easier to inventory and assess compared to IP. Of course, tangible assets are the easiest to valuate as a collateral. However, in most tech ventures and especially at an early stage, tangible assets are often insignificant. Direct signals such as customer orders and market adoption are far more predictive but have not yet emerged.

The latest annual Global Intangible Finance Tracker (GIFTTM) report by *Brand Finance* lists various categories of intangible assets under IFRS 3 (Brand Finance, 2021, see Fig. 3).

3.1 The Importance of IP and IA Is Exploding

For most of the 20th century, the majority of the assets on a company's balance sheet were its tangible PPE assets: plants, physical properties, and equipment.

In 1975, all the tangible PPE assets of the S&P 500 companies contributed 83% of the total value of all their (tangible and intangible) assets. The debt lenders viewed these tangible assets as hard collateral.[6] Most still do. The quantitative monetary value of PPE is easy to calculate and seen as the downside protection. However, as Fig. 4 shows, the situation has reversed quickly.

The advent of information technology began to tilt the scales. This trend was amplified as the developed economies became service and knowledge heavy. The emergence of the internet and other exponential technologies killed this contest. The drastic shake-up in the five biggest S&P 500 companies proves that IA/IP and not the tangible PPE assets enable and drive the success, profits, and growth of today's mega-cap companies. Each of the five biggest companies is now a technology juggernaut powered by its IA/IP.

3.2 Data Is the New Oil

In his May 2020 HBR article, Stefaan Verhulst called *data* "Today's Rembrandt[7] in the Attic." There are at least two big reasons why VCs see data as "the new oil" (Verhulst, 2020):

[6] This is why traditional banks, which need tangible assets as collateral, struggle to fund tech start-ups. Only niche investors such as *Silicon Valley Bank* or *Sovereign Wealth Funds* have the expertise and appetite needed to do so. However, their opportunity costs and fund sizes are high. Only a few start-ups need and can use the minimum check size of the venture debt they often issue.

[7] The IP practitioners who are aware of the impact Kevin G. Rivette's and David Kline's influential book *Rembrandts in the Attic* had on their industry will quickly get this reference and its significance. Patents were seen and monetized in a whole new light and at a whole new level as a result of this book. Today, data is seen and monetized like never before (Rivette & Kline, 2000).

Marketing-related intangible assets	Customer-related intangible assets	Contract-based intangible assets	Technology-based intangible assets	Artistic-related intangible assets
• Trademarks, trade names • Service marks, collective marks, certification marks • Trade dress (unique color, shape, or package design) • Internet domain names • Mastheads • Non compete agreements	• Customer lists • Order/production backlog • Customer contracts • Contractual customer relationships • Non-contractual customer relationships	• Licensing and royalty agreements • Advertising, construction, service, and supply contracts • Lease agreements • Construction /other permits • Franchise agreements • Operating/ broadcast rights • Drilling, water, air, mineral, timber, and route authority use rights • Servicing (e.g., mortgage) contracts • Employment contracts	• Patented technology • Computer software • Unpatented technology • Databases • Trade secrets (such as secret formulae, processes, and recipes)	• Plays, operas, and ballets • Books, magazines, newspapers, and other literary works • Musical works such as compositions, song lyrics, and advertising jingles • Pictures and photographs • Video and audio-visual material, including films, music videos, etc.

Fig. 3 Intangible assets under IFRS 3 (redrawn by the authors based on a table listed in Brand Finance, 2021)

Fig. 4 The explosion in the value of intangible assets (by the authors, based on Ponemon, 2019)

First, revenue models based on monetizing the data can yield lucrative profits. Businesses that collect, mine, and monetize user data can also afford to give away their solutions and buy market share. Freemium models reduce customer acquisition costs. The services they give away (often for free) are not their real product anyway. Their true customers are not the end-users they gave these services to. The end-users and their data are the real product and those who buy this data are the true customers.

Second, the breakthrough and disruptive power of AI/ML (artificial intelligence and machine learning) comes mainly from data.

Surely, AI/ML talent is also important and in short supply. However, in most cases, talent is less important than data. Within reason, money can buy AI/ML talent. Data can be bought,[8] too, but not all data is available, affordable, or accurate. Companies like *Google* and *Facebook* can afford to pay seemingly exorbitant compensation to their best engineers. Businesses can license AI/ML algorithms. In many uses, off-the-shelf algorithms they can buy or license are almost as good as the custom ones they can build. Yes, AI/ML engineers with deep domain expertise can tweak and optimize algorithms to squeeze more value. However, the marginal ROI can be low compared to the opportunity costs of deploying this talent elsewhere. Simply put, a large majority of the commercial value of AI/ML comes from the data sets used to train the AI/ML models.

Silicon Valley technology investors jump at the chance to invest in a start-up that has identified a lucrative use case where AI/ML can meaningfully move the needle if such a start-up has access to a large amount of curated (or otherwise clean) data. The more proprietary the underlying data, the more valuable the intangible asset and the higher the valuation an investor is willing to pay.

[8] We see both "data licensing" and "IP licensing" as equally powerful tools and view both as an art as well as a science.

3.3 Technologies to Help Measure, Manage, and Monetize IA/IP

Technology private placement investors strongly believe that intangible assets are the secret sauce to create value and are convinced that exponential technologies such as AI/ML are poised to make disruptive contributions.

Significant venture capital is being invested in these intersections to help a business quantify, codify, and monetize its intangible assets.

Figure 2 listed the following eight categories of IA:

1. B2B contract rights
2. Brand equity
3. Data
4. Goodwill (hard intangibles)
5. Intellectual property (IP)
6. Non-revenue rights
7. Public rights
8. Relationship capital

We see innovative and exciting applications emerging that help systemically capture, measure, manage, and monetize the intangible assets of a business in each of these eight categories. An investee who adopts such technologies and demonstrates success at monetizing its intangible assets will raise capital quickly, at higher valuations, and on friendlier terms. Elite investors will leverage such technologies in their due diligence to accurately inventory, assess, and value the intangible assets of their investees and to de-risk their investment decisions.

Personally, we believe that some of the best uses (and ROI) of intangible asset management technology will come from two categories of intangible assets: data and relationship capital. Some years ago, we cofounded a People Analytics start-up[9] whose innovation was a passive way to collect metadata (we called it "the digital exhaust of knowledge work") from collaboration servers such as Calendar, Email, IM Chats, etc., and apply AI/ML and graph theory algorithms to analyze and mine it for actionable insights related to relationships and the productivity of people. Such analyses yield valuable inferences and predictions that sales, HR, engineering, operations, and finance functions find very useful.

4 The Mindset of Technology Private Placement Investors

The outcome distributions of a VC, especially in technology, are highly lopsided. The winner-takes-all nature of disruptive innovation substantially shapes the investor mindset.

[9]This start-up successfully raised angel funding and subsequently realized an acquisition exit.

4.1 The Various Players in Technology Private Placements

The investments made by venture capital (VC) and private equity (PE) funds are among the most commonly known examples of private placements. These funds are run by professional financial intermediaries who aggregate capital from other investors, limited partners (LPs), invest it in a portfolio of private companies, and often take an active and ongoing board role in the company.

VC/PE funds add value through ongoing monitoring and mentoring, intervene when necessary, and do not hesitate to change management or force a different strategy on the company if they deem it necessary. Their primary goal is to generate a lucrative financial return for their LPs and themselves within the finite term of their fund (typically eight to 10 years, with up to three years of automatic extensions).

VC/PE funds usually measure and report their performance using IRR[10] and MOIC.[11] Both are important. When a $1 million investment returns $5 million in five years or in eight years, the MOIC is the same (= 5) but the IRR is lower in the latter (eight-year) situation. However, a VC's liquidation preference is typically based on MOIC and not on IRR. Likewise, founders may not be satisfied receiving a high IRR but a low MOIC. They may not get other equally attractive opportunities to create generational wealth later.

However, private placements are not just limited to a VC investor and a start-up investee. The private placement investor may be an angel acting solo or through a syndicate, a member of some crowdfunding platform, a family office, the VC arm of a big company, a sovereign wealth fund, a specialized venture debt bank or fund, or a special purpose acquisition (aka "blank check") company (SPAC). Likewise, their investee may be a tiny pre-revenue start-up in a garage with a single founder and zero employees, a privately held small to midsize business, or even a large and publicly traded company seeking venture debt in distress or in a special situation.

4.2 The Mindset of a VC

We know a cofounder and the managing director of a VC fund with $10 billion in AUM (assets under management). His portfolio companies have created $100+ billion in enterprise value. He told us that his fund investment returns follow the Pareto Principle (the 80–20 rule) not just once but to three degrees.

[10] IRR = Internal rate of return.

[11] MOIC = Multiple of invested capital.

It is essential to ponder on this nuanced concept and elaborate. Applying the 80–20 Pareto Principle in the VC universe once, 20% of a VC fund's investments will generate 80% of its return. Apply the same idea to a second degree, and it is evident that 4% (= 20% × 20%) of its investments will generate 64% (= 80% × 80%) of its total return. When this pattern holds in the third degree, more than half (80%^3 = 51.2%) of the entire fund profit comes from only one out of every 120 investments (20%^3 = 0.8%).

In such a skewed distribution, it simply does not matter if the bottom quartile of a VC portfolio simply returns the invested capital or goes bust. Either way, the needle on this fund's performance does not move much in either direction. This has major implications on how a VC conducts and optimizes their due diligence.

Only a few of VC investments succeed, and VCs expect to lose in many deals. If they don't, the theory goes, they are too timid and may miss out on the next *Google* or *Facebook*. A VC may see tens of deals that will go on to become *Ask Jeeves* or *Myspace* for a deal that may go on to be a Google or Facebook.

Unfortunately, the indirect signals a VC sees and must base decisions on at an early stage look the same in all these deals. Breaking even or making a moderate profit on majority of their deals is not enough to meet their IRR/MOIC goals. That is why all VCs dream of and aim for proverbial moon shots or home runs.

4.3 Sub-specialties in the VC/PE Segment

Even in the VC/PE segment, not all players think or act the same. Different funds specialize in different types of private placements.

- **Seed funds** provide small-size capital to concept-stage start-ups through SAFE/convertible notes.
- **Series A/B funds** give larger size capital to start-ups with a proven product-market fit at their pre-profit stage. They typically structure it as preferred equity with various antidilution, liquidation, participation, pro-rata investment, and redemption rights.
- **Growth venture capital funds** provide very-large size Series C (or later) capital to thriving businesses to fund their scaling through organic or inorganic (acquisitions) growth.
- **Mezzanine funds** offer bridge capital in anticipation of an impending IPO or liquidity event.
- **Buyout capital (private equity) funds** offer debt or equity capital to buy out late-stage or mature companies with a controlling stake and a potential management change and offer its founders/investors a partial or complete exit.
- **Turnaround/distress capital funds** provide debt or equity capital to buy out a stalled or failing company with a controlling stake. They either turn around the business by infusing new management, strategy, and cash or break it into pieces that are collectively more valuable than the original (distressed) whole.

4.4 The Mindset of Other Investors

VCs are rarely the first, the last, or the only type of investor in the full life cycle of a business. Different types of investors specialize in financing a business at its various stages through equity or debt.

When discussing how (and if) an investor will view and value IP, we must keep in mind that the typical mindset of other investors may differ from typical VC mindset in material ways. For example:

- **Bootstrapped entrepreneurs** may invest out of passion and patience.
- Their **friends and family** may not possess the expertise necessary to validate the idea but may still invest due to their trust in the entrepreneur.
- **Excited stakeholders** (e.g., potential end-users, customers, partners, suppliers, employees, or consultants) may put skin in the game because they have something to gain if this idea works.
- **Crowdfunding platform users** may invest out of expertise, an emotional attachment, or pure peer pressure (herd behavior).
- **High-net-worth (HNI) or ultra HNI (UHNI) angels** may invest in groups or solo based on expertise, for financial reasons, or simply for bragging rights (to impress their peers).
- The business models of **incubators and accelerators** may require them to accept a certain number of inductees in each batch. In turn, VC funds may invest in such incubators for deal flow.
- A **family office** may insist on providing most or all follow-on funds. They hate to give up control and prefer to keep a winner all to themselves.
- Specialized banks and financial groups issue **venture debt** secured by 100% of the borrower business's assets (including IP/IA) with liquidity preferences senior to all other investors.
- A **sovereign wealth fund (SWF)** operates on a scale and time horizon unmatched by other investors and gets a unique deal flow and near-monopoly access to certain sizes of deals.
- A **corporate (strategic) VC** may invest with dual goals of advancing their company's strategic and financial interests.
- **Special purpose acquisition companies (SPACS)** (aka the "blank check companies") have unique constraints and drivers. They need to buy a target that fits within their charter, require investor shareholders to vote and approve, and may have to return the money if they cannot close a deal in a specific time frame.

5 IP Considerations in Technology Private Placements' Due Diligence

Technology private placements involve rapid, high stakes decision-making with asymmetric and uncertain information. In venture capital, where the investee is often at an early stage, reliable signals about their viability, investability, and

valuation have not yet emerged. Indirect proxy signals, if available, are fuzzy at best. The time needed to conduct a thorough, yet quick due diligence is finite and has a high opportunity cost.

In the HBR article "How Venture Capitalists Make Decisions: An inside look at an opaque process," Paul Gompers et al. conclude that, "for each deal a VC firm eventually funds, the firm considers a total of 101 opportunities on average, meets the management of 28; discusses 10 deals at a partner meeting; conducts formal due diligence on 4.8; and offers a term sheet to 1.7 (Gompers et al., 2021). A typical deal takes 83 days to close. The firm invests an average of 118 hours on its *due diligence* during that period."

VCs know someone else will snap up the winner if they don't act fast. They must recoup the costs of all their diligence on every deal they examine, including the ones they did not fund, only from the deals they do fund. Successful investors excel at reading the tea leaves and finding the proxy signals that will short circuit or accelerate their diligence. They use IP as one such proxy to gauge the technical capabilities of the team.

A detailed look at all the various best practices in private placement due diligence is beyond scope. Hence, we will limit focus to only a partial list of the typical IP considerations in diligence.

5.1 IP Factors in Due Diligence at an Early Stage[12]

Investor interest in the IP of an early-stage deal is typically narrow and usually limited only to the commercial potential of such IP within the constraints of other factors such as the team, business plan, etc.

Specifically, investors primarily want to know how (or if) this IP can and will be monetized if they proceed with their investment, and to what extent their capital will make a material difference. They want to know if this IP can be a driver and a determinant of future success. They may also view IP as a downside cushion.[13]

Typical IP questions at this stage include:

1. (How well) does this IP support and enable the investee's business plan?
   (a) Especially its current offerings sold in its current target markets/regions
2. Will this IP be relevant to, and enable, the company's expansion?
   (a) Especially its applicability in new products, markets, and regions, or
   (b) Its potential for pivots into new business models and revenue models.
3. (How well) will this IP help the company to
   (a) Defend from current/future competition?
   (b) Maintain or improve its pricing and profit margins vs. direct and indirect alternatives available to the customer?

[12] These considerations may also apply for evaluating later-stage deals.

[13] See case study 8.3 where the IP liquidation value was instrumental to a turnaround strategy.

4. Pedigree and ownership paper trail:
   (a) Who exactly owns the IP?
   (b) Has all of this IP been assigned to the company by the inventors?
   (c) If a university was involved, has it formally (i.e., in writing) waived IP claims or licensed this IP to the company?
   (d) If the inventor or founder created this IP while working elsewhere, in which state was this employment?[14] Are there any real or perceived IP conflicts?
   (e) Is there a prior (ideally demonstrated) track record of the company, its founders, and key people in creating, filing, protecting, and monetizing IP?
5. Alignment with business strategy:
   (a) Does the company's IP strategy and IP portfolio match the claims it is making to its investors, customers, and partners?
   (b) Do the technologies and jurisdictions of the company's patent applications match its product and business road map?
6. How many months/hours/dollars were invested in creating IP?
7. Does the realized IP output match the claimed investments? If not, why?

5.2 IP Factors: Due Diligence at a Later Stage

In a later-stage deal, or in a deep-tech business model, or in verticals like biotech, IP may already be or later become fundamental to the investment thesis, company valuation, or deal terms.

In such situations, in addition to the factors outlined above, an investor may ask its internal or external domain experts to determine:

1. IP's likelihood of achieving claimed (and hoped) commercial potential
2. IP's likelihood of surviving a possible challenge in IP litigation
3. IP's cross-licensing viability for defensive use
4. IP's licensing viability for strategic partnering
5. IP's viability for generating additional and material licensing revenue streams
6. IP's value as collateral in venture debt deals or attractiveness in acquisitions
7. IP's potential liquidation value as a downside protection to the investor

6 Investors' Typical Advice on Managing IP

Seasoned investors and businesspeople know that some IP best practices must be adopted by a venture right from its beginning. They succeed by coaching portfolio companies and subordinates to avoid the same mistakes they or others they know may have made in the past.

[14] In the United States, such Employer-Employee IP conflict rules can be state specific.

Here are some proven insights about filing, managing, and monetizing IP we often see the investors (and ourselves) offering mentees and portfolio companies:

6.1 Typical Investor Advice: Things to Consider when Filing IP

1. Understand how IP can be and is used before investing in it.
   (a) Don't pursue IP only for "use in own products."
   (b) IP is useful only if it is enforced – either to prevent others from copying your products or by demanding royalties for the license to your patents.
2. Writing strong patent applications is an art.
   (a) Even after a patent is granted, if the claims made in the original application were phrased weakly, the patent can and will be easily designed around.
   (b) If the patent application claims are too broad, you may not get the patent. Worse yet, you may get it, invest in maintaining it for years, and later see your patent get challenged and invalidated during litigation after you have paid all the filing, maintenance, and litigation costs.
   (c) You get what you paid for with IP applications. Cutting corners at this point is rarely worth it.
3. Don't file weak patent applications unless you do so knowingly and merely for an aesthetic benefit.
   (a) Some IP is created or filed purely for aesthetic (aka optical only) benefits. These could be to pass an investor's yes/no checklist, appease an investor's or customers' psychological needs, or make some marketing claims. It has no other use: It won't prevent anyone from copying your idea, and you have no hopes to ever collect even a dollar of licensing revenue by enforcing it.
   (b) Don't be surprised if your investor tells you to pursue aesthetic IP. Ironically, once an investor invests, they want other investors to invest in you too. It de-risks their investment. In big firms, they may also need to justify their investment decision to their peers or superiors. At the same time, they don't want to dilute their stake too much. They do not like to cede too much (or if this were an option, any) control to other current and future investors either. It is strange coopetition.
4. If you have a limited budget, file fewer but high-quality applications. You must make technical information about your invention publicly available to get patent protection.
   (a) If an infringement of your invention cannot be easily detected or proven, you may not benefit from or may even harm your interests by publishing such a patent. Instead, focus on cultivating trade secrets and other types of intangible assets as your moat.
   (b) Investors love investees who believe and act as if everyone's time and resources are always finite. For every choice (or dollar) an investee says (or wants their investors to say) "yes" to, the investors ask them to share which five other alternatives the investees have already considered and said "no" to.

5. If you operate in certain industries (e.g., biotech) or developed market segments (e.g., United States), patents are a good tool in your toolkit to gain and maintain a competitive advantage. However, if you operate in other industries (e.g., software applications) or emerging market segments (e.g., Turkey), patents are a costly and impractical means to enforce your rights. Look at other means such as time to market, customer intimacy, and execution agility to gain and maintain your competitive advantage.
6. Not everything is patentable. Not everything patentable should be patented.
7. Let your business needs and strategy drive your IP strategy and priorities.

6.2 Typical Investor Advice: Why You Should File Patents

Below, we present two "Top 10" lists on why you should patent and why you should not patent. Both lists are presented alphabetically out of necessity. They cannot be sorted in any order of importance. The absolute and relative relevance as well as importance of each reason across both lists depends on the context.

It takes a seasoned player to judge which reasons are the most applicable and which among them trump over the others in any given situation.

With that caveat, here are the top 10 reasons (listed alphabetically) investors typically give a start-up or SME in their portfolio why they should invest precious time and money on filing patents:

1. Block competitor patents and interfere with their ability to operate
2. Bragging rights and marketing purposes
3. Create a patent portfolio to get others to cross-license with you
4. Help raise funding
5. Increase the threat of a counter suit and deter/prevent others from suing you
6. Monetize the invention through IP licensing
7. Pass a yes/no checklist of an investor [the aesthetic or optical benefit]
8. Productize the invention and prevent competition to earn premium profit
9. Shield against unfair NDAs in partnerships and in M&A talks
10. Signal technical abilities of your team to the investor, market, or customer

6.3 Typical Investor Advice: Why You Should *Not* File Patents

On the flip side, here are the top 10 reasons (also listed alphabetically) the very same investors typically give other start-ups and SMEs in their portfolio why they should not invest precious time and money on filing patents:

1. Country of operation or jurisdiction is cost prohibitive or impractical to enforce patents due to judicial, political, legal, or other reasons
2. Damage from any patent infringement is hard to establish or low

3. Direct costs of filing and maintaining patents, when or if saved, are better invested elsewhere
4. Don't prematurely tip hand to the competition
5. Invention not patentable under current laws
6. Operating in an industry or region where patents are considered irrelevant or inferior to other competitive advantages such as access or time to market
7. Opportunity cost of filing and maintaining patents (e.g., management and engineering bandwidth) can be better deployed elsewhere
8. Patent claims can be easily worked around
9. Patent infringement cannot be easily detected or proven
10. Trade secret path offers a better return to the business vis-à-vis patenting

7 Investing in Patents, Not in the Patent-Owner's Business

So far, we have looked at the investors who consider IP as a factor when deciding whether to invest in the patent owner's business. Such investor's return depends on the success of the patent owner's business. IP is merely a potential driver and determinant of this success.

After years of strong bull markets, many investors believe the upside of stocks may be limited and are seeking hedge opportunities. They worry about inflation and the monetary easing by governments worldwide. With yields and interest rates in the proverbial basement, they don't like bond market opportunities either. They see crypto assets as too volatile. To diversify and de-risk their portfolio, they need newer forms of uncorrelated alternative investments.

The niche investors who have the necessary expertise, pockets, and appetite to invest directly in select patents instead of in those patent owner's business know that doing so can be an excellent alternative investment.

7.1 Patent Investment Funds

Hedge funds such as *Magnetar* and private equity funds such as *Fortress* have been making equity investments in patents quite successfully.

Such investors appreciate and methodically cultivate the information asymmetry advantages in their favor. They consider patents' (and pending applications') quality, priority, novelty, market applicability, infringement, and geographies, etc. when making their decisions. They manage and substantially reduce their risks through their deep patent expertise and favorable information asymmetry. Success in this segment requires niche skills and deep industry connections.

7.2 Debt Financing

Patents can be excellent collateral for debt financing for corporations, whether publicly traded or private, and whether established or not. Banks such as *JP Morgan*, *Wells Fargo*, and others offer debt by taking a lien on patents. Such lenders may be willing to significantly reduce the loan coupon rates for good *IP collateral*.

7.3 Patent Litigation Financing

In recent years, patent law has become more favorable to the implementers,[15] especially in the technology area. There is no upside for large companies to license IP willingly. Often, the courtroom is the best and perhaps only way to get patent licensing deals done.

The average cost of patent litigation lawsuits in the United States can run into millions of dollars. Litigating abroad or in the *International Trade Commission (ITC)* can sink tens of millions of dollars. If the Tech-Co (see case study in Sect. 8.1) or its investors were willing to sue the infringer but did not have the money to do so, they could have approached an IP litigation fund. These specialty financiers have expertise in and an appetite for such litigation. Previously, law firms drove most of the growth in litigation finance. Now, patent owners, licensing companies, and large corporations regularly partner with litigation funds to monetize their IP. In addition to paying legal fees and expenses, companies can use pending litigation as a liquidity source. Litigation funders issue working capital to the patent owner against the expected future value of their IP litigation outcomes.

This is a small and niche market with barely $10 billion in this asset class. However, a secondary market for litigation finance is also emerging. The secondary investor has no direct relationship with the patent owner or their law firm. The litigation fund invests in portfolios of cases to mitigate risks. The secondary investor invests only in an individual case based on its merit.

Most litigation financiers insist that the law firm put skin in the game, too, and put patents at the riskier end of their investment spectrum. Typical deals may include recourse vs. nonrecourse loans, equity investment, purchase of existing royalty streams, and purchase of pending judgments. Deal returns are tied to the performance of the IP through settlement, licensing, or damage awards and not to the performance of the IP owner. Lenders often demands risk-weighted discounts on the royalty streams. To mitigate their high risk, the financier may also demand preferential distributions until they recoup their investments. The remainder, if any, will get shared among the various stakeholder parties.

[15] Such as the large established company from the case study we present in Sect. 8.1 of this chapter.

7.4 Considerations when IP Owners Choose Litigation Financiers

In Sect. 8.1, we discuss a case study where Tech-Co sold its patents to help recoup its R&D costs and minimize investor loss. Theoretically, Tech-Co's Board could have taken a substantially riskier path of patent litigation. It would have required them to raise even more capital, commit to high and uncertain amounts of open-ended expenses, and be willing to accept a binary all-or-nothing outcome.

Here is a high-level checklist Tech-Co needed to consider when choosing its litigation financier:

1. The financial strength of the investor
2. Deal structure and cash flow waterfall design
   (a) Align incentives
   (b) Separate the patent-based capital raises from broader capital raises
3. Committed vs. invested capital
   (a) Usually, only 10 to 20% of the committed amount may get invested
4. IP/patent expertise of the financier
   (a) Value the financier can and will add above and beyond their money
5. Relationships
   (a) Patent owners and law firms may willingly sacrifice short-term returns to cultivate and preserve valuable relationships
6. Decision freedom
   (a) Resolving internal conflicts drain time and energy. Ideal funders support their IP owners' and law firms' decisions.

7.5 Considerations when Financiers Evaluate and Choose IP Deals

Here is a high-level checklist which Tech-Co's litigation financier may have considered:

1. Return on invested capital
   (a) Typically measured in MOIC
2. Relationships
   (a) A financier may value business benefits of cultivating good relations with patent owners or law firms above the deal merit
3. First pass due diligence: High level facts
   (a) Is a competent law firm in place?
   (b) Size of the damages and the range of expected settlement
   (c) The story behind the case

(d) The number of defendants
(e) Alice risk[16]
(f) Recovery potential

4. Second pass due diligence
   (a) Evidence of use charts
   (b) Validity search
   (c) Prosecution history
   (d) Term sheet
5. Third pass due diligence (after an agreement on the terms)
   (a) Extensive validity search
   (b) Internal outcome matrix: e.g., motion to dismiss, discovery and evidence, expert discovery, summary judgment, pre-trial, and trial

8 Seven Illustrative Case Studies

Each of the seven case studies presented below is based on the real-life situations we have tackled. For privacy and confidentiality of the various players involved, we have withheld real names. Where necessary or appropriate, we have also omitted or changed certain details for brevity, clarity, or relevance while taking care that no such changes and omissions materially alter the "moral of the story."

8.1 Patent Sales Help Recoup R&D Costs

In the late 1990s and early 2000s, a video collaboration tech start-up we will call Tech-Co had invented and patented unique technologies. Tech-Co's IP allowed video calling multiple users simultaneously with minimal bandwidth and low latency. Only a few competitors offered group video calling then. None offered the features Tech-Co had invented. Tech-Co had also built ancillary solution features such as billing for video calls and automated calendars. With a solid business model, low price-per-minute solution, and the strong belief that network effects will

[16]The term "Alice risk" refers to a 2014 U.S. Supreme Court decision in the "Alice v. CLS Bank" case. This decision set difficult-to-pass criteria to determine whether a software invention is patentable. If the claimed invention is an "abstract idea" then it must contain an "inventive concept" beyond just the computer implementation of code for this invention to be patentable. Unless the invention improves the functioning of the computer, and if it merely uses the computer as a tool, then the "abstract idea" lacks an "inventive concept" and hence the claim is not patentable. For this reason, a previously issued patent can get invalidated in litigation. This 2014 decision radically altered how (and, if at all) software patents are claimed, analyzed, and litigated in the U.S. In the last eight years since Alice, there have been multiple unexpected results. Different courts have applied the "Alice" criteria in their patent rulings in unpredictable ways, adding even more uncertainty and complexity to patent enforcement, an inherently uncertain and complex topic to begin with.

drive adoption, Tech-Co expected to become profitable within 12 to 18 months of its launch.

Tech-Co raised venture funding, filed dozens of high-quality patents, and was on track to launch when Murphy's law struck. A large company acquired another video conferencing start-up and offered video conferencing to all its users for free. The superior technologies and products of Tech-Co could not compete with a free product already in the hands of hundreds of millions of users. The large company had time and resources to keep improving their mediocre product and eventually brought it on par with Tech-Co's product. They could copy many of the Tech-Co ideas to get there faster.

By then, Tech-Co had exhausted the funding it had raised. It could not find any investor who would provide additional capital. Tech-Co's attempts to pivot or license its patents to the large company failed. Tech-Co's Board then engaged our team to help sell their patent portfolio. We received multiple bids from various buyers and helped Tech-Co's CEO and investors to select the best offer. Tech-Co recouped its R&D costs and could return the investor's capital. By selling patents, they reduced the uncertainty of the outcome but also received immediate payment to pay off their VCs.

Theoretically, Tech-Co's Board and investors could have reduced their risk and hoped for better returns by partnering with a litigation fund and litigating. However, that would have required them to wait a few years for a favorable litigation outcome and gamble that the final outcome would indeed be favorable.

8.2 IP Monetization Strategy Boost During an Industry Downturn

Large and established technology companies such as *IBM* and *HP* sell or license their non-core patents to generate income. Such transactions, if cultivated as a recurring business, help reduce patent maintenance costs. Their proceeds go straight to the bottom line. The financial impact on the top and bottom lines of (especially) small and midsize companies, whether private or publicly traded, can be material.

Assuming a 15% profit margin, earning one dollar in an IP transaction[17] is equivalent to earning seven dollars in traditional product sales. Hence, this can be a potent business strategy in certain situations.

Carol was the CFO of a medium-sized publicly traded semiconductor company we will call Semi-Co. Carol couldn't control the cyclical nature of his industry. She was still expected to show reliable income to the stock market every quarter. Semi-Co's customers only wanted to buy from financially stable companies which

[17] Recurring and non-recurring revenues are reported (and should be viewed) differently. A breakdown of items classified as nonrecurring is provided in the footnotes of financial statements.

they felt would be more likely to be around longer. Semi-Co was simultaneously facing competition headwinds and an industry downturn.

We informed Carol that Semi-Co held a sizable and high-quality patent portfolio. Semiconductor patents do not suffer the "Alice risk." Once Carol verified that these patents were in technologies not core to Semi-Co strategy, she retained us as Semi-Co's exclusive sell-side advisor. To create a steady patent transactions revenue, we gradually sold a small portion of Semi-Co non-core IP every quarter for six consecutive quarters.

This strategy helped Semi-Co weather the industry downcycle and boost its customers' confidence. Later, Semi-Co was able to get acquisition offers at an above industry average valuation multiple.

8.3 IP Licensing Enables and Finances a Corporate Turnaround

This is a partial story of a complex but elegant turnaround strategy we successfully architected and executed to save and revive a failed venture. It took threading a needle to make this strategy work. A full explanation required to understand or appreciate it is beyond scope. Instead, we focus only on its IP licensing aspects. Without IP, this entire strategy would not have been possible.

Some 20+ parties had a stake in or a claim against this nearly bankrupt venture. Any one of them refusing to compromise would kill the business. We persuaded each to make a voluntary sacrifice, trade in their valid but worthless claim, and give us a chance to recoup their losses with this strategy:

1. We formed a New-Co with a subset of the parties (reasons are beyond scope).
2. We got all parties to approve New-Co's acquisition of this now Old-Co.
3. In parallel, we found and persuaded a partner to license Old-Co's IP, and to engage New-Co to maintain and further develop this Old-Co IP for this partner's use in certain verticals worldwide.
4. We structured two IP licensing agreements with reverse licensing (grantback) clauses, and a separate consulting service agreement[18] with two entities controlled by the partner.
   (a) The revenue New-Co earned from the first IP Licensing Agreement was fully offset against the NOLs[19] New-Co inherited from Old-Co. We used it to pay off Old-Co's debts.

[18] All contracts clearly defined background/foreground IP and clarified which party has which IP rights in which vertical. This helped keep the IP clean and pass future investors' diligence.

[19] NOL = net operating loss(es).

(b) The reverse license (grantback) gave New-Co rights to use the IP it would develop for the partner in its own vertical. This step was essential to make New-Co commercially viable and investable.
(c) We structured the second IP licensing agreement signed with another corporate entity owned by the partner as a tax-neutral asset swap. In return for giving up one asset (our IP interest) we received another asset (an equity interest in this corporate entity). Reasons for this complex maneuver are only partly in scope (see #5a below).

5. We raised venture debt to finance the Old-Co acquisition and New-Co operations.
   (a) Previously, this same lender had passed on lending to the Old-Co because it could not assess Old-Co's IP and considered it as potentially weak and hence unacceptable collateral.
   (b) However, the partner equity New-Co now had instead of Old-Co IP on its balance sheet (although this equity was still a private security) had a clearer and market-established price (based on the partner's latest funding round).
   (c) New-Co used this partner equity as collateral to raise its venture debt.

8.4 IP Sales Help Preserve Expiring Net Operating Losses

Fast-forward from the previous case study to a time when New-Co had successfully turned around. We were now looking to deliver an acquisition exit to the investors. We had also identified a buyer interested in acquiring New-Co.

However, due to complex tax and accounting laws regarding the cumulative net change in control, the NOLs accumulated on New-Co books were at risk of being frozen (in effect, lost for all practical purposes) after New-Co's acquisition.

Meanwhile, the investors behind the potential buyer could not agree on how much some of New-Co's IP and other assets were worth. They felt that they did not have the necessary expertise to set a fair market value on these assets. They further viewed some of this IP as non-core and feared that attempts to commercialize or monetize it after acquiring New-Co would be a costly distraction. Haggling over how to value and treat this IP risked derailing the entire acquisition deal.

We found a third-party buyer who bought this IP just before the acquisition. This IP transaction raised enough revenue to offset all the NOLs that would otherwise have been lost. It also helped clean up New-Co's balance sheet before the acquisition, making it more attractive to the buyer. By preserving the NOLs, removing a barrier that risked stalling the acquisition, and improving New-Co's books and valuation, we scored multiple goals with one shot and made all parties happy.

8.5 Strategic Investor Invests for Intangibles

One of our AI start-ups had raised eight-figure venture capital from a strategic investor: the venture arm of one of the largest pharmaceutical companies. The

start-up and its Fortune-Global investor were both thinking strategically. They were measuring their deal return not just on pure financial metrics alone, but on relationships, know-how, and cultural impacts.

The pharma company stock was unlikely to move in either direction materially whether this venture succeeded and doubled the investment or failed and drove it to zero. However, if or when this pharma company's management witnessed and internalized the Silicon Valley AI/ML and big-data mindset of this start-up and became an internal change agent for the pharma company, the value for the corporate investor would be substantial.

Likewise, the health-care start-up did not have the connections and capital needed to close a large hospital as its beta customer and research partner. Having this pharma investor would help pave the way to sign this customer.

As we have said before, different investors have different goals and intangible benefits can drive some of their private placement decisions.

8.6 Walked Away over Patent Assignment

Many founders file for a patent before raising money. Sometimes, they do so before they formally incorporate their company. Many later inadvertently (or sometimes deliberately) "forget" to assign this patent to their company. Some even go further and put the IP in a holding company that licenses it to their operating company.

Many big companies often use a patent-holding company registered in a tax haven as a tax strategy. This strategy can save large companies substantial money. However, in the case of a start-up, this is usually a nasty surprise and a big headache to its private placement investor.

We were considering investing in an innovative start-up. Its products could be sold in multiple markets. Impressed by the innovation, a peer rushed to make a seed investment. We were sold, too. However, we were unwilling to bypass or cut corners in our due diligence process. We kept asking the questions on our checklist.

We found out that the invention was patented by the founder in his own name. The patent was not yet assigned to the company. We explained why he had to assign this patent to the company before we could invest, but he stalled. The third time we asked, the real reason for his hesitation came out: He was hoping to "license" his invention to the company. If the company failed, he reasoned that he will at least be able to sell the patent to someone and salvage his loss.

We had invested substantial time and energy in mentoring this inventor and founder. We had extended a small bridge loan to help him meet a key milestone. We had also lined up other potential investors and customers. Nonetheless, instead of letting our emotions and sunk costs impact our investment decision, we chose to walk away.

8.7 Protecting IP Before Meeting a Mega-cap

A venture-funded start-up in our portfolio had built exciting machine learning IP in a big market. This start-up hoped to land a publicly listed company as its channel partner. This mega-cap partner had a track record of acquiring similar players in the industry. The start-up was excited when the mega-cap partner called. The mega-cap decision maker wanted to meet at short notice.

However, there was a (huge) catch: Mega-cap's boilerplate NDA the start-up had to sign before this meeting was egregiously one-sided. We had no leverage to negotiate on its terms and zero hopes of getting them to change it. Stalling or pushing out the meeting was risky, too. The only way to seize the opportunity was to knowingly and willingly accept that we may lose our crown jewels for nothing in return. The founders and investors of this start-up were legitimately nervous.

In an "all-hands-on-deck" moment, the start-up gathered all key personnel for a marathon session. Over the next few days (plus nights and weekends), this team brainstormed and wrote as many provisional patent applications as it could. Its IP attorney scrambled to file them before meeting this partner. This allowed the start-up to accept the mega-cap partners' NDA, meet with the mega-cap partner, and still protect its IP. Like the previous example, this situation also happens often. Provisional patent applications are a great protection in such situations.

9 Learnings and Takeaways

Used correctly (or incorrectly), IP can shape industries, impact businesses, and affect both business and personal fortunes. Still, in Silicon Valley – the innovation capital of the world – venture capitalists and other investors financing start-ups through private placements may not view patents as the most important (and sometimes even a minor) consideration in their investments. This can be true even when they are investing in the technology industry and a technology start-up.

This dichotomy is not a surprise to seasoned investors and entrepreneurs. Except in niche situations and circumstances, IP is rarely a key decision factor in an investor's decision and deal terms, including valuation. Instead, intangible assets (which include IP) are often a better predictor and driver of future success. Until direct performance signals emerge, investors must use IP and IA as proxy signals to help accelerate or short-circuit due diligence and de-risk decisions.

Once the investee business matures, IP and IA can and do play many types of offensive and defensive roles in the decision-making and operations of both an investor and their investee.

Takeaways

1. IP can shape industries and affect business as well as personal fortunes.
2. How (or even if) an investor values an investee's IP depends on context.
3. Intangible assets (IA) include and matter far more than IP alone. The contest between IP/IA and tangible PPE assets was a knockout punch (IP/IA won).
4. Data is the "new oil" and "today's Rembrandt in the Attic."
5. Technologies to help manage and monetize IP/IA are hot.
6. Distribution of VC outcomes are extremely (third degree of Pareto) skewed. This fundamentally affects VC priorities and decision-making.
7. Private placement investors are not a homogeneous group. They coopete. Their performance goals, motivations, and expectations differ.
8. IP can be a good proxy signal in the early (but less so in the later) stages.
9. As a business matures, its IP plays various offensive or defensive roles.
10. Optimal IP strategies and tactics are always context specific. Often, there is no "one-size-fits-all" answer.
11. Business model and business strategy drive the IP strategy.
12. Investing directly in patents is a new class of alternate investment uncorrelated with other investments. It can give good returns, diversify the investment portfolio, and reduce portfolio volatility.

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Praveen Shah is the Founder and CEO of Mobity LLC, a boutique strategic advisory, IP transaction broker, and Silicon Valley venture incubator/accelerator.

Since 2002, technology, health care, software, and services, and other clients worldwide have relied on Mobity to help transform and optimize their businesses and launch and scale their new ventures. As their trusted (and often exclusive) advisor, Mobity delivers them premium outcomes in their business, IP (patents), and other technology transactions.

Mr. Shah is a serial entrepreneur and start-up CEO. He mentors purpose-driven entrepreneurs and technologists building practical applications of AI-ML, IoT, and other exponential technologies. Serving as their Cofounder, CEO, Executive Chairman, Board Member, or Advisor, he has incubated 15+ VC-backed digital health, supply chain, and people tech start-ups with five acquisition exits.

Mr. Shah is also a trusted advisor and change agent to clients of all sizes, ranging from Fortune 10 to pre-revenue. A partial list of the for-profit, government, nonprofit, military, and academic research institutions he has counseled in his three-decade career includes: Apple, BCG, Best Buy, Cisco, Commonwealth of PA, Deutsche Telekom, Exide, Frito Lay (PepsiCo), Fujitsu, HP, IBM, Intuit, J&J, KPMG, KraftHeinz, LG, Lockheed Martin, Mack Truck (Volvo), McDermott, NXP Semiconductors, On Semi, Oracle, Philips, Qualcomm, Smurfit-Stone, ST Micro, Sun Microsystems, Sutter Health, Takeda Pharmaceuticals, Toyota, and US DoD.

Before founding Mobity in 2002, Mr. Shah founded, built, and led a Big-4 and two boutique professional service practices. He hyper-scaled a cloud services firm from ~$5 million to $50 million annual revenue and ~$7 million to $200 million enterprise valuation within two years. He sold and delivered 200+ strategy engagements worldwide and led implementation teams across five continents.

Mr. Shah holds a BE in Mechanical Engineering from Savitribai Phule University of Pune (Maharashtra, India) and an MS in Systems Engineering from Lehigh University (PA, USA).

Pallavi Shah is the Managing Director of Transactions and Alliances at Mobity LLC and a FINRA registered broker-dealer through GT Securities (member FINRA/SIPC). She has also served as Board Observer for a Softbank-funded venture.

Ms. Shah is renowned in the IP investment banking community as a fearless negotiator and deals closer. She consistently closes high-velocity and premium outcome transactions for her clients. They retain Mobity as their trusted (and often exclusive) transaction advisor for her incredible ~90% close rate. They covet her connections to the thousands of decision makers at various operating, venture capital, private equity, and other companies globally whose access they seek.

Before Mobity, Ms. Shah closed 50+ transactions within three years at Houlihan Lokey (NYSE: HLI) as their Head of IP Transactions. Before HLI, she served HP in various IP strategy, product management, and business incubation executive roles. She nurtured, marketed, and monetized HP's innovations through lucrative channel, technology licensing, and patent sales deals. Before HP, she served Sun (now Oracle) in various engineering and market development senior roles. She invented, productized, and commercialized leading-edge streaming media technologies. She also cultivated and managed 120+ digital media strategic alliances that generated $250+ million in new revenues annually for Sun. She also chaired the MPEG4-Java international standards committee and contributed to the ISO image/video compression standards. Before Sun, she pioneered and demonstrated the world's first interactive HDTV at Sarnoff Labs of Stanford Research Institute (SRI).

Ms. Shah is a renowned media spokesperson, the inventor of 18 highly referenced patents worldwide, and a published author. Some 260+ patents and 200+ publications by many mega-cap internet and media companies have cited her work.

Ms. Shah holds a BE in Electronics and Telecom Engineering from the Savitribai Phule University of Pune (Maharashtra, India) and an MS in Electrical Engineering from Utah State University (UT, USA).

What's the Big Idea? The Crossroads Between Investment and IP

David Durand and Cédrick Mulcair

1 Start-Ups: Attractive Ventures

Start-ups can be founded in a multitude of places. The defining moment and idea can come from industry leaps, such as *Bumble* CEO and founder *Whitney Wolfe's* transition from *Tinder*; famous garages, such as *Bill Gates's*; university collaboration; cooperation with an accelerator or an incubator; at a coworking space (Tripathi & Oivo, 2020); or on the back of a paper napkin.

Start-ups act as important catalysts for innovation (Colombelli et al., 2016; Szarek & Piecuch, 2018), fueling business growth, productivity, and competition (OECD, 2019). They also offer a reflection of today's intangible economy, in which *intellectual property (IP)* is valuable. Indeed, a 2015 *KPMG Australia* report highlighted that "[m]ore businesses are looking to start-ups and entrepreneurs for ideas and solutions, to bring new thinking into their organizations and to challenge the status quo" (Sheppard et al., 2015). Recently, in June 2021, the *McKinsey Global Institute's* discussion paper on the topic outlined the increased investment share of intangibles in the U.S. and European economies; it has achieved a 63% growth in gross value added over the past 25 years (Hazan et al., 2021). Writing for the *Public Policy Forum*, Speer and Asselin (2019) identified data and IP as the drivers of the Canadian intangible economy.

Though start-ups present themselves as lucrative ventures, they are often confronted with the investment paradox which results from them being inherently risky investment opportunities. Start-ups need to protect their IP, data, and unique offering, all while simultaneously attracting funding from different types of investors. They must be able to reconcile these objectives by understanding how

D. Durand (✉) · C. Mulcair
David Durand, Attorneys Corporation Inc., Montréal, QC, Canada
e-mail: ddurand@durand-lex.com; cmulcair@durand-lex.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_8

investment opportunities arise and fit within their business model and by implementing an IP strategy which we identify under the label of "*minimum viable intellectual property*" *(MVIP)*. Therefore, the purpose of this chapter is to provide readers with insights regarding the following:

1. Understanding how to attract capital, including investment processes, as well as investors' investment criteria in start-ups and early-stage companies; and
2. The importance of investing in MVIP, which consists of a strategic management system that ensures that the proper steps have been taken to safeguard innovation by way of contract, trade secret, and/or traditional forms of IP so as to provide investors with a form of "insurance."

Taken together, this insight should allow both investors and entrepreneurs to better understand the role which IP can play within the design of a start-up, and its positive relationship with investment and financing opportunities.

2 Challenges of Start-Ups: Understanding Survival Rates

Before addressing the role of investment in start-ups, the authors wish to acknowledge that the very factors which tie into start-up success make them volatile, high-risk investments. These include their goal orientation (Kim et al., 2018), development potential (Skawińska & Romuald, 2020), as well as their reliance on both the personality traits of entrepreneurs (Kerr et al., 2018) and the kind of innovation or disruptive technologies. In the Canadian context, authors Grant et al. (2019) presented statistics which found important differences in the survival rates of *angel-funded* start-ups when compared to other start-ups in Canada, with the caveat being that their paper investigated survival from the time at which start-ups received angel investment from a *Canadian National Angel Capital Organization (NACO)* member (Fisher & Reuber, 2010; Innovation Canada, 2018). Notably, Grant et al. (2019) indicated an average one-year survival rate of 79% for start-ups that received angel investment, for the period between 2002 and 2011, and an average five-year survival rate of 54% for these start-ups. These findings were compared with those published by *Industry Canada* in May 2018, which examined new firms' birth rate and survival. They concluded that 63% of new firms survived for five years, while 43% survived for 10 years. An exploratory study conducted by Atsan (2016) reviews the learning experiences of mature companies that experienced failure, the definition of which is itself difficult to endorse with any certainty.

Understanding that start-ups have a "limited runway" given their rates of survival, entrepreneurs and scholars have tended toward promoting the "lean start-up" methodology originating in the work of Blank (2013): effectively, a scientific approach to start-up creation and management (Shepherd & Gruber, 2020; Shepherd & Patzelt, 2021). Literature on the subject finds that start-up failure often results, unsurprisingly, from a variety of external and internal factors. Internal factors include poor relationship with business partners (Atsan, 2016), a lack of product differentiation

(Miloud et al., 2012), an unsuitable pairing between technically trained founders and early employees (Mueller & Murmann, 2016), overestimating the start-up's value, and lack of data relevant to investors to support the proposed valuation. These may be exacerbated by external factors, such as a jurisdiction's social and regulatory framework, as well as its ecosystem (Gaskill, 1993) and the availability of financial resources (Liao et al., 2008), among other factors. Nor must it be forgotten that the projects undertaken by a start-up can fail and, if not terminated appropriately or in a timely manner, can significantly aggravate these internal and external factors.

Indeed, as start-ups are expected to grow and scale rapidly, founders and managers are advised by Balachandra and Raelin (1984), as well as Royer (2003), that R & D projects can be terminated upon set-up termination triggers for signaling an inefficient project which could lead to the failure of a start-up, acting as a "money pit." These can include, for example: (i) level of top management support, (ii) rate of new product introduction, (iii) probability of technical success, (iv) technological route, (v) project manager as project champion, (vi) association between marketing and technical aspects, (vii) end uses of the solution, (viii) effectiveness of the project manager, (ix) commitment of project workers, (x) life cycle of product, (xi) internal competition, as well as (xii) cost schedules. It is important to keep these termination factors "top of mind" when assessing the viability of a start-up. Understanding and integrating these termination triggers into project management, as well as ensuring that various teams communicate effectively regarding the same, will allow start-ups to prioritize beneficial projects.

3 The Role Investment Plays in a Start-Up

By understanding the aforementioned challenges that a start-up faces, entrepreneurs can better position themselves to secure adequate funding, which can come from one or more sources depending on the start-up's state of maturity. These funding opportunities range from more "traditional" investment vehicles, such as equity, asset-based finance, debt, and crowdfunding (Cusmano & Koreen, 2015), to newer methods, such as tokenization, which may entail further regulatory compliance. However, in an effort to limit the scope of this chapter, the authors will focus on the most common sources of funding for start-ups, namely: angel investors (AI) (i.e., "accredited investors"), venture capital (VC), private equity (PE), university gap funds, and institutional investors. Each of these types of investors has their respective investment criteria or thesis, specialty (i.e., preferred industry), expected return on investment (ROI), and impact on both the innovation ecosystem and governance norms (Lerner & Nanda, 2020).

While the financial resources available to a start-up play a vital role in its survival, it is often difficult to distinguish between the inherent quality of a start-up's offering and the impact and value added by funding, whether acquired from AIs or VC. Indeed, Corea et al. (2021), in preparing a data-driven framework for investors, highlighted that external investment, while not the only determinant of success for a company, is "an accelerator, that can reduce the time to exit, and in general foster the

development and growth of a business". Start-ups which manage to acquire funding not only benefit from monetary resources that funders provide, but also from the connections and networks that they may offer. Wang and Schøtt (2020) interestingly found that there are rather "few start-ups [that] are both highly innovative and well financed," and that nascent entrepreneurs should therefore pay attention to networking in the public sphere, such as in coworking locations and at conventions, to encourage the coupling of innovation and financing. In Canada, Grant and Croteau (2021) have therefore posited, like Liu (2000), that angel investment forms a critical part of the entrepreneurial ecosystem. Considering VC investment impacts within the United States, Jeong et al. (2020) similarly conclude that the earlier a start-up is offered investment by VC firms, the higher its performance. Finally, entrepreneurs should also be receptive to large established companies providing them with mentorship (Ghezzi et al., 2021).

3.1 Finding the Fit: Investor Type and Stages of Financing

The authors now turn to the "art" of making a start-up attractive to specific investors, which presents challenges for entrepreneurs seeking investment. In an overview of angel investors and their selection criteria in Canada, Liu (2000) noted that AIs are more likely to reject investment proposals due to "the entrepreneurs' unrealistic valuations of their companies and their lack of product and market knowledge." This is particularly pressing, Liu observes, in relation to the preferences of private investors and the process of early-stage capital raising. However, difficulty in evaluating the worth of a company is far from an entrepreneur-specific challenge. In a recent study, Corea et al. (2021) noted that the incorrect valuation of a company's worth by investors and a poor ability to identify profitable deals remain important considerations for VC investors themselves.

Furthermore, it is essential that start-up entrepreneurs seeking funding understand the difference between pre-seed, seed-stage, start-up stage, first-stage, and subsequent rounds of financing, such as Series A, B, C, etc. (Klein et al., 2019). Figure 1 represents the authors' preference when advising on rounds of financing. Further information can be found in Wilson and Silva (2013), wherein the authors present a particularly complete portrait of a firm's growth (or life cycle) and its link to the stages of raising capital. By way of example:

- **Pre-seed funding**, such as "friends and family" loans and government subsidies, is sought when there is a concrete need within the market identified by the start-up, and it can present a very solid short pitch and pitch deck that demonstrate their concept and market opportunity, while also identifying the steps by which their company can obtain a minimum viable product (MVP).
- **Seed funding**, which includes angel investment and crowdfunding, should be sought once the MVP is built. The start-up can provide business analytics and the entrepreneur can therefore present investors with a clearer picture as to the feedback the start-up received regarding its product(s) and/or services.

Fig. 1 Approximating investment and growth (authors' own figure)

- **Series A** funding should be sought when the start-up has acquired sufficient metrics to demonstrate its growth. In other words, entrepreneurs should have developed a growth model which is tried and tested and be ready to answer questions relating to key performance indicators and initial revenue. This funding is meant to come from more traditional investment firms. Subsequent rounds of financing, which are not included in Figure 1, take entrepreneurs further through their start-up's growth to a potential exit.

While the foregoing stages of funding can appear confusing, a well-prepared entrepreneur who has done sufficient research on their investors' preferences will go much further than one who counts on charismatic leadership. This is particularly true when approaching more sophisticated investors who will typically favor not only areas of practice, but also other more subjective factors (Bonnet & Wirtz, 2010).

Moreover, start-ups will need to understand the form of investment they may obtain (i.e., equity, debt, convertible debentures, etc.), as well as the types of vehicles which may be used by investors; for instance, (i) *special purpose vehicles (SPVs)*, which can be utilized for structured finance transactions including leasing and securitization (Sainati et al., 2020); (ii) *special purpose acquisition companies (SPACs)*, which authors such as Boyer and Baigent (2008) have argued allow for the faster raising of private-equity funds and high-risk high-reward IPOs; or (iii) even other types of investment contracts, such as *simple agreement for future equity (SAFE)* or *simple agreement for future tokens (SAFT)* (Peters, 2021).

3.2 The Rise of University Gap Funds

As a departure from the traditional private-sector investment mechanisms detailed above, Canadian universities are exploring a way for investors and entrepreneurs alike to partner during the early stages of technology development within university environments. To this end, Canadian universities have adapted to develop prototypes, conduct market research, and invest increasing amounts of money to bring products to market (Veugelers & Siegel, 2007). One such mechanism being explored concerns gap funds, which consist of a pool of resources provided by a given university to fund their commercialization activities of internal technologies with strong commercial potential. These funds seek to enable technologies to make it through the so-called *"valley of death"* by bridging the gap between traditional research funding and investment (Ostrovski & Irvine, 1988). These pooled resources may come from one or more sources, including: alumni endowment funds, university funds or budgets, as well as departmental budgets. These funds may prove invaluable prior to pre-seed funding and the development of an MVP. Universities often invest in spin-off companies which can be co-founded by project inventors to establish a corporate entity to which the underlying IP can be assigned. These opportunities are beneficial, provided that that the parties, including entrepreneurs, are aware of the effect this will have on their IP ownership (Fritsch & Aamoucke, 2013; Munari et al., 2018).

In this regard, any successful gap funding process relies as much on the university where the research is conducted as the *technology transfer office (TTO)* involved in the commercialization process and spin-off management. Thus, for gap funding to serve its purpose, both governance guidelines and investment processes should be adopted by universities and their TTOs to ensure compliance with their charters, by-laws, as well as applicable laws to attract further investor funding. Authors Dunne et al. (2019) and Sattar et al. (2020) both consider traditional investor and technology biases, and in so doing highlight the fact that universities must do more

to establish gap funding guidelines which can mitigate such biases. Indeed, the proper identification and prioritization of projects by a TTO is an instrumental part of a university's relationship with investors and entrepreneurs.

Two commonly used gap funding instruments include *proof-of-concept programs (POCs)* and *university seed funds (USFs)*. The former, POCs, evaluate the technical feasibility and the commercial readiness of inventions which are still in an early stage of development. USFs, on the other hand, invest in university start-ups to encourage commercialization through seed or early-stage funds. If you are an investor or an entrepreneur looking to obtain gap funding in partnership with a university, consideration could be given to:

1. Applying for POCs:
   (a) The start-up is capable of setting clear milestones; and
   (b) The start-up may have attracted investor attention at events or through media.
2. Applying for USFs:
   (a) Encourage the formation of partnerships between the start-up and other university departments;
   (b) Look to bridge the threshold between research support and external sponsors; and
   (c) USF programs will look for clear budgets for the project, so ensure that the start-up's financials are in order and that it has set budget milestones.

It should be noted that USF programs help universities to enforce some of the characteristics which they believe are fundamental at the research stage of an invention. These often include shareability, transferability, sustainability, and collaboration. Indeed, though universities are fertile grounds for generating and collaborating with start-ups, private investment into and/or acquisition of university research and commercialization is not obvious *per se* and may present its own set of challenges, including:

1. The university's right to publish research articles on the technology, and potential improvements thereon, such being synonymous to public disclosure of the invention, which may not be properly controlled by the co-contracting parties; the whole in line with the foundational principle of "academic freedom";
2. Providing a "license back" to the university so as to enable them to conduct additional research on the technology, of which they could become sole owner thereof; thereby, allowing for the potential creation of conflicting intellectual property rights if not properly addressed in the corresponding contracts;
3. Determining the amount of royalties owed to the university, if any, which may further encompass improvements on the technology and could be outside the scope of the original research project;
4. Being required to provide credit to the university on the product as well as marketing materials;
5. The introduction of "non-negotiable" clauses, from the perspective of the university, within agreements, such as indemnification and limitation of liability clauses

which seek to disclaim any liability on the use of the technology. This will, of course, impact the drafting of both the representations and warranties section of applicable agreements; and

6. Determining inventorship and assignment of IP right(s), especially when students are involved in research projects. In this regard, the student agreements (if any), staff and professor collective bargaining agreement(s), as well as university IP policies must be reviewed to ensure that there are no conflicts regarding the chain of title to the technology (whether for patent or copyright purposes).

3.3 The Canadian Context: The Changing Securities Landscape

Though Canadian entrepreneurs can benefit from the *Government of Canada's science and research tax incentive program (SR & ED)*, government funds such as the *Strategic Innovation Fund*, the *National Research Council* of *Canada's Industrial Research Assistance Program (NRC IRAP)*, Ministries (i.e., *Natural Resources Canada (NRCan)* for its zero emission vehicle infrastructure program), as well as corporations like the *Business Development Bank of Canada (BDC)*, must also comply with securities regulation, which is being modernized. Indeed, Canada's securities regulatory regime has in the past been identified as burdensome (Asano, 2020) and lagging behind that of other advanced economies (Robson & Wu, 2021). Many of these issues have been commented upon within the scope of public consultations regarding the modernization of capital markets as both provincial and federal regulations are currently addressing them.

Unlike in other countries where a single national securities regulator exists, in Canada, securities regulation falls within provincial jurisdiction. As noted by the *Canadian Supreme Court* in the *Reference re Pan-Canadian Securities Regulation*, "Provincial legislatures – and not [the Canadian] Parliament – have the authority to legislate in respect of the securities trade within their respective borders. The result is a nationwide patchwork of provincial regulatory schemes and the absence of a truly national approach to regulating capital markets." To overcome these challenges, provincial and territorial Canadian securities regulators are modernizing their respective securities regulation to become more competitive and to adopt regulatory frameworks which achieve the balance between investor protection and fostering innovation. For example, provincial and territorial Canadian securities regulators made effective, on September 21, 2021, new nationally-harmonized crowdfunding rules for start-ups, known as *National Instrument 45-110 start-up Crowdfunding Registration and Prospectus Exemptions* (NI 45-110). These rules provide exemptions from a prospectus and dealer registration requirements, as well as increase the annual limits of capital that a start-up can raise within 12 months. Recognizing that prospectus offerings can be costly, and that early-stage companies need flexibility to raise capital efficiently, provincial regulators provide start-ups with prospectus exemptions, such as: (a) private issuer (section 2.4 of NI 45-106); (b) friends, family, and business associates (section 2.6.1 of NI 45-106);

(c) accredited investor (section 2.3 of NI 45-106); and (d) offering memorandum (section 2.9 of NI 45-106).

In addition to the foregoing, certain Canadian provinces have also adopted a new prospectus exemption designed to facilitate greater access to capital for small and early-stage businesses while addressing investor protections. Indeed, under *Canadian Securities Administrators (CSA)* Multilateral Notice of implementation 45-539 *Small business financing*, securities regulators would allow these businesses to raise up to CAD$5 million from the public using a simple, streamlined offering document under a three-year pilot project.

It is also important to keep in mind that while more financing instruments are being contemplated, such as tokenized assets (OECD, 2020, 2021), initial coin offerings (Howell et al., 2020), *non-fungible tokens (NFTs)* and *decentralized finance (DeFi)* (Schär, 2021). Securities regulators will most likely scrutinize these instruments, including the fractionalization of securities, to determine whether they fall in the purview of securities regulation as per the teachings of the Supreme Court decisions in *Securities and Exchange Commission v. W.J. Howey Co.*, 328 U.S. 293 (1946) in the United States, and *Pacific Coast Coin Exchange v. Ontario (Securities Commission)*, [1978] 2 SCR 112 in Canada. In this regard, further reference can be made to the CSA Staff Notice 46-308: *Securities Law Implications for Offering tokens*, which gives insight as to when an offering of tokens may constitute a distribution of securities.

From the above, it can be seen that proactive steps are being taken by Canadian and provincial securities regulators to improve access to capital for start-ups and entrepreneurs while making the applicable securities regulation more competitive in the global capital markets, as well as more innovative and adaptive to new technologies or technological advancements.

4 What Do Investors Look for?

Having provided an overview of the different types of funding available to start-ups, the authors will now describe the factors which make a start-up attractive to investment. As noted by Catalini and Hui (2019), "[i]nvestors are profit maximizers, and their returns depend on three factors: access to deals, ability to perform due diligence, [and] mentoring and monitoring costs." Since investors are sensitive to risk and do not wish to fund litigation, they will most likely subject their investment opportunities to a process which could involve screening, evaluation, negotiation, as well as investment or funding criteria (Preet et al., 2017; Šimić, 2015).

Depending on the investor's profile, objectives, and risk tolerance, investors – in particular angel investors – favor companies wherein: (i) they understand the product and/or service; (ii) they trust the management team; and (iii) they believe they can add value to the company. Once a company matures, management should also prioritize: (i) realistically valuing their start-up; (ii) seeking knowledge of early-stage capital raising; (iii) *knowing their product (KYP)* and market fit; (iv) market size; (v) financials (if any); and (vi) exit strategy, among other considerations.

However, the foregoing parameters differ among each type of investor, and some investors will look to involve themselves within the governance and operations of the business. To this point, VC funding, which in 2010 was estimated to have backed roughly half of all true IPOs (Gompers et al., 2020), is increasingly interlinked with *environmental, social, and governance (ESG)* investing approaches (Boffo & Patalano, 2020). As stated above, it is likely that later stage investors will expect your management team to have a clear idea of your growth indicators, whether they are financial or customer-based, including churn rates, burn rates, sales revenue, EBITDA, and other multiples, depending on the type of technology and industry. Finally, while there are different investor profiles, it is worth mentioning that they may grow to be complementary as the start-up undergoes multi-stage financings as it matures.

4.1 Determinant Investment Criteria for Investors

In light of the above, the following is an overview of determinant investment criteria for start-ups:

1. Management team
   (a) What is the experience of your management team? (i.e., whether they have worked with an incumbent in the same sector or have industry experience);
   (b) What is the track record of each member of the management team? Consider whether their career includes notable successes or failures and what your start-up gains from either of these;
   (c) Is there a chief technology officer (CTO) or tech-savvy member comprising a key part of the team? Do they intend to remain with the business? This factor could be of significant importance, especially if the product and/or service requires future development work or consists of future releases, relies on technical skills, or the company performance has been tied to founders having a technical background in the past; and
   (d) What is the composition and diversity of your management team and/or board? and what are social impact objectives of the start-up?
2. Product and/or service characteristics
   (a) Do the investors understand your product and/or service, as well as their corresponding stage of development (i.e., proof of concept, MVP, or prototype)? In other words, have you painted an adequate picture of the product and/or service underpinning your company?
   (b) Is there technical merit in the product and/or service? Does it enhance the investor's own product(s) and/or service(s), or those existing in the marketplace, if any; and
   (c) Has the product and/or service been protected by one or more different forms of intellectual property rights (IPR) (i.e., trademark, patent, copyright, industrial design, etc.)?

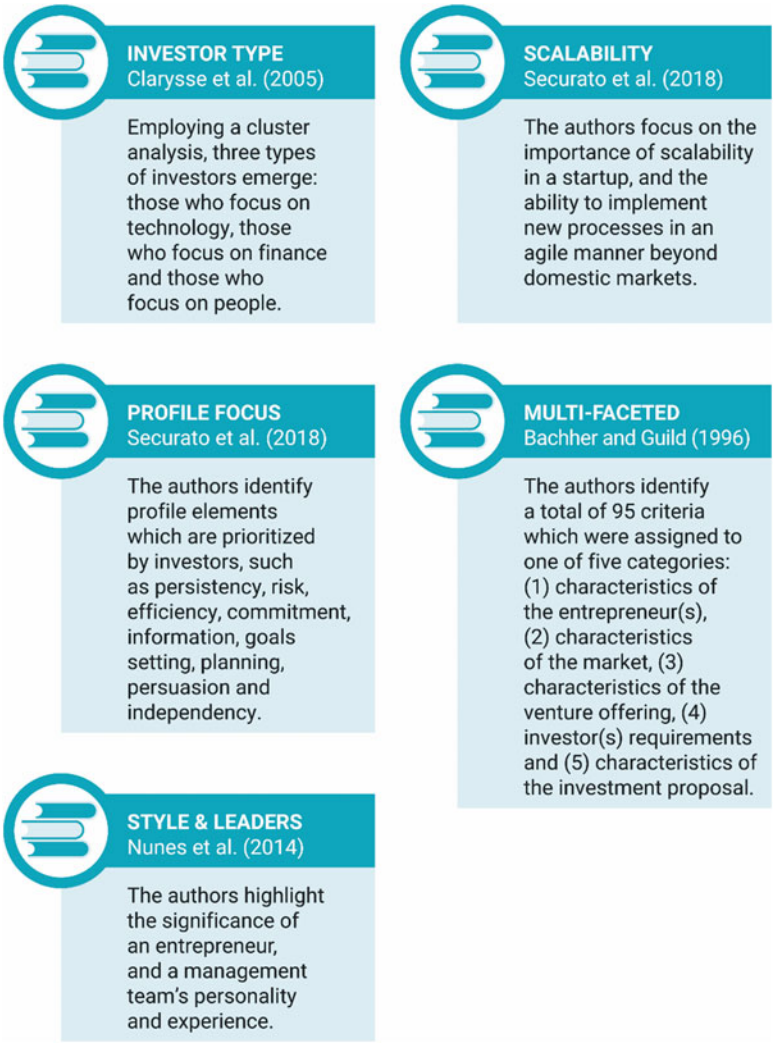

Fig. 2 Other investment criteria and selected literature (authors' own figure)

Of course, other investment criteria exist (see Fig. 2).

4.2 Rate of Return

Though it goes without saying that investors want a *return on investment (ROI)* or *return on equity (ROE)* on their investment, establishing these rates in a predictable manner is difficult. Variation may result from factors such as type of industry and an individual investor's appetite for risk, among others. However, there are some

general rules of thumb which can inform our discussion for the purposes of this chapter. One such rule, as reiterated by Gregson et al. (2017), establishes that investors seek high rates of return (multiples) on their investment before other common shareholders receive anything from the corporation. Literature indicates that "[m]ost angel investors expect an after-tax annualized return of 30–40%. Compared to the typical 17–19% Return on Equity (ROE) expected by banks, the level of expected return reflects the high-risk nature of angel investment" (Liu, 2000). Other research conducted by Dibrova (2015) and the OECD highlights that business angels in the United Kingdom typically make 22% *internal rate of return (IRR)* on investment deals, compared to the 27% that is expected in the United States. Wiltbank and Boeker (2007), cited by Dibrova (2015), indicated an "average return of angel investments being 2.6 times in 3.5 years – approximately 27% IRR." In certain instances, when the start-up is at a pre-revenue stage, investors may even ask for a higher (i.e., 5–10×) multiple for taking on additional risk resulting from factors such as start-up survivability.

4.3 Start-Up Valuation

As this chapter has previously mentioned, the ability for entrepreneurs to realistically value their company is important to attract investment. Indeed, it is often during the negotiation phase between investors and entrepreneurs that disagreements arise with respect to company valuation, especially if they are pre-revenue companies. Founders tend to argue for the "moon and stars," whereas investors attempt to de-risk their investment by arguing for a low company valuation. However, start-up valuation presents particular challenges. Firstly, as Deenitchin and Pikul (2006) has noted, no single valuation method (i.e., discounted cash flow analysis, valuation by multiples, and transaction analysis) is "best," as each comes with its own virtues and drawbacks. Furthermore, entrepreneurs must contend with the often-limited history that their start-up has. Damodaran (2009) identifies common characteristics of young companies which contribute to the difficulty of their valuation, including: (i) a lack of business history (no corresponding data); (ii) little or no revenue; and (iii) dependency on private equity to survive.

In order to overcome these limitations, entrepreneurs can concentrate on other variables which can impact valuation, such as the existence of applied-for or registered IPR, the diversity and knowledge of the management team, and product differentiation (Köhn, 2018). In this regard, it is recommended that entrepreneurs and investors work together to reach a valuation (i.e., pre- and/or post-money valuation) (Damodaran, 2009) that mutually aligns with their respective interests, especially when a deal opportunity has been identified and vetted to a certain extent, and if additional funds will have to be sought in the future.

4.4 Additional National Security Considerations

Applicable to both investors and start-ups is their knowledge of how Canadian science and research must be safeguarded. Developed in consultation with university working groups and the Government of Canada, *Innovation, Science and Economic Development (ISED)*, Canada published guidelines in July 2021 to limit research ecosystem penetration by foreign interference and espionage (Government of Canada, 2022; Innovation Canada, 2021). While risk assessment questionnaires are made available to researchers in Canada, partnership grant applications submitted to *Natural Sciences and Engineering Research Council of Canada (NSERC)* which are considered to be at "higher" risk will undergo a national security review. This initiative is a perfect example as to why start-ups must consider particular guidelines of the nations in which they seek funding, whether institutional or otherwise. In Canada, for example, this concern on the part of the federal government and civil society continues to grow. Recently, the *Centre for International Governance Innovation* published a special report which highlighted the link between digitally enabled espionage and the IP held by start-ups that advance technology (Shull and Wark, 2021). Further consideration must also be given to the Government of Canada's discretion in reviewing foreign investment in Canadian corporations under the *Investment Canada Act* and the *National Security Review of Investments Regulations,* SOR/2009-271. Indeed, the *Government of Canada* published, on March 24, 2021, guidelines for investors regarding the procedures that will be followed in the administration of the national security review process set out in the foregoing act (Industry Canada, 2021).

4.5 Being Exit Ready, All the Time

In order to further reduce deal friction with investors, entrepreneurs should plan exit strategies (Yusuf, 2012), as this will enable each party to a transaction to know their respective roles and responsibilities. As has been made abundantly clear, investors are almost always sizing up start-ups in relation to an expected return on their investment following a "liquidity event." To this point, research by Botelho et al. (2021) cited that in a majority of examined cases (14 out of 17), investors exhibited a positive attitude toward achieving an exit.

However, this does not mean that a start-up must be exit focused to appeal to an investor. Rather, elements such as value capture targets, levels of managerial control, and exit options, including an IPO, sale to a stakeholder, buyouts/leveraged buyouts (LBOs), convertible securities, and liquidation/dissolution, should all be assessed by start-ups while looking to attract investors. Indeed, exit options have both distinct advantages and disadvantages. Deenitchin and Pikul (2005) adapt exit options to the growth model of a start-up by considering variables such as the amount of money available to entrepreneurs, whether the entrepreneur wishes to exit at once or over a period of time, payment options, and whether the entrepreneur wishes to preserve any ownership in the start-up upon exit.

In the same vein, investors also establish their own *exit strategy* from their existing portfolio of companies. Preet et al. (2017) provide a useful overview of such determinants for VC investment exits, along with the *exit channel* which should be prioritized (i.e., write off, reverse leverage buyout, secondary sale, or IPO). Entrepreneurs should not shy away from using VC exit determinants to inform their own exit decision-making process. Preet et al. (2017) notably ask both entrepreneurs and investors to consider:

1. What happens in case of financial loss, liquidity issues, and instances of technological risk;
2. Whether the exit should be done in a phased manner;
3. Has the expected marginal cost of investing become more than the expected marginal benefit from investing; and
4. The type of industry in which you operate. As an example, internet firms exit faster than biotech firms.

Furthermore, consideration must be given to the share capital structure, as certain legal tests (i.e., acquisitions of "substantially all" the assets of the corporation) may be triggered in the event of a sale. Considering the above elements will allow savvy entrepreneurs to preempt the questions that most investors will have and provide them with some reassurance in knowing that they have considered these metrics and options. Lastly, and as a word of encouragement, those who have successfully exited are most likely to invest in new start-ups and contribute to the innovation ecosystem (Stuart & Sorenson, 2003).

5 MVIP: Investor and Business Protection

Having an IP strategy established within a start-up is important and may be considered as a form of "insurance" for prospective investors. As is well known to entrepreneurs, a prerequisite of each successful transaction (and corresponding due diligence) is a demonstration of ownership in the start-up's know-how, including potential IP rights. It is usually in the context of due diligence, namely in the preparation of the disclosure schedule, that "skeletons in the closet," are more likely to see the light of day (i.e., inappropriate chain of title, use of open source, contractual conflicts) (Harroch, 2016).

Investors are more likely to invest in start-ups that own their IP. This does not mean you are required to have a substantial IP portfolio in terms of volume but rather one that is of quality. For instance, when *Nasdaq Inc.* acquired *Verafin*, an anti-financial-crime technology company, for a price of US$2.75 billion (subject to customary adjustments, Nasdaq Inc., 2020), the Canadian company only had one U.S. patent (U.S. Pat. no. 9792609 B2), one pending Canadian patent application (CA 2,860,179), and a registered trademark in both Canada and the United States.

How do you get the most out of your IP? The answer isn't always to seek full IPR protection for the start-up's intangible assets. While this may seem like a

contradiction, it is actually an opportunity for entrepreneurs to create flexible and adapted IP management strategies in their business. Recognizing that seeking IPR protection isn't always a priority allows businesses to establish other means by which they can make their IP work for them. Because MVIP asks companies to build their IP and intangible asset management and protection from the get-go, it can minimize the need for costly audits at a later stage. Similarly, knowing *when*, *what*, and *how* a start-up needs to file for IPR allows it to navigate negotiations prior while relying on contractual agreements, and to know how best to value its intangible assets.

In sum, an IP strategy, which the authors have coined as MVIP, is a tool they believe every start-up should learn to wield, especially early in its life cycle (Somers, 2019), with respect to core company intangible assets.

5.1 What Is MVIP?

MVIP is an IP management strategy which is premised on identifying the intangible assets of a company, the costs and risks associated with securing IPR on those assets, and the incidence of this cost-analysis on a business's model from both an investor and an entrepreneur's perspectives. While revenue generation is often a focus of young companies, it should be done in tandem with concerted efforts to gain value from its IP while following an IP management process.

From the moment of a start-up's inception, it is important that entrepreneurs address questions such as:

- Do we own our technology? Has everything been assigned to the start-up? Does the work product of an independent contractor belong to the start-up? Are there any contractual conflicts which may put in doubt the ownership of IP?
- How much do we disclose when making a proposal to an organization? How much do we disclose when negotiating subsequent agreements? What is the likelihood of someone stealing our ideas or know-how?
- Do we need to trademark our business's brand name right away? Do we need to trademark our logo or just the name of our business?

The issues underlying these questions are either easily answered or may require significant investment in time or capital to resolve. Keeping in mind that the management of IP and start-up know-how by entrepreneurs are important for investors, authors such as Power and Reid (2020), as well as Willoughby (2013), have considered the relationship between firm investment in IP and performance indexes. Power and Reid (2020) notably highlight that trademark registration and out-licensing provide the clearest value-added, while patent protection for start-ups does not.

In this way, MVIP is akin to the concept of *privacy by design (PbD)*. Developed by the Information and Privacy Commissioner of Ontario *Dr. Ann Cavoukian* in the 1990s, PbD describes itself as advancing the view that the "future of privacy cannot

be assured solely by compliance with legislation and regulatory frameworks; rather, privacy assurance must become an organization's default mode of operation" (IPC, 2013). Similarly, MVIP asks corporations to evaluate, from the time of their creation, how intangible assets can best be made to work for the purposes of their business model. While this may rely on IPR registration, it may also come from diligent practices internally, such as regular auditing and bookkeeping of license terms. In this way, like PbD, MVIP seeks to reduce unnecessary costs in the short and long term which can be mitigated by the organization's implementation of an IP strategy.

5.2 Breaking Down MVIP

MVIP, according to the authors, relies on four pillars (see Fig. 3):

Management (and Internal Processes) This pillar depends on a start-up's internal structures and promotes the effective management of the intangible assets, including IPR, and mitigates risks such as IP and data theft as well as contract conflicts with respect to the IP (i.e., to address the ownership of IP). It also means instilling processes within an organization to identify and assess IP opportunities, as well as to establish dialogue between business units, including management, to allow for the efficient decision-making in line with the business strategy.

Value (and Viability) The second pillar considers the value added to your company with instances of IPR registration and balances such value with the applicable costs or risks. This means promoting IP opportunities or projects that have business value and viability to become competitive and productive, both domestically and internationally. It revolves around identifying the intangible asset(s) (i.e., IP opportunities, human capital, etc.) that can promote company growth and value in line with your business strategy.

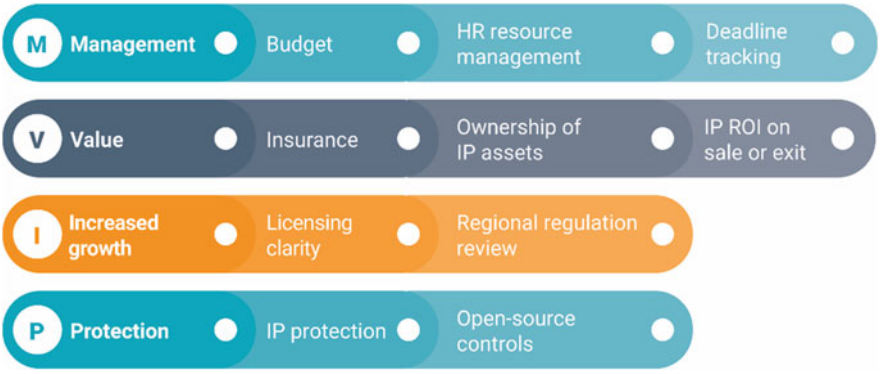

Fig. 3 The rationale of MVIP (authors' own figure)

Increasing Growth (and Investment in Intangible Assets) The third pillar recommends that start-ups prioritize and invest in projects which lead to revenue generation through the use of their intangible assets, which may attract further investment.

Protection (and Property) This final pillar seeks to defend the IP which your company may later sell. It relies on identifying which intangible assets, whether company property or human capital, should be protected and ensuring that the corresponding methods of protection (i.e., agreement, trade secret, IPR, HR, and confidentiality policies) are implemented to mitigate risk and assert rights when necessary.

Taken together, these pillars form the basis of your business's "roadmap" when it comes to managing, securing, enforcing, and defending your intangible assets.

5.3 Benefits of Implementing MVIP Early on

There are numerous advantages to implementing MVIP within the start-up's business strategy. Indeed, MVIP:

(i) Provides assurances to investors that the start-up owns its know-how and that it can be efficiently managed, as well as helping to secure an exclusive competitive advantage in the market;
(ii) Reduces deal friction during the due diligence phase of an exit;
(iii) Enables IP to be collateralized in order to obtain investments and loans;
(iv) Reduces business operational risk with respect to the start-up's IP;
(v) Allows entrepreneurs the ability to monitor the value of their business;
(vi) Provides entrepreneurs with a management process through which they can consider their IP in a holistic manner and as a valuable corporate asset which can be licensed, sold, or otherwise leveraged. It can also be pooled with the IP assets of other companies in order to promote competition; and
(vii) Allows entrepreneurs to create an IP risk matrix in which specific business risks are assessed based on their applicable technology or innovation.

IP management strategies do not need to be complicated, nor do IP portfolios have to be voluminous (depending on the industry). However, they do need to align with the overarching business strategy and be implemented early on.

6 The Dos and Don'ts of IP Protection and Investor Attractiveness

As this chapter has exposed, there exists a complex bond between a start-up's IP and its attractiveness to investors. For this reason, start-ups should learn to identify the IP at their disposal and make it work for them through an IP management strategy

which they implement early and in line with their business model. To assist entrepreneurs with the foregoing, the authors present a list of actions which entrepreneurs seeking investment should consult. While not all of them may apply to your business, they are meant to serve as a primer on the pitfalls experienced with respect to IP management and its relation to investor relations.

Keep in mind that these recommendations are based on the Canadian regulatory and legal landscape and should be taken as informative, rather than legal advice. If you and your team face particular legal challenges with respect to your IP or investors, seek legal counsel in your applicable jurisdiction.

Do

- Establish an IP strategy as soon as possible within your business which: (i) aligns the IP protection needs of your company and your business strategy, taking into account the management needs of your various business units; (ii) involves your top-level management staff in the IP planning and protection process; and (iii) is organized to foster frequent exchanges and to promote IP literacy (or awareness) among your business units (sales, marketing, communications), IP managers, and board of directors so as to facilitate their understanding of your companies' competitive advantage and the role that each employee can play in securing it;
- Understand your product and service differentiation, your know-how, and how investor funds would be allocated within your business and extant projects;
- Review and understand your industry's regulatory requirements as well as securities regulations. Discuss these requirements with your legal counsel and ensure that you track regulatory compliance, as it may provide you with insight on upcoming regulatory changes;
- Research and carefully select your management team, as this will have a strong impact on the success of your start-up. Strong management profiles will also allow you to access key networks;
- Ensure that potential investors are on the same wavelength, or team, as the entrepreneurs they fund. Developing a habit of setting common goals and mutually beneficial compensation structures can enable you to run your business, not only work for your investors;
- Understand that some investors may wish to provide capital and support in exchange for a minority share and a non-operational role unless their participation is required for the purposes of growing and scaling the company;
- Conduct a search and review of third-party IPR before initiating a commercial project, akin to a freedom-to-operate opinion. Ensure that these searches are well documented. This will minimize the risk that your products or services and associated communications do not infringe on the IPR of others, especially if the contract contains representations and warranties of non-infringement;
- Identify and assess the intangible asset(s) and components thereof that should be protected and the best way to achieve that protection;
- Obtain insurance coverage for IPR infringement, for cybersecurity, for rogue employees, as well as customary insurance policies for businesses;

- Ensure that your projects with business partners establish how your IP will be protected throughout the term of the agreement;
- Ensure that your contracts with a business partner or affiliate consider issues related to the authorship and inventorship of a document, algorithm, or other technology, as well as any applicable reserve of IPR;
- Determine who owns the work product (i.e., IP) and how costs will be shared in the context of the joint-development of a technology, if applicable;
- Determine how issues of infringement, and the reporting of suspected infringement, are to be dealt with in contexts of co-contracting parties;
- Understand how disclosure, and premature disclosure, which can occur unwillingly through blog posts, press releases, scientific publications, sales, and/or presentations at conferences, can affect the attainment of IPR. In this regard, do inform your team as to how and why they should limit disclosure; and
- Ensure that there is no conflict between open-source licenses and your proprietary software.

Don't

- Ignore your competitors' IP, including registered or unregistered rights. Ensuring your IP managers supervise these filings will allow your team to determine the viability of opposing, expunging, canceling, invalidating, or protesting third-party IP;
- Overlook how your agreements with another company may sell and/or assign your know-how to them. By way of example, a vendor may inadvertently assign or confer perpetual rights to a product to the purchaser;
- Wait until a new product and/or service has been launched on the market to decide whether or not they should be protected by one or more forms of IPR;
- Overlook whether an artist, author, or programmer (among others) retained their rights to work they have done for you by effects of the law and/or not waiving moral rights in the work;
- Ignore key differences between the IP regimes of jurisdictions in which your company may conduct business;
- Omit to follow governance and investment guidelines or criterion so as not to be in breach of contractual obligations to investment partners or third parties, if applicable;
- Exclusively focus on the valuation of the company, as traditional valuations methodologies (i.e., discounted cash flow, etc.) cannot always be applied when the start-up's value is zero. Consult an expert to provide investors with analogues to traditional values, if possible;
- Overlook the possibility of allocating shares in the company to employees (i.e., stock option plans, etc.) to incentivize them for their contribution to its success; and
- Ignore the value of having an exit strategy early in your company's life cycle. This strategy can be based on certain liquidity events or project termination (i.e., closing a lucrative deal with a partner, selling a certain number of shares to investors, or reaching a development milestone).

7 Learnings and Takeaways

Attracting investment is no easy task and usually requires a serendipitous fit between investor and start-up profiles, as discussed above. It requires start-ups and entrepreneurs to be well prepared with answers to any questions prospective investors may have relating to the products and services offered by the start-up, competition, marketing and customer acquisition, risks, IP, and the amount of funds being sought. Implementing an IP strategy, such as one based on MVIP, is also a contributing factor to a successful capital raise. However, it is complementary to the investor's decision-making process, which considers elements such as the personality traits of the entrepreneur and the management team, their level of trust in such team, the relationship which develops between the two, and the ability of the start-up to attract further capital (Prohorovs et al., 2018).

On a positive note, Canada continues to offer start-ups with investment opportunities. Indeed, the *Canadian Venture Capital and Private Equity Association (CVCA)*, in its 2020 Year in Review (CVCA, 2020), reported the second-highest level of VC investment on record, wherein Canadian VC invested CAD$4.4 billion across 509 deals in Canada. The CVCA's quarterly reports in 2021 demonstrate that this pace is only growing, as investment reached CAD$11.8 billion as of November 16, 2021 (CVCA, 2021). It should also be noted that according to the World Ultra Wealth Report 2021, Canada ranks fifth in the world in terms of wealth of ultra-high-net-worth individuals (i.e., individuals with more than CAD$30 million in net worth), such totaling over CAD$1,186 billion (Wealth-X, 2021).

Though capital is available and is known to have an influence on innovation (Okrah & Nepp, 2018), entrepreneurs must learn *how* to make their start-up more attractive for investment. The authors contend that the implementation of an IP strategy early on within their business, as well as knowledge by management about potential investors, plays a key part in attracting capital. By promoting the careful management of their IP and intangible assets, entrepreneurs can further contribute to the role of start-ups in the innovation ecosystem.

Takeaways

Challenges of start-ups

- Start-up failure is often attributable to a cocktail of contributing factors which are both internal (i.e., management training, poor business relations, product differentiation) and external (i.e., social and regulatory framework, availability of financing).
- Know that a project can fail at any time, even one which you associate greatly with your start-up. Pivoting away from time or money pit projects can be promoted by the conscientious development of trigger events.

(continued)

The role investment plays in a start-up

- Entrepreneurs must know their product/service differentiators and know how raised capital is to be used.
- When approaching investors, at any stage of the start-up life cycle, knowledge of the investor, of your product, and of your market offering is invaluable.
- Practice your pitch often, in the preferred language of your investor, so that the delivery is seamless.
- Entrepreneurs should realistically value their start-up, if possible, and consider alternative arrangements to incentivize investors and employees.

What investors do look for

- Carefully vet and select your management team, as this will likely have an impact on the success of a start-up.
- Know your product and your competitive landscape, as well as potential barriers to investment.
- Tailor your exit strategy to both your business's and your investors' objectives, considering market conditions and share capital structure, among other factors.

Investor and business protection

- Align your IP strategy with your business strategy and model early on and find ways for them to complement one another.
- Invest in an IP strategy. It may provide investors with confidence, as well as checks and balances to avoid wastage of raised capital.
- Implement an IP strategy which allows you to identify how your product and/or service can best be monetized, such as through licensing regimes.

Acknowledgments The authors wish to thank Dr. Mark Weber of the McGill Office of Innovation and Partnerships, Mr. Drew Dorweiler, FRICS, FCBC, MVA, CPA, AVC, ASA, CVA, CBA, CFE at IJW & Co., Ltd., and Mr. Christopher Thierry for their insightful comments and suggestions. An additional thanks goes to Ms. Thiboutot and Philippe Vallerand for their support, and the law students at the University of Ottawa who were involved in research assignments on behalf of the authors.

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David Durand, LL.L., B.Sc. (chem) is a member of the Québec Bar, founder of Durand Lawyers, registered Canadian and U.S. trademark agent, and part-time lecturer at the Faculty of Law at the University of Ottawa. He is also the president of FORPIQ, an advisor to the National Crowdfunding and Fintech Association (NCFA) of Canada, and has been called upon by the Canadian House of Commons Standing Committee on Finance (FINA) to provide analysis with respect to the use of digital assets, as well as the legislative and regulatory gaps surrounding them in Canada, such as within the statutory review of the Canadian Proceeds of Crime and Terrorist Financing Act.

Cédrick Mulcair, LL.B., B.A. is a member of the Québec Bar and Durand Lawyers. He is a graduate of the McGill Faculty of Law and has worked as a youth fellow for the Montreal Institute for Genocide and Human Rights Studies and under McGill University's patent portfolio manager.

Intellectual Property-Backed Financing

Lally Rementilla

1 Introduction: A Start-Up CFO's Reflection

Lally, I can't lend your company more money. You have a history of losses.

That's because we raised venture capital and are investing in growth. Look at our revenues, they have more than doubled every year. All our research and development has led to a large portfolio of patents and trademarks, as well as a robust software platform and the collection of a lot of data.

Well, you don't own any hard assets. You don't own any land, equipment, or buildings.

That's because we are a software company with customers all around the world. We don't need to own land, equipment, or a building.

Sorry, I cannot help you. I can't lend to you without any of those assets. Why don't you just raise more equity?

Such was a conversation that I had with my banker when I was head of finance at the supply chain software start-up company *Nulogy Corporation*. It was a frustrating conversation that highlighted the fact that there was gross inefficiency in start-ups' access to capital. And sadly, countless other entrepreneurs, CEOs, and their finance heads are probably still having the exact same conversation.

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L. Rementilla (✉)
BDC Capital, Toronto, ON, Canada
e-mail: lally.rementilla@bdc.ca

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_9

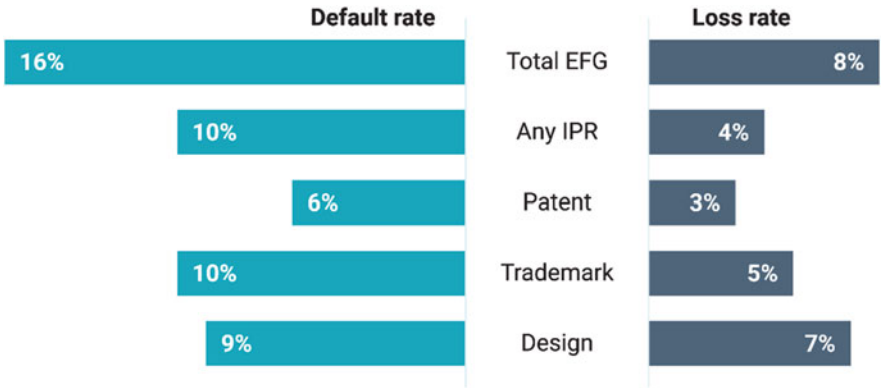

Fig. 1 Default and loss rates on EFG-backed loans (author's own figure)

Such is the "tyranny of collateral" (Cecchetti & Schoenholtz, 2018). Why is it that as our economies become more driven by intangible assets, start-ups find it difficult to leverage their intellectual property (IP) and other intangible assets to raise financing?

In what has often been considered as a risky asset class, research has shown that loans secured by intangible assets are no riskier than those secured by tangible assets. Using bankruptcy rates as a proxy for loan performance, firms that pledge their intangible assets as loan collateral are 4% less likely to file for bankruptcy over the life of the loan (Loumioti, 2012). As shown in Fig. 1, the *British Business Bank* (2018) conducted research that showed that companies with intellectual property rights (IPRs) in the Enterprise Finance Guarantee (EFG) program from April 2009 to March 2016 had lower than average default and loss rates.

Furthermore, research has shown that ownership of intellectual property has resulted in positive business outcomes. Figure 2 shows that IP ownership has been shown to increase business value, revenues, and strengthened business prospects (Statistics Canada, 2019).

Sharma and Nerurkar (2016) noted in an IP financing article that while a survey conducted by the United States Federal Reserve System showed that more than 98,000 secured and collateralized business loan transactions in 2015 were made by domestic and foreign banks in the United States, only 4% of those transactions were secured by intangible assets, primarily patents.

Therefore, there is great opportunity for the financing community to provide capital to start-ups that can leverage their IP and intangible assets to help them grow without undue risk.

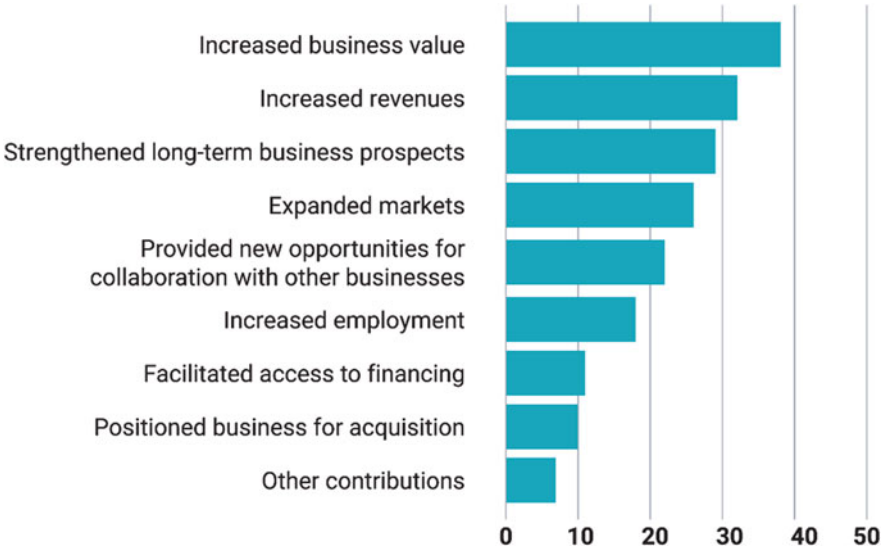

Fig. 2 Reported benefits of owning intellectual property, 2017 to 2019 (author's own figure)

2 IP-Backed Financing

Intellectual property-backed financing (also known as IP-backed financing) is a financing type where value is attributed to both the tangible and intangible assets of a company and where the company's intellectual property is pledged as collateral to a loan.

Contrary to some opinions, IP-backed financing is not strictly lending to the value of a company's intellectual property portfolio. It is a holistic process that looks at the *general credit worthiness and future potential of a company* and where the process of analyzing and valuing a company's IP portfolio results in additional insights of a company's strengths and attractiveness for financing.

IP-backed financing, while a relatively new way of funding start-ups, has been around for years. One of the earliest instances of IP-backed financing happened in the late 19th century when Thomas Edison used his patent for the incandescent lightbulb as collateral for a loan to finance the establishment of the *General Electric Company* (Brassell & Boschmans, 2018). In modern times, large IP-backed financing transactions have been entered into by established financial institutions to large and profitable entities. IP-backed loans have been extended to multinational companies such as *Xerox*, *General Motors*, *Eastman Kodak*, *LSI*, and *Avago* (CII, 2019).

2.1 IP-Backed Financing for Start-Ups

In the financing of start-ups, IP-backed financing is not as prolific owing to the limited number of financial institutions that have the skill set to analyze and value a company's IP portfolio. Most technology lending, for example, is formula driven or based on certain financial metrics such as monthly recurring revenues. The growth and proliferation of IP-backed financing is said to be hampered by the lack of valuation expertise in this space, since financial analysts typically ignore or eliminate several technology parameters, whereas multiple variables (such as transactions, technology domains, target products, relevant markets, and competition) must all be considered when valuing IP assets (Sharma & Nerurkar, 2016). Furthermore, the regulation of most financial institutions and their capital reserve requirement as set out in Basel III make it much more difficult and unprofitable lend against IP.

In the last decade, governments have led the way in promoting IP-backed financing for start-ups. In 2014, the Intellectual Property Office of Singapore (IPOS) launched the Intellectual Property Financing Scheme. Under this scheme, start-ups could bring a valuation of their IP portfolio to a list of financing institutions that could then extend loans to the start-ups. The Singapore Government provided a guarantee for such loans and subsidized the cost of the valuation for successful applicants. Similar programs were launched by the governments of Korea, Malaysia, and China. Innovation programs were also started by the governments in France, Italy, and the United Kingdom.

2.2 Benefits

IP-backed financing is an innovative way to help start-ups maximize the amount of capital that they could raise to fund their growth. The following are key benefits to consider:

Larger Financing Amount The money a start-up could raise from IP-backed financing can potentially be more than what they can access through a non-IP-backed lender who tends to lend against tangible assets or a company's profitability and cash flow generation. It is very common for start-ups, especially those that sell software with recurring revenue streams, to borrow against these amounts based on a multiple. The recurring revenue provides a tangible asset (the accounts receivable) to lend against. Through IP-backed financing, the same *start-up could potentially access more funding by leveraging the value of its IP*, and intangible assets could provide additional collateral in excess of the accounts receivables that it owns.

Financing Is Non-dilutive Since most IP-backed financing is structured as a loan, the start-up's only obligation is to pay back to the lender the original loan amount plus any interest obligations. Therefore, the start-up *does not give up any share ownership or control of the company*. This allows the start-up's shareholders (which oftentimes include its founders and most employees) *to generate more returns from*

their investment or ownership as the *company's valuation grows*. On occasion, an IP-backed lender may seek additional return components, known as kickers, which could be a small amount of warrants or royalties on revenue. And in some cases, there could be a feature where a portion or all of the IP-backed lender's loan and accrued interest could be converted into shares of the company.

Sends a Positive Signal to Other Investors IP-backed financing involves a lot of due diligence on a start-up's technology and IP portfolio. This due diligence process will be discussed later in this chapter. The fact that an IP-backed lender has extended a loan to a start-up therefore *sends positive signals to other potential investors that there is enough credit worthiness and future potential in the company* and a positive view of the value in the start-up's IP portfolio. Investors who do not have the capacity to conduct a lot of due diligence of technology and IP could therefore rely on the work that an IP-backed lender has done to substitute their own due diligence efforts or at least give them comfort that another party has taken comfort on the state of the IP portfolio. This benefits the start-up in terms of having a faster fundraising process, generating more interest from potential investors, and potentially negotiating a higher valuation for the company.

Alternative to Personal Guarantees Some loans to start-ups and early-stage companies may require a personal guarantee from the founder or CEO which could put a financial strain or limitation on the individual. In IP-backed financing transactions, *most of the guarantee comes from taking the IP portfolio as collateral* and therefore personal guarantees are usually not required. This gives the founder or CEO the peace of mind that they will not need to pledge their personal or family assets. And rightly so, there should be enough value in a start-up's IP portfolio to give the lender comfort.

2.3 Costs

While IP-backed financing has some clear benefits, the following are some costs which start-ups need to consider:

Requirement to Pledge IP Assets Any IP-backed transaction will require a start-up to pledge a portion of or its entire IP portfolio as collateral to a loan. This means that for any reason a start-up defaults on its payment obligations or breaches covenants on its loan (including going bankrupt or becoming insolvent), the lender can seize the IP portfolio. It is therefore important for a start-up to be prudent in *ensuring that it will have sufficient cash flow to comply with its loan obligations*.

It Is Also Important that the Start-Up Know Well the Reputation, Motivation, and Track Record of the Lender Believe it or not, there are IP-backed lenders who seek to acquire a pledged IP portfolio too quickly when the start-up defaults. They then monetize the IP portfolio by litigating against possible infringers. Having

said that, there are IP-backed lenders who are solely motivated to provide capital to help companies grow. These are the *lenders who appreciate the environment's start-ups' face* and tend to be relatively patient and collaborative in tough times.

The Process Is Long and Intensive A start-up should plan for an IP-backed financing to take at least three months, if not longer, to complete. This is due to the requirement to analyze and value a company's IP portfolio, which could, on its own, take four to six weeks, depending on the portfolio size. While some IP-backed lenders have automated parts of their process, there is still a lot of human judgment applied to the valuation process. Furthermore, a more technical analysis of a start-up's products and services is incorporated into the process, which adds to its length and intensity. The *process will also require an inordinate amount of preparation, organization, and coordination on the part of the start-up*. Employees who are involved in setting and managing the start-up's IP strategy will more than likely be asked to be more involved in the process, taking time away from their day-to-day priorities. The impact of such an intensive process could be mitigated by good preparation and discipline in IP management.

IP-Backed Financing May Not Be Widely Available There is a limited number of IP-backed lenders to start-ups globally. IP-backed financing is still a niche (but growing) offering that requires *investment professionals with knowledge and experience in IP valuation* and technical analysis, of which there is a limited supply. IP-backed lenders also tend to have strict criteria of the types of start-ups that they would finance. Typically, lenders may require a start-up to meet one or more of the following criteria:

- Established revenue generation
- Ownership of granted intellectual property rights (in most cases, patents)
- Strong equity backing (preferably institutional investors)

3 How IP-Backed Financing Works: Breaking Down the BDC Capital Experience

Let me now walk you through how IP-backed financing works, and to do that, let me describe to you how we do it at *BDC Capital*. BDC Capital is the investment arm of BDC, the *Business Development Bank of Canada*. BDC is a development bank with a mandate to provide access to financing, investment, and advisory services to entrepreneurs in Canada to help them grow and succeed. Founded in 1944, BDC's sole shareholder is the Government of Canada. It is also a certified Beneficial company (a B Corp), which means that its purpose is to create value for society as well as money (BDC, 2022).

On July 16, 2020, BDC Capital officially launched a $160 million IP-backed financing fund to support IP-rich Canadian companies. The fund has four main objectives:

- *Accelerate the growth of IP-rich companies in Canada.* To do this, we are making term debt, convertible debt, and minority equity investments between C$3 and 10 million to adequately capitalize companies to help them execute on their plans to grow.
- *Serve the needs of companies in underserved industries and sectors where it is necessary to have strong IP strategies and portfolios.* This includes companies in IP-intensive industries such as health and medical technologies, telecommunications, semiconductors, advanced manufacturing and materials, cleantech, life sciences, and consumer products.
- *Facilitate access to advice and expertise to help our portfolio companies further develop their IP strategies and portfolios to compete globally.* Beyond the capital we provide, we are making available our networks of IP professionals, strategists, subject matter experts, and even corporate partners to help companies find effective ways to create, manage, and monetize their IP portfolios.
- *Drive the development of an inclusive IP ecosystem, or what we call an "IP Village," in Canada.* It is as important to us that Canadian companies see the value in having strong IP strategies. Therefore, we look to bring together and collaborate with both public and private sector organizations and firms to promote IP awareness, education, and financing in the country.

The first investment made by this fund was a $2.6 million loan to a robotics company called *Novarc Technologies*. Novarc Technologies specializes in the design and manufacture of collaborative robots (or cobots) for industrial applications. Its flagship product is a spool welding cobot that increases the quality and efficiency of pipe welding. Other fund investments include *Baanto International Ltd.*, which has developed enterprise-grade touchscreen solutions for digital signage applications and *MB1 IoT Inc.*, the developer of an advanced driver assistance system called *E-SMART* that actively controls the speed of vehicles, making them safer and reducing accidents.

What makes this fund unique and first of its kind in Canada is the use of an investment process that was specifically developed to finance IP-rich companies. The hallmark of this process is the *integration of IP analytics and valuation techniques into a lending or equity investment process*. To reinforce the point that I made in an earlier section of this chapter, we are not making our investment decision solely on the analysis and valuation of a company's IP portfolio. We are integrating the insights we generate from the IP analysis and valuation into our investment process. This then leads us to have greater conviction in backing and financing a company.

At the time of this writing, the strength and focus of the fund is to finance companies that have portfolios of granted patents. Believe it or not, *patents are the most tangible of intangible assets to value*, especially in terms of the financing of

start-ups, which tend to have nascent revenue streams and little to no track record of profitability. Having said that, when we qualify companies for investment, *we look at their entire IP strategy* and understand the role that patents pending, copyright, trademarks, proprietary software, datasets, and regulatory licenses and approvals play in giving them a competitive advantage. Therefore, we also analyze and assess the strength and success driving capabilities of a company's entire IP portfolio and strategy.

The following points highlight the steps we take in integrating IP analytics and valuation in our investment process.

3.1 Qualification

Qualification is the step in an investment process where we determine our early interest in making an investment in a company. During this step, we ask you to send information about your company and then meet with you to further understand your business, learn more about your *track record and future plans for growth*, and determine whether your start-up would make a valuable addition to our portfolio. A favorable outcome of this process would be for you to receive an indication of our interest in making an investment and terms by which we are looking to invest.

The hallmark of a practitioner of IP-backed financing is *early focus on understanding a company's IP strategy and portfolio*. During the qualification stage, we seek to establish what we call "product-market-moat" fit. "Product-market fit" is a term coined by Andy Rachleff (2013), the co-founder of *Benchmark Capital*, a Silicon Valley-based venture capital firm, to describe the degree in which a product satisfies a strong market demand. *Marc Andreesen*, the co-founder of another Silicon Valley-based venture capital firm, *Andreesen Horowitz*, also popularized the use of the term. In our case, we look to see if a company has developed and commercialized a strong product that has been successfully adopted by a large, growing and global market, and if the company has successfully used their IP strategy to build a "*moat*" to give them a clear competitive advantage. The important word here is "*clear*." We need to fully understand and be very convinced that your IP portfolio helps drive your ability to out-sell or out-innovate your competitors, while driving sticky and growing demand from your customers.

In order to make an early assessment of *"product-market-moat" fit*, we rely on information you provide to us in terms of your business, your industry, and your future growth plans. We like to see and hear an investment presentation that provides very concrete evidence on how your product(s) or service(s) deliver(s) a strong value proposition to your customers. We then would like to further understand how the market will continue to grow, not just in terms of numbers and size but also in terms of the technology and innovation options and how you will gain more market share.

You will be asked to fill out an IP questionnaire. The IP questionnaire helps us understand the history and context of your portfolio, as well as get up to speed on the key foundational elements of your IP strategy. It also serves as a way for us to get a detailed listing of your IP portfolio, as well as know if you have been a party to any

form of dispute. We use the information in the questionnaire to get a better sense of how your current IP portfolio contributes to your current moat, and to understand how further developing your IP strategy will increase the depth of your moat in the future. Critical to this exercise is to establish the direct (or sometimes indirect) *connection your IP has on your source of revenue generation* – whether it be a product, a service, or the licensing of your patents. Establishing the connection between your IP and revenues is made easy by regularly performing *IP mapping* – an exercise wherein you link the claims in your patents to specific products or features or components of your products and services.

The information we receive in the IP questionnaire is used to do a preliminary search of competitors in your innovation or technological development space. By looking at the patent landscape in which your start-up operates, we get a better sense of your known (and sometimes unknown) competitors. Competitive analysis is another hallmark of IP-backed financing. It is not enough to know that a company has adequately protected its innovation. It is as important to understand who else has a similar protected innovation and what competitive and legal threats may be lurking in the sidelines.

3.2 Due Diligence

If you accept the terms that we have extended, we then move on to due diligence. Due diligence is the step in the investment process where we validate the claims that you make during qualification, since those claims were the foundation of what made us interested in making the investment in the first place. I describe due diligence as "qualification on steroids" and is more intensive in terms of information gathering, questioning, and analysis on all aspects of your business.

A key focus during due diligence is the technical and competitive analysis of your product and IP. At this point, it is important to get a more detailed understanding of how your technology or invention works and, more importantly, how it is driving your customer's purchase decision vis-à-vis the presence of direct competitors or substitutes in the market.

There is heavier reliance on third-party sources of validation at this stage. We also seek market research, academic research, and industry reports to get a better sense of competitive dynamics. This could include *detailed discussions with your customers* (past, present, and future) and even some *key suppliers or partners* (such as distributors or joint venture collaborators). In certain industries, such as life sciences or medical technologies, we have discussions with key opinion leaders (KOLs) or industry experts to assist with the analysis of clinical trial data and to get a better sense of how your IP and technology have created a competitive advantage.

During due diligence, *we also go deeper into understanding your IP strategy and IP management culture*. At this point, we would ask to meet with your IP strategy team, which would include your employees and outside consultants or counsel. The answers given in the IP questionnaire are used to further delve into your IP history

and culture. The following are a few questions we attempt to answer during due diligence:

- How do you *foster a culture of creation and protection of IP*? Are there clear IP creation and capture processes that your team understands? What incentives have been put in place to create and maintain a strong IP culture across different departments?
- How do you use *different forms of IP rights to protect your business*? Are you solely reliant on patents or are you being thoughtful in determining the optimal form of IP rights to use to create your moat?
- What have you done in terms of seeking *freedom to operate* in key jurisdictions?
- If you have been a party to threatened or actual *IP litigation*, what have you done about it?
- How do you *safeguard your trade secrets*? For example, how prolific is the use of non-disclosure agreements by your employees?
- How well are your employees *trained on the importance of various IP rights and disclosures*?
- How much of an investment have you made in your *IP strategy* and what plans do you have in the future?
- How are you *monitoring the competitive landscape* for changes and *potential infringement*?

3.3 Underwriting

If a deal passes due diligence (which means that we did not find anything that would lead us to believe that our original investment thesis has been weakened), we then proceed to the underwriting process. During this step, we pull together an investment package that sets out the rationale for the investment and the key investment structure terms and conditions that aligns with the opportunities and risks we see in making an investment in your company.

A key component of our investment package is the valuation of your IP portfolio. The IP valuation is a snapshot in time of what we believe the IP portfolio could be sold for under certain key market conditions to an arm's length party. This exercise is the attribution of value to the intangible assets of a company, which is a component of the definition of IP-backed financing.

The valuation of an IP portfolio is both science and art. The science behind it involves the use of three generic methods that are commonly used by valuation professionals and practitioners. They are:

Cost Method Under this method, an IP portfolio is valued by estimating the cost of developing an asset of similar utility (Royal Institution of Chartered Surveyors, 2020). There are two approaches commonly used under this method (IPOS International, 2020):

- The reproduction cost approach seeks to recreate the IP portfolio from scratch.
- The replacement cost approach seems to replace the IP portfolio with something of equal utility.

The cost method requires a considerable amount of information to properly identify the linkage between the time, money, and effort to recreate or replace the IP. The estimated cost may not necessarily be equal to the historical development cost provided by the company. In many cases, it may be less due to business or technology pivots.

Income Method Under this method, an IP portfolio is valued by estimating the future earnings or savings that it is expected to generate in its remaining economic life (Royal Institution of Chartered Surveyors, 2020). Since this method is more future oriented and based on assumptions of revenues generated from past, current, and future customers (and products), care needs to be put into the assumptions used in employing this method. Pure IP transactions are rarely public and often occur at inflated values. A variation of this method is called royalty relief method (RRM), which involves estimates of royalty fees a company could save by owning the IP instead of licensing it from another party.

Market Method Under this method, the IP portfolio is valued by benchmarking against transactions of comparable assets (Royal Institution of Chartered Surveyors, 2020). Using this method requires a considerable amount of research in order to find like assets and then trace back the values of those assets with information on transactions (which may not be available through public sources).

Deciding which method to use (or how they are weighted if a valuator is using a combination of two or more methods) is where IP valuation becomes an art. No one valuation methodology is perfect. This is so because sufficient data necessary for each method may not be available, accessible, or reliable. For example, if an income method is being used, it may be extremely difficult to project future sales for an IP portfolio that has not yet been fully commercialized. Or in the case of the market method, there may not be enough comparable transaction information available in the public domain to generate a good benchmark.

Factors internal and external to your company help us determine the methods to use and how we would come up with corresponding assumptions. With our current focus on valuing granted patents, the following are just some of the factors that we consider:

- How easy or difficult is it to be able to show a direct connection between your patents, cost structure, and revenue streams? How predictable are those revenue streams?
- What is the current or most recent state of patent acquisition activities relating to your patents? How much information do we have on who have made these acquisitions and their reasons for doing so?

- Might another company or companies be infringing on your patents? What has been their history and track record of entering into licensing agreements with other companies?
- What are the possible exit scenarios for your company and how would your patent portfolio factor into a successful outcome? How acquisitive are your competitors and are you likely be a target for one of them, especially if you fill a gap in the acquiror's IP portfolio?
- If your company has patents pending or other forms of IP and intangible assets, how could they be adding to the strength of your portfolio?

There are more factors considered on a case-by-case basis. And again, a lot depends on your unique situation and the market in which you operate. This is where having an experienced team and knowledge of the inner workings of different industries and sectors become important.

3.4 Portfolio Management

For some IP-backed financing practitioners, the process ends at underwriting (assuming that there is a successful approval and negotiation of an investment that results in the start-up receiving funding). In the case of our fund, the work continues beyond funding. Because we have made an investment in your company that has a long journey to being a global leader, we believe that we play a role in helping you strengthen your IP strategy for as long as we are an investor.

Therefore, the last and probably the longest step in the process is what we call portfolio management. During this step, we work with you to find ways to further strengthen your IP strategy and to ensure that you properly execute on such.

On an ongoing basis, we scan the IP markets to keep on top of the latest developments that could affect the value of your IP portfolio. This could include mergers and acquisitions activities, litigation initiative by competitors, or major developments in patent prosecution. We also track your progress in filing for more IP rights.

At least twice a year, we will sit down with you to learn more about the progress you have made in executing on your IP strategy. As part of the exercise, we mutually determine key IP strategy deliverables and, more importantly, the enablers that could help you meet these deliverables. We then leverage our networks to facilitate introductions to those enablers (whether they be IP professionals, strategists, subject matter experts, or even potential customers).

We fully expect that our portfolio companies will make minor or even drastic changes to their IP strategies for the life of our investment. This is because it is a best practice for a start-up to align their IP strategy with their business strategy, the latter of which could include a major pivot. Remember that we strive for "product-market-moat" fit, and therefore when there is a shift in the "product-market" piece of the equation, we would expect and encourage you to make the corresponding changes to the "moat." An example of this would be the filing of a new patent to protect a new

application or product serving a new market, or inversely, a decision to abandon the prosecution of certain patents pending in jurisdictions where you have decided to not enter.

4 Raising IP-Backed Financing

I always counsel companies that IP-backed financing is not for the faint of heart. As you may have read in the previous section, it can be a more intensive process requiring a lot of information to be shared and time spent in meetings and discussions. Preparation is key to this kind of financing process.

The fundraising process is overwhelming enough for any start-up. But it can be even more demanding for start-ups building highly innovative and often untested technologies to market.

So, as a founder, CEO, or employee of an IP-rich start-up, what can you do differently to increase your chances of success in raising IP-backed financing?

Believe it or not, the answer to this question is not necessarily about the size of a patent portfolio. Nor is it about having a sophisticated financial model. Nor is it solely about having the most beautiful pitch deck.

The answer lies in four steps, each containing three words. . . a dozen words.

4.1 Know Your Audience

Early in the process – whether it be in the first pitch deck or in the executive summary you send – you'll need to capture your potential investor's attention and interest. Paramount to this is understanding their investment strategy, criteria, methodology, team background, and value-add, and then tailoring your approach and communications accordingly.

Approaching the right funder at the right time with tailored material will save both you and your prospective investor a lot of precious time.

Let's take the example of our fund. We are a "jack/jill-of-all-trades" and a "master-of-none." We can be looking at a cleantech company one day, a medical device company the next, and then a cybersecurity company the day after.

Because of this, we appreciate getting an explanation of your products or services in a way that is quick and easy for us to understand. Explainer videos are extremely helpful, step-by-step visual guides are amazing, but please reserve hundred-page white papers for a later step.

But, even if we are generalists from a technology perspective, you should be aware that we look to you articulating your IP strategy upfront. Therefore, make sure that the information you send over includes an overview of your IP strategy. You would be surprised at the number of pitch decks we have received from start-ups that don't talk about their IP portfolio at all.

4.2 Tell Your Story

After you have successfully tailored your communications to the right investors, the next step is getting them to buy into your story and rally behind your team. Now is the time to wow them with who you are, where you have been, where you are now, and where you want to go.

Foundational to this step is to clearly articulate your "product-market-moat" fit. Weave into this narrative and make explicitly clear how your products (or services or IP licensing revenue streams) address the needs of a growing and lucrative market, and, importantly, how you and your commercially-oriented team are creating a moat (or competitive advantage) and leveraging your IP strategy.

Ensure that you have a clear and believable story on how the financing will help you achieve your financial goals. Show how each dollar you raise will be spent and demonstrate the resulting return on investment (ROI). And make sure that you also provide a clear account of how the capital will help grow your IP portfolio even more.

Should you disclose the dark parts of the story? Should you talk about the skeletons in your closet (e.g., IP litigation, shareholder dispute, or a product recall)? The answer is yes. Better to disclose it early, give your explanation, and earn the trust of a prospective investor. Because good investors will almost always figure it out anyway. And this leads us to the next step. . .

4.3 Prove Your Story

At this point, you will have received a term sheet or an indication that an investor is interested in your company. Now comes the fun part. During due diligence, you will need to provide investors with the confirmation that the story you sold them holds.

Investors will have already come up with an investment thesis (i.e., the story that they will put forward to their investment committee). They are looking to validate how you position yourself within an industry, your ability to drive growth, the strengths in the deal, and find ways to mitigate any risks. They are also looking for consistency between your story and the information and documents you will be asked to produce.

Here are some of the actions that you can take to make proving your story effective:

- Share a very detailed pipeline of your sales opportunities, contracts, and orders. Most of the deals that fail due diligence do so because the company painted too rosy a picture of future sales. A detailed pipeline (with reasonable assumptions on probability of converting to sales) or an order book with actual purchase orders (and not merely quotations) needs to support your story for the deal to succeed.
- Show how your historical financial statements and your projections are consistent with the story you are telling. If you are raising capital to accelerate the growth of an existing revenue stream, then don't bring forward a plan to invest almost all of

the capital in pure research and development activities. In addition, show how data- or metric-driven you are in calculating and monitoring the efficiency of your marketing and sales investments.

- Provide sufficient information to show chain of ownership of your IP assets and seriousness in executing on your IP strategy. If trade secrets play a key role in your IP strategy, demonstrate that you employ best practices in guarding trade secrets (such as using iron-clad non-disclosure agreements and having employees, including founders, sign employment contracts that protect your company's IP). Be ready to produce and summarize key terms in your joint venture, technology partnership, and IP licensing agreements. And make sure that you have a complete and up-to-date registry of all your IP assets both granted and pending.
- Share third-party reports, audits, and case studies to investors so that they have an appreciation that external parties have validated your value proposition. Arrange for them to interview key opinion leaders or subject matter experts who have had exposure to your technology or innovation.
- Give access to your customers, suppliers, employees, board members, and current investors. The more these stakeholders prove and validate your story, the more convinced your prospective investor will be.

4.4 Make It Happen

Fundraising never really stops. For as long as you are looking to grow your company, there will always be a need to raise capital, especially in early stages. As your company evolves, so will your capital structure.

You should aim to make each round easier than the last. The key here is to get the support of your investors and to help them help you access more capital in the future. This could mean receiving follow-on financing or introducing you to better-suited investors.

And the way to do that is to make your story happen. Create a sense of urgency and purpose in your organization, especially in terms of aligning your IP strategy with your business strategy. Share the story you tell your investors with your team because they will play a crucial role in bringing it to fruition. Remember that an IP strategy is not just the domain of the technologists in your company. All teams and disciplines across the organization have a role to play in keeping your IP strategy strong – whether it be your human resources function ensuring that all employees sign confidentiality agreements, your marketing team safeguarding the proper use of your trademarks, your finance personnel keeping on top of your patent maintenance fees, or your development team ensuring that trade secrets are kept as such.

Even when the financing process is ongoing, keep your prospective investor informed of key areas where you are getting traction. Share news on key customers, patent grants, or distribution partnerships. Don't just make it about successes by also using this communication to ask for help in terms of access to customers, partners, and even talent.

After receiving your financing, develop a plan to keep your investors updated on your traction – both positive and negative. And stick to it. Transparency in investor communication builds trust and keeps your investors engaged.

If you raised debt financing, make sure you focus on meeting your financial plan and respecting your debt covenants. Since lenders are focused on getting their money back at maturity, they will look to you and your team to remain on top of managing liquidity and cash flow.

If you raised equity financing, you should also ensure that you keep your value-creation milestones, governance process, and organizational structure in step with your growth stage. You will likely be changing your board of directors and perhaps welcoming new team members. Make sure everyone understands the story that you just sold and the role they play in making it happen.

5 Learnings and Takeaways

IP-backed financing is a relatively new way to finance IP-rich start-ups and there will be more developments in this space. As IP and intangible assets play a greater role in investment decisions across all asset classes, there will be more investors capable of performing the necessary analytics and valuation exercises and developing their own form of IP-backed financing. Developments in artificial intelligence, big data analytics, and increased education on IP valuation techniques will converge to find ways of overcoming current valuation challenges.

Therefore, it is imperative for start-ups to see the value in this type of financing and to be prepared to seek funding this way. At the foundation of this is having a well-developed IP strategy that is aligned with the business strategy, a strong IP management culture, and a focus on achieving "product-market-moat" fit.

Takeaways

As intangible assets play a greater role in the development of start-ups, IP-backed financing is an alternative way to raise capital. Critical to raising this type of financing is having a strong "product-market-moat" fit, strong IP strategies, and IP management culture that are aligned with business strategy. Adequate preparation is also important since IP-backed financing involves more steps than other investment processes.

Acknowledgments The author wishes to thank Anne-Marie Bourgeois, Stefan Chiasson, Leonard Kofman, Jerome Nycz, Vera Xie, Maximilian Yam, and Sarim Zia for their contributions in developing and launching the BDC Capital IP-Backed Financing fund and for their ongoing commitment to supporting the growth of IP-rich companies in Canada.

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Lally Rementilla is Managing Partner, Intellectual Property-Backed Financing at BDC Capital. She oversees and provides strategic guidance to a national team that helps IP-rich companies become global leaders by accelerating their growth and commercialization of their innovation.

Following nearly two decades of experience as a financial executive in the technology sector, Ms. Rementilla moved into investment, becoming Chief Financial Officer and then President & Chief Executive Officer of commercial lender Quantius. At Quantius, she structured and launched the company's main fund and helped build a diverse portfolio of knowledge-based companies. Prior to that, she was Vice President of Finance and Administration at Nulogy Corporation. She was Vice President Finance at Lavalife Corp. and Area Vice President Finance and Contract Management at Lucent Technologies Canada.

Ms. Rementilla is currently chairperson of the board of Interaxon Inc. and is an Associate Fellow at the Creative Destruction Lab. She previously served on several other boards, including the Innovation Asset Collective (Canada's first patent collective), Pique Ventures Investments, the Information Technology Association of Canada, and Canadian Women in Communications. She also served as the former Canada Lead for the Billion Dollar Fund for Women.

Ms. Rementilla is a proud supporter of Canadian innovation and derives great satisfaction from partnering with founders and management teams to help them scale. She is an experienced gender lens investor with an eye to creating impact for women globally. A Chartered Professional Accountant, she also holds a Master of Business Administration from York University and a Bachelor of Arts in Communications from Ateneo de Manila University.

Part III

The Corporation's View

But the core of my message here is to take IP very seriously. [. . .] Therefore, do invest in it.
—Dr. Jörg Thomaier
Managing Director Bayer IP GmbH
Global Head of IP Bayer Group (Bayer AG)

IP as an Important Value Driver for Start-Up Strategies in Established Companies

Beat Weibel and Rudolf Freytag

1 Introduction

For many established companies, working with start-ups is an important part of their innovation and growth strategy.

There are *two basic types* of start-up strategies employed by established companies (see Fig. 1):

- **Outside-in start-up strategies:** With these strategies, the established company gains access to external start-up innovation to foster profitable growth. At the beginning, there is usually a collaboration between the established company and a start-up. This can be accompanied by a venture capital investment and can ultimately lead to a complete acquisition and eventually integration of the start-up.
- **Inside-out start-up strategies:** With these strategies, the established company builds a spin-off based on an internal innovation. Very different goals can be pursued with this, such as the building of a new innovative business outside the core business, the establishment of a supplier for a technology, or the creation of a start-up with a pure financial objective.

B. Weibel (✉)
Siemens AG, Munich, Germany
e-mail: beat.weibel@siemens.com

R. Freytag
Siemens AG, Munich, Germany

Siemens Technology Accelerator GmbH, Munich, Germany
e-mail: rudolf.freytag@siemens.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_10

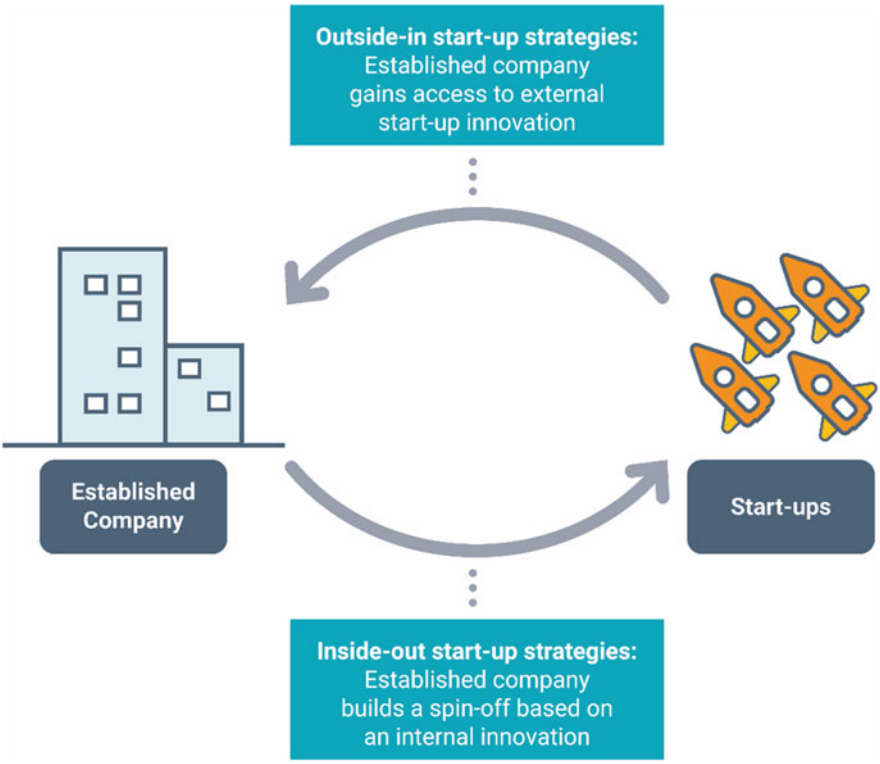

Fig. 1 Start-up strategies of established companies (authors' own figure)

When the inside-out strategy is used to build or accelerate the creation of a business, the start-up may also be integrated back after its successful set-up and growth. This would close the circle of inside-out and outside-in strategies.

The focus of this chapter is on IP as an important value driver for start-up strategies of established companies. We build our discussion on two generally accepted principles:

- **Start-up strategies are growth and innovation drivers:** There is extensive literature on this premise (e.g., Christensen & Raynor, 2003; Dodgson et al., 2014) which focuses on the business aspects, including "looking to the future," innovative technologies and products, digitalizing business models, new production methods, and setting up innovative businesses separate from the company's core business.
- **IP is a value driver for businesses:** This central role of IP has also been described in detail in existing scholarship (e.g., Gassmann et al., 2021; Weibel, 2021; Wurzer et al., 2016). What constitutes a value-driven IP strategy and how it can be implemented in practice we have described in detail in Weibel and Freytag (2019) and Freytag (2020). In particular, we have also outlined there how the

application of the *Business Model Canvas* (Osterwalder & Pigneur, 2019), which is well established in the start-up scene, facilitates the generation of targeted IP to protect the unique selling points of the business model.

Even if these two principles are extensively explored in various publications, there is a gap in scholarship when it comes to the following: the concrete application of these principles to the case of start-up strategies of established companies to promote innovation and growth. Many failures and, above all, disappointed expectations attest to the fact that it is by no means obvious exactly how IP can become a value driver for start-up strategies in practice.

Drawing on our many years of experience with this topic, we will address this question in detail in this book chapter. We will consider the outside-in and inside-out strategies separately because they are fundamentally different.

For established companies, this book chapter can serve as a practical implementation guide for start-up strategies. And start-ups, on the other hand can easily deduce from the explanations of the outside-in strategies which requirements they must fulfill with respect to their own IP strategy in order to become attractive collaboration partners for established companies. In the following, "*IP*" refers to any form of intellectual property – meaning not just patents, but as well utility models, design rights and copyrights. Before we investigate the outside-in and inside-out strategies, let's analyze why IP is particularly important for start-ups.

2 Importance of IP for Start-Ups

What constitutes a start-up and what distinguishes it from an established company? Is IP of special value to it? Answers to these questions may help to explain why many start-up companies underestimate the relevance of IP to their overall business success.

There is no standard definition of a start-up. However, according to Gabler-Wirtschaftslexikon (2022), a *start-up* is a young, not-yet-established company that needs venture capital to realize its innovative business idea. In other words, with the help of external financing, a start-up tries to convert a new idea, product, or business model into an innovation, that is, into a successful business.

At this junction, it becomes important to distinguish between *invention* and *innovation*, as shown in Fig. 2. Whereas for invention one takes money and creates ideas, an innovation takes an idea and turns it into a successful business. To achieve this, inventions need to be legally defined and delimited from other inventions. In other words, "*who*" owns an idea and to "*what extent*" someone owns it has to be defined. The legal means for doing this is through intellectual property rights (IPRs). For technical innovations, the most important suitable IP right is the patent.

It goes without saying that for the transformation of inventions into innovations, additional funds are necessary. Besides highly capable personnel, inventions and business ideas are a start-up's most important assets. These are intellectual assets that need to be legally secured and protected. Otherwise, the start-up's advantage (often

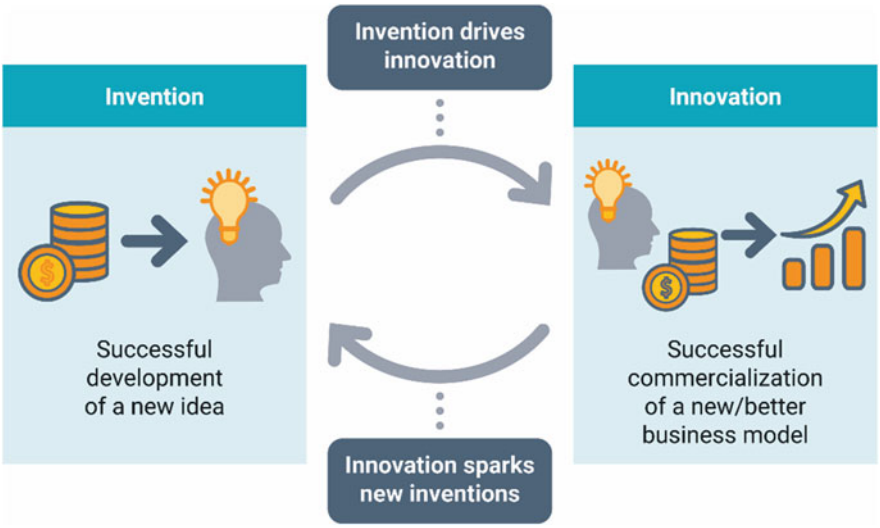

Fig. 2 The difference between invention and innovation (authors' own figure)

called "*unfair advantage*") is nonexistent. The financial investors therefore want to have some certainty that the ideas and inventions of a start-up are unique and offer a competitive advantage. This again can be achieved with IP rights. If a start-up has not thought about IP and an IP strategy from the outset, it will be forced to do so when it begins to look for financing. Investors carefully examine the IP situation and, to this end, frequently use an *IP due diligence*.

It is not just about having any IP rights: The start-up should have the most appropriate and valuable IP rights – in other words, the IP rights that support the innovative business model and protect the start-up's competitive advantage. And unfortunately, very often the IP rights of a start-up do not really protect its competitive advantage.

In order to avoid such pitfalls, a "*value-driven IP strategy*" is especially helpful. It is appropriate for businesses of every size, and we apply it at *Siemens* as the core of our company's IP strategy. The basic concept of this methodology, which we described in detail in Weibel and Freytag (2019) and Freytag (2020), is to actively generate targeted IP rights in order to protect a business's unique selling proposition. In contrast to an "*invention-driven IP strategy*," where patent applications are drafted and filed based on the input of invention disclosures, the value-driven IP strategy tries to generate IP protection for those assets and characteristics of the business model that are critical to competitively distinguishing a company on the market.

In order to find these unique selling propositions (USPs), the business model canvas method (Osterwalder & Pigneur, 2019) is the most frequently used tool. Because start-up companies tend to use a business model canvas anyway to define their business model and to pitch to financial investors, it is natural for them to also

employ the same business model canvas to define an IP strategy for generating targeted IP to protect their future business. This methodology also allows the IP protection to be dynamically modified later if the start-up finds that it needs to change its business model, for example, from selling a product to selling Software-as-a-Service (SaaS).

A value-driven IP strategy can thus enable a start-up to protect its present and potential future business models and ensure that it has the necessary "*freedom to operate*" so it can pursue those businesses.

Good IP protection is able to create real value for a company: By reducing the competitive pressure on a start-up due to its exclusive nature, IP rights protection of the business improves the return on investment, or at least makes sure that the return lasts longer. In this way, a value-driven IP strategy also regularly improves the start-up's growth and margins, and thus ultimately also boosts its enterprise value.

Most importantly, however, a value-driven IP strategy makes a start-up more attractive to financial investors and to established companies that may work with the start-up and possibly even acquire it later on.

3 Outside-in Start-Up Strategies

We now turn to established companies. Before we discuss the outside-in start-up strategies from Fig. 1 in more detail below, we will begin with a specific example for illustration purposes: the transformation of "*Siemens Automation Technology*" into "*Siemens Digital Factory*" (Collis & Junker, 2017).

Case: Siemens Digital Factory's Start-Up Strategy

In 2005, management at *Siemens Automation Technology* realized that they faced an important strategic decision: On the one hand, *Siemens Automation Technology* was a highly successful market leader in automating production facilities in many different industries, such as the automotive industry or the chemical and pharmaceutical industry. On the other hand, it had become clear that digitalization would ultimately transform this business, and that customers' requirements and the resulting range of products and services to be offered would change dramatically.

It was also clear that this digital transformation could not be managed on the basis of the existing automation business because the skills and resources needed for transitioning to a software-dominated business were either not available in-house or could not be built up fast enough.

To build up this software business, in 2006 *Siemens* first acquired *UGS*, a U.S.-based company with sales of more than US$1 billion, whose core business was a software platform for digital management of a product's life cycle, covering the entire associated value chain from development to simulation, testing, operation, and service. This software business then became the "digital core" of the digital transformation of *Siemens Automation Technology*, which later was renamed *Siemens Digital Factory* as part of the same process.

Another important part of this digital transformation was *Siemens Digital Factory's* associated start-up strategy for systematically expanding the functions of the *UGS* platform it had acquired. One example here is a start-up named *Polarion*.

Polarion had developed a software to support workflow in developing complex hardware and software. In 2014, *Siemens Digital Factory* began by launching a collaboration project with *Polarion* to test how well *Polarion's* software would fit with the *Siemens* software platform, and how *Siemens'* customers would respond. This collaboration project was accompanied by a rather small venture capital investment in *Polarion*. The project worked out so well that by 2016 *Siemens Digital Factory* took over all of *Polarion* in an M&A transaction.

In a nutshell, *Siemens* used the collaboration with and the investment in an external start-up, first to test the fit and success of the offered software, as well as to accelerate and expand the software externally. Finally, the start-up was completely taken over and integrated.

This outside-in start-up strategy, based on a very long-term perspective and still in use today, is the core of *Siemens Digital Factory's* success in expanding its market lead amid the rapidly changing and increasingly digital market for industrial automation. ◄

3.1 Characteristics of Outside-in Start-Up Strategies

Start-up strategies of established companies can be divided into three categories (Freytag, 2019) as shown in Fig. 3:

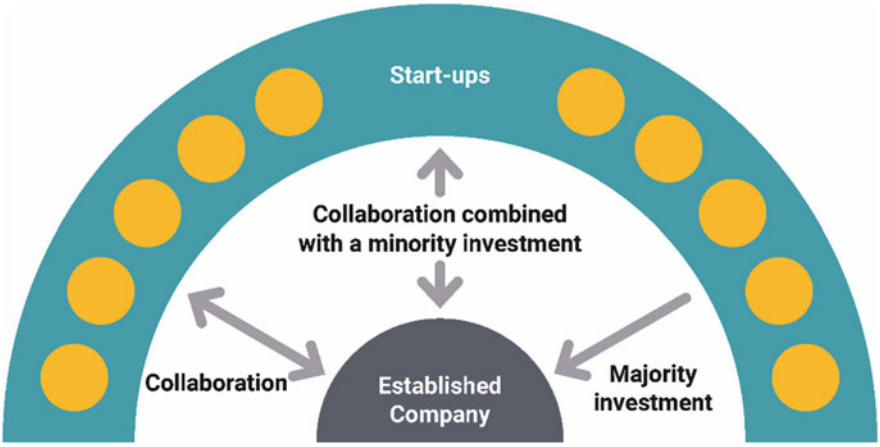

Fig. 3 Categories of outside-in start-up strategies in established companies (authors' own figure)

1. Collaboration
2. Collaboration combined with a minority investment
3. Majority investment

Collaboration This refers to any form of cooperation between an established company and a start-up on a project basis. In the case study of *Siemens Digital Factory*, the collaboration with *Polarion* served to find out, in a flexible way, how well *Polarion's* solutions would fit with the solutions of *Siemens Digital Factory*. For *Polarion*, this represented the first steps toward gaining *Siemens* as a customer; for *Siemens*, it was a chance to find out how well *Polarion*'s software would complement *Siemens'* own software business.

Collaboration projects are flexible, temporary instruments for which rights and obligations can – and must – be clearly defined. This is particularly important for IP. For instance, from the established company's viewpoint, there is a need to clarify whether the start-up actually has *freedom to operate* for its solutions, what kind of *IP protection* it has for those solutions, and how the results of the joint project work will be dealt with from the IP perspective.

Collaboration Combined with a Minority Investment This is a variant of a collaboration project in which, in addition to the project-based cooperation just described, the established company makes a minority investment *("venture capital investment")* in the start-up. In our sample case, this is the path which *Siemens Digital Factor*y chose with *Polarion*. This kind of venture capital investment for usually far less than 25% of the shares can help supply the start-up with capital for the collaboration project, and also keep a direct competitor of the established company from buying up the start-up or working with it. Conversely, however, a venture capital investment, as a rule, ties an established company to a start-up for a significantly longer period than would be the case with a pure collaboration project, which usually is for a limited time.

If an established company makes a venture capital investment in a start-up, it must then make sure the start-up's *IP portfolio* and *IP strategy* are a good fit for the fast, profitable growth of the start-up as a whole. This is an important basis for an investment decision, and often goes far beyond the *IP review* that is needed for a collaboration project. It is important to note that a venture capital investment, as a minority investment, does not give an established company any rights to access the start-up's technology or IP. Such access is possible only by way of separate agreements, for instance in connection with a collaboration project.

Majority Investment If an established company wants to have control over the start-up, it must acquire a majority of the start-up's shares. What usually takes place in these cases is a "*trade sale*," meaning a complete takeover of the start-up by the established company. The example of *Siemens Digital Factory* and *Polarion* shows

how a smooth-running collaboration project can ultimately lead to such a takeover via a majority investment.

If an established company makes a majority investment in a start-up, this means making a significantly greater effort to analyze the start-up's *IP portfolio*, *freedom to operate*, and *IP strategy* than for a minority investment. The start-up may involve hidden *IP risks*, which can have a serious impact on an established company's overall business in the event of a complete takeover. In case of a majority investment also the integration of the start-up into the full-fledged *IP processes* of the established company should be considered. However, this step has to be carefully thought through and balanced since watertight and sometimes burdensome IP processes, common to many technology-driven established companies, might also endanger the flexibility and creativity of the start-up. This is particularly true if the start-up is still comparatively small. The larger it becomes, the more revenue and value are at stake and the more sophisticated the IP processes must be.

Importance of IP Due Diligence Because of IP rights' significance as value drivers, established companies must analyze a start-up's *IP situation* in due breadth and detail as they implement their start-up strategy so that they can assess the risks and opportunities. This is done by way of an "*IP due diligence*," which we will discuss in more detail later in the chapter.

Above and beyond this IP due diligence, however, both as a collaboration partner and as an investor, the established company must be careful that the IP portfolio also continues to develop adequately, and always fits to the established company's present and planned future business models. Depending on the overlap with the start-up's activities, considerable attention should also be paid here to interdependencies between the established company's and the start-up's IP portfolio. The value-driven IP strategy approach described earlier is very helpful here.

As the example of *Siemens Digital Factory* shows, it may be advantageous for an established company to combine its start-up strategy with the acquisition of a larger company to which the acquired start-ups can be attached later. With such a "buy and build" strategy, value can be generated especially well by way of what is known as the "leverage effect" (Freytag, 2019). The IP strategy must also cover this aspect.

3.2 IP Due Diligence of a Start-Up by an Established Company

As was explained in the preceding section, before starting any collaboration project with a start-up, and before any investment in a start-up, an established company must perform an IP due diligence. The content and depth of detail of this due diligence will depend heavily on the specific situation.

However, there are fundamental dimensions and issues that must be addressed in any IP due diligence. We will now explore these using the example of the IP due diligence that is standard practice at *Siemens*. An IP due diligence analyzes whether the start-up has adopted an IP strategy that inspires sufficient confidence in the start-up among cooperating partners and investors.

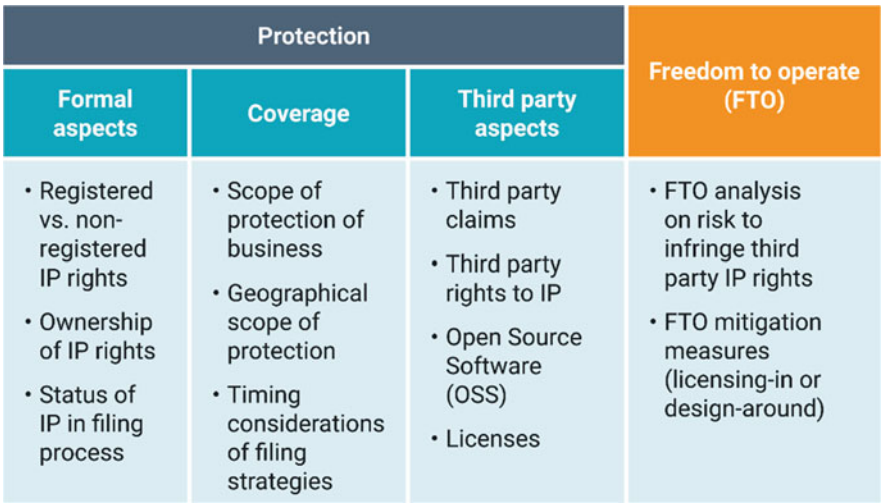

Fig. 4 Principal topics in an IP due diligence (authors' own figure)

The structure of an IP due diligence pursues the two primary tasks of an IP strategy:

- *Protection:* This examines whether a start-up has created as much valuable IP as possible so as to protect its current and future business and whether it has kept dependence on others as low as possible.
- *Freedom to operate:* This explores the extent of the risk that a start-up may infringe on a third party's IP and what countermeasures have been taken.

The primary points analyzed in an IP due diligence review in this connection are shown in Fig. 4 and will be explained in further detail below:

- Formal aspects
- Coverage
- Third party aspects
- Freedom to operate (FTO)

Formal Aspects

Registered vs. non-registered IP rights: An IP due diligence begins with the most complete possible overview of all IP rights. These include both those IP rights that are registered with patent offices (e.g., patents, design rights, and utility models), and also unregistered IP, like know-how, trade secrets, copyrights, and non-disclosure agreements (NDAs).

Registered IP rights are preferred over non-registered rights for two reasons: On the one hand, non-registered IP rights are often linked to individuals. This means that if the individual know-how owner should leave the start-up for any reason, a

substantial know-how loss can occur. And on the other hand, registered IP rights can more easily survive an exit scenario, and, in case of a start-up company's failure, they are less at risk for being lost in bankruptcy proceedings.

Ownership of IP rights: Start-ups are frequently individual-based endeavors with a dominant know-how owner. Start-ups are also frequently created as spin-offs, such as from universities or established companies. In the first case, the IP rights are often registered in the name of the individual. In the second case, the start-up without any appropriate agreements has no IP rights in its ownership, as the rights usually remain with the spinning-off institution. Therefore, it is of utmost importance for the start-up company to ensure that it owns or at least has access to the IP rights needed.

The same rule applies to the start-up's employees and collaboration partners: It should be ensured to the greatest extent possible that the start-up has ownership of the IP rights created by its employees and collaboration partners.

Status of IP in filing process: Above and beyond the IP rights that have already been granted, a due diligence must also examine how probable it is that the patents currently still in the filing process will be granted. Here, search or examination reports by patent offices may provide valuable indications.

Coverage

Scope of protection of business: In addition to the formal aspects, one should also examine to what extent the start-up holds IP rights that adequately cover not only its present business model, but also future business models and alternative implementations of these business models. Aside from patents, this includes trademarks for the most important products and services, design protection for the unique appearance of certain products, and safeguarding domain names for the start-up's website(s).

The first point to determine is whether the start-up has any IP rights or if its ideas are entirely based on trade secrets – or, even worse, if its ideas are publicly known. The latter is of course critical because no long-lasting advantage can be achieved. Trade secrets are a fine thing, but they are much harder to manage than patents – and it is hard to keep them secret.

This is true even for digital start-up companies where the main asset is a software whose source code is a carefully guarded secret. As a matter of fact and experience, every piece of software can be decompiled, and the hidden "secrets" can be brought to light. Experts hold that every software can be decompiled with enough effort within 12 months. A start-up is therefore better positioned if it has IP rights.

Geographical scope of protection: The broader the geographical scope of the IP protection, the better. However, with its limited financial power, a start-up will not be able to patent its ideas to the same extent as established companies can afford to do. Consequently, the start-up needs to prioritize and keep the window to nationalize patent applications open for as long as possible. This can be achieved by taking the *PCT (Patent Cooperation Treaty)* application route, where the final decision on the patent's geographical scope can be extended up to 30 months.

There are two approaches to deciding on basic geographical coverage: focusing on key markets or focusing on production countries. The first approach is applied to

products that can be produced anywhere and will usually lead to a broader geographical range. The latter approach is preferred for goods that can only be manufactured in a limited number of countries due to a special need for manufacturing resources.

Timing considerations: Timing is one of the trickiest tasks in an IP strategy. By holding back an idea for too long, the risk is high that another party will file a patent for the same invention. On the flip side of the coin, filing an application too early may fix the content of the patent application too soon. For a start-up, the earlier expiry of a rather early filed patent is of less concern than the restrictions on amending a patent application and its claims.

To overcome this risk, PCT applications are again the preferred application type, and start-ups can try to squeeze as many ideas as possible into one patent application with the goal of dividing out the particularly important aspects by divisional applications at a later stage – even if they are not unitary and will therefore be prone to an incomplete search report or negative patent office actions. These measures also help save costs and retain the option to amend. Where feasible, a start-up can also profit from patent examination and granting procedures with a delayed examination, which, for instance, is possible in Germany.

Third-Party Aspects

Third-party claims: An IP due diligence must also cover all existing claims of third parties against the start-up's patents, such as oppositions, nullity actions, or infringement suits.

Third-party rights to IP: A start-up's existing IP rights may be encumbered with various third-party rights. In addition to ongoing claims for inventor's compensation, it may happen that IP rights are encumbered with licenses granted to third parties. Open-Source Software licenses are a highly specific and important form of third-party rights. We therefore explore it separately next.

Open-Source Software (OSS) licenses: OSS is very popular, and especially for fast and efficient software development, programmers can hardly avoid relying on OSS licensed software libraries. This is true in particular for artificial intelligence (AI) applications, where the basic AI structures and learning algorithms are available as OSS libraries.

However, OSS can also have an infectious effect (the so-called "*copy-left effect*") that limits the option to own and control the start-up's proprietary competitive advantage (Schwarz & Kruspig, 2017). To be on the safe side, the start-up should ensure that it only uses OSS under non-infectious licenses and that the core of its software is preferably programmed without relying on an OSS license. Scanning tools are helpful to this end.

Freedom to Operate (FTO)

Freedom-to-operate (FTO) analysis of whether third-party IP rights are infringed: This should be checked for both the start-up's existing business activity and its activities planned for the future. Established companies maintain detailed procedures to clear products and interfering third-party patents, but a start-up company usually has neither the resources nor the expertise to do so. A worst-case scenario for any

start-up and its investors or collaboration partners arises if a court puts a product under an injunction, for instance due to patent or copyright infringement. This problem has already led to the demise of several start-ups. The most famous example is probably Napster, which had to be shut down because of problems with copyright infringements (Napster, 2022).

To secure the success of a start-up and ease the minds of investors or collaboration partners, at the very least, a basic FTO analysis should be carried out already by the start-up. The key features of the start-up's offering should be defined, and a patent search should be conducted. For example, the Swiss Patent Office offers this service at a relatively low cost. The results of the patent search should be discussed with an experienced patent attorney. The entire process should be documented and presented to investors or collaboration partners later during the IP due diligence.

Freedom-to-operate mitigation measures (licensing-in or design-around): If the FTO analysis indicates that the start-up potentially infringes on third-party IP rights, there are two basic solutions: either licensing the necessary rights in or trying to modify the start-up's products or services in such a way as to avoid the IP infringement.

However, licensing-in IP rights or technology can be detrimental to the value of the start-up and its potential for acquiring financial support from investors because the start-up does not have free disposition over the IP rights. The license conditions decrease its ability to become profitable, and the start-up is dependent on the goodwill of the licensor. Of course, a good license contract will help mitigate these risks, but full ownership is certainly more attractive to investors.

4 Inside-Out Start-Up Strategies

Up to this point, we have considered the "*outside-in*" strategies from Fig. 1, meaning strategies with which established companies can make use of start-ups to draw innovation into their own company. Now we will turn to the converse case, the "*inside-out*" strategies, in which a spin-off is founded out of an established company. We will begin again with a case study as an illustration.

Case: Siemens Spin-Off Symeo GmbH

Siemens Technology Accelerator GmbH (STA), a wholly-owned subsidiary of *Siemens AG*, has been successfully founding start-ups for 20 years on the basis of highly innovative technologies that arose in research and development departments of *Siemens*, but which for various strategic reasons were ultimately used only in a limited way or not at all in *Siemens* products (Siemens, 2022). STA is taking these technologies to externally build innovative businesses that serve market segments or stages of the value chain that are not in the focus of any *Siemens* business unit. One example is *Symeo GmbH* (Symeo, 2022).

For customer-specific industrial solutions, *Siemens* research laboratories had developed an innovative radar technology that had a wide range of versatile uses,

from radar-based position finding for transport vehicles in industrial plants to determining fill levels in large tanks for the chemical industry. The *Siemens* units in charge decided not to enter the components business for radar solutions because they could not foresee any adequate scaling options within the *Siemens* business environment.

Siemens Technology Accelerator saw an opportunity to position this innovative radar technology as an independent spin-off in a very attractive market outside the *Siemens* business environment and began the business building for such a spin-off. This also included setting up a highly qualified founding team and launching a search for outside venture capital financing. This gave rise to *Symeo GmbH* in Neubiberg, near Munich, in 2007. STA brought on board an experienced business angel as an investor. For its business building activities and for transferring and licensing technology and know-how as well as seed financing, *Siemens Technology Accelerator* received shares in *Symeo*.

Symeo's business in radar components for position finding and distance measurement in a wide variety of industries developed very well. *Symeo* also became a supplier to *Siemens*' business units which could then use these innovative radar components in their industrial solutions without having to develop and produce them themselves.

Over time, it became clearer that *Symeo's* radar technology might also have very promising applications far beyond the industrial environment, namely for autonomous driving and driver assistance systems. This major market potential ultimately led in 2018 to a trade sale of *Symeo* to a U.S. corporation, *Analog Devices*. Everyone benefited: The founders and investors had a very successful exit, and *Analog Devices* acquired a technology that will help it expand its automotive business further. ◀

4.1 Characteristics of Inside-Out Start-Up Strategies

As the example of *Symeo GmbH* shows, inside-out strategies require a different approach than the outside-in strategies discussed so far. With an inside-out strategy, the focus is on business building.

Methods for Business Building Established companies can apply all the instruments for business building that have proved their worth in the start-up environment, such as the business model canvas (Osterwalder & Pigneur, 2019) and the lean start-up approach (Blank & Dorf, 2012; Ries, 2011).

But as Fig. 5 shows, business building most importantly also means proceeding iteratively in fast learning cycles between developing the business model and developing assets. Usually, the first customer interviews about the business model indicate that certain assets are still missing or must be adapted. Based thereupon and on revised assets, a new hypothesis about the business model is drafted that again must be checked with customer interviews and prototype tests. This iteration

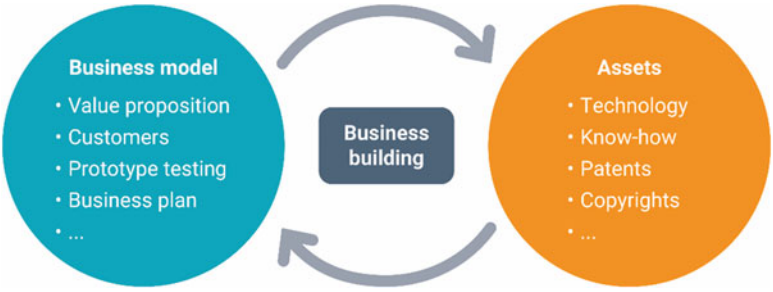

Fig. 5 Business building for a spin-off from an established company (authors' own figure)

between business model and assets must continue until both fit ideally together, which in particular also defines what is known as a "*minimum viable product*" – the first salable product of the future spin-off.

IP Represents an Important Part of the Assets The continuous expansion of the IP portfolio in the course of the iteration process for business building must be accompanied by a FTO analysis and protection measures in the sense of a value-driven IP strategy (Weibel & Freytag, 2019). This is the way to make sure that the spin-off's future business model has the best possible protection and, at the same time, that the spin-off is free to pursue its business.

The *strategic goals* of spin-off strategies of established companies can vary widely. The most common variants are:

- *Establishment of a new innovative business outside the core business:* In such cases, the spin-off is usually a 100% subsidiary of the established company, which thus retains control over the spin-off but also has to bear the entire financing. The high expectations placed on these spin-offs in terms of their contribution to the growth of the company as a whole are often disappointed. The following calculation example shows why this is the case: Let's consider a very successful spin-off that already has €1 million of sales in its first year of existence, and then generates revenue growth of 133% each year afterward. It will take 10 years for this spin-off to reach €100 million in sales. In an industrial environment especially, that would be a tremendous success. But for an established company with several billion in revenues, €100 million is not a really significant additional amount. For that reason, established companies' spin-off strategies must be combined with a leverage approach. In other words, the spin-off's revenues must stimulate additional revenues in the established company's core business that far exceed the spin-off's own revenues (Freytag, 2019).
- *Establishment of a joint venture with strategic partners:* In these cases, the partners contribute capital, know-how, and technologies to the spin-off of the established company in return for a share in the spin-off. In this way, they jointly drive forward a technology or product development by exploiting synergies. In

the end, each partner usually holds only a minority share in the spin-off and thus does not have sole control.

- *Establishment of an independent supplier for a technology:* If, as in the *Symeo* case study, the established company is interested in using a technology but does not want to get involved in development or production itself, then a spin-off may be considered. This serves not only the established company but also other customers and thus has a greater chance of success. Financial investors are usually involved in this spin-off for financing. This is only possible if the incumbent company limits itself to a minority share in the spin-off; otherwise, the financial investors see their freedom to optimize the exit of the spin-off endangered by the strategic interests of the incumbent company. This was precisely the constellation in relation to *Symeo GmbH*.
- *Establishment of a technology start-up with a pure financial objective:* The aim here is to generate financial returns for the established company by founding a spin-off with the goal of a subsequent exit that is as financially successful as possible. To this end, venture capital investors are involved in the spin-off to contribute seed and growth capital. As in the case of "independent supplier," the incumbent company usually holds a minority share in the spin-off. The *Symeo* case study shows that creating an independent supplier and establishing a start-up for financial objectives fit well together.

These examples indicate how wide the range is for spin-off strategies. The examples are sorted in descending order of strategic relevance for the spin-off's core business. In the same way, both the share and the control influence of the established company in the spin-off decrease.

But even if the incumbent initially has only a minority share in a spin-off, it can still make a takeover offer to the other shareholders later on and thus become the full owner of the spin-off.

4.2 Transferring and Licensing of IP Rights to a Minority-Owned Spin-Off

If an established company retains control of the spin-off as majority shareholder, it only needs to ensure that the spin-off is allowed to use the IP rights identified as relevant in the business building process.

However, if the established company, as a minority shareholder, has no control over the spin-off, it must view the spin-off as if it was an independent third-party company and answer the following key questions when granting IP rights to the spin-off:

- What IP rights does the spin-off need to develop its business?
- How much and in what way does the spin-off pay for these IP rights?

We will now turn to addressing these questions in more detail in the following:

Equipping the Spin-Off with IP Rights The spin-off must be provided with IP rights by the established company in such a way that it can operate its business independently. Only then will it be able to attract financial investors and pursue a successful growth course through to exit.

- *Scope of rights:* In principle, both registered property rights (patents, utility models, design rights, and trademarks) and non-registered property rights (copyrights and know-how) must be taken into account. The non-registered property rights must be described in detail in the IP contract; in particular, regarding copyright, the status of the source code of software must be well documented. Frequently, the so-called foreground IP, which relates directly to the business model of the spin-off, cannot be used without background IP, which consists, for example, in basic patents of the established company. Here, great care must be taken to ensure that the spin-off only obtains the rights absolutely necessary to this background IP in its area of application.
- *Licensing vs. transfer:* There are many ways to structure the licensing of IP rights, depending on whether and to what extent exclusivity is granted or how narrowly or broadly licensed products, licensed fields, and licensed territory are defined. IP rights that are very specific to the spin-off and of minor importance to the established company are often transferred to the spin-off. In most cases, the established company retains a back license for its own current and future business so that it cannot be attacked later by the spin-off on the basis of these IP rights. Established companies sometimes also precede a transfer of patents with a phase of licensing these patents until the spin-off reaches a certain milestone. In this way, they want to minimize the risk of losing IP rights in the event of the spin-off's insolvency.
- *Differentiation from the established company's business:* The established company has an interest in not giving the spin-off more IP rights than is absolutely necessary. The described handling of background IP is an example of this. The more specifically the IP relates to the spin-off's business model, the better. If no specific IP exists, it must be created at the spin-off's side with the purpose of underpinning the business model of the spin-off and at the established company's side with the purpose of safeguarding and delimiting the use by the spin-off from the use by the established company. To this end, the value-driven IP strategy is the best means by which to reach focused IP protection.
- *Change of control:* In the strategy for granting IP rights to the spin-off, the established company must also consider what could happen in the event of an exit in the form of a sale of the spin-off to a competitor. Likewise, attention must be paid to what happens to the spin-off's IP rights in the event of the spin-off's insolvency.

Payment for the IP Rights by the Spin-Off If the established company, as a minority shareholder, has no control over the spin-off, it must be contractually clarified how much and in what form the spin-off pays the established company

for the IP rights. A balance must be found between the appropriateness of the payment and the cash burden on the spin-off, which should not be excessive, particularly in the initial phase:

- *Shares in the spin-off:* Often, the management team of the spin-off founds the spin-off as a legal entity, and the established company contributes its assets in exchange for shares in this legal entity. These assets include the IP rights discussed above and others, such as technology prototypes or business building services. Similarly, venture capital investors acquire shares in the spin-off by contributing capital. They will only be willing to do so if the established company is only a minority shareholder and does not claim any special strategic rights vis-à-vis the venture capital investors, such as rights of first refusal or access to the spin-off's technology. The advantage of having shares in the spin-off is that the established company participates directly in the success of the spin-off and there is no cash burden on the spin-off. But it also means that the established company commits to the spin-off as a shareholder for the longer term.
- *Cash payment:* Usually, the company valuation of the spin-off and the requirements of the venture capital investors result in an upper limit for the shares that the established company can hold as a maximum. If this is not sufficient as remuneration for the assets contributed, revenue-based royalty payments or purchase price payments divided into tranches can be a good complement to shares in the spin-off held by the established company. Care must always be taken not to place too great a burden on the spin-off in terms of cash. Suitable mechanisms for this are, for instance, minimum revenue thresholds for royalty payments and deferral of purchase price payments.
- *Convertible loan:* An established company can also contribute its assets to a spin-off via a convertible loan, which can be successively converted into shares in the spin-off in the course of subsequent financing rounds. This is also an interesting instrument with which an established company can be remunerated for the assets contributed to the spin-off on a performance-related basis. And at the same time, the cash burden of the spin-off is minimized.

These levers for equipping a spin-off with IP rights and for payment for these IP rights by the spin-off can be expanded in many ways and combined with one other. Established companies can thus adapt their approach very flexibly to their strategic goals and the situation of the spin-off.

5 Learnings and Takeaways

There are two basic types of start-up strategies of established companies: *outside-in strategies* and *inside-out strategies* (see Fig. 1).

- With **outside-in strategies**, established companies gain access to external start-up innovation to drive their own profitable growth. There are three basic approaches,

which can also be run consecutively: collaboration, collaboration combined with a minority investment, and majority investment. The IP due diligence of a start-up by an established company is a key aspect of any outside-in strategy to clarify to what extent the start-up has protected its business model by IP and whether it has freedom to operate. The content and depth of an IP due diligence depend on the specific situation, but the topics to be addressed are always the same (see Fig. 4).

- With **inside-out strategies**, established companies build spin-offs based on internal innovations. The business building methods tried and tested in the start-up scene are employed here (see Fig. 5). Inside-out strategies can be used flexibly to pursue very different goals. These range from building innovative businesses that are independent of the core business, to setting up joint ventures, to creating independent technology suppliers, to building start-ups that have purely financial goals. When transferring or licensing IP rights to a minority-owned spin-off, there are many options but also many critical points to consider. In particular, a balanced solution must not result in too great a cash burden for the spin-off. Nevertheless, the compensation for the established company must be appropriate to the risk profile.

Takeaways

IP becomes an important value driver of start-up strategies of established companies if a *value-driven IP strategy* is used from the beginning and the concepts and guidelines discussed in this chapter are considered.

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Beat Weibel studied Electrical Engineering at the ETH in Zurich and was a Trainee Patent Attorney with ABB from 1991 until 1995. In 1995, he qualified as a European Patent Attorney. He was head of Corporate IP of Georg Fischer AG from 1998 until 2000, head of the IP Department of ABB Switzerland from 2000 until 2007, and Chief IP Counsel of ABB Ltd. from 2007 until 2012. Since 2013, he has presided over the Intellectual Property Department of Siemens AG. He was a lecturer on patent law at ETH Zurich for many years and is a lecturer at the University of Applied Science Zurich, as well as a guest lecturer at the Technical University of Munich. He teaches in preparation courses for the Swiss patent attorney qualifying examination and regularly publishes and speaks on timely topics in intellectual property law. He is currently President of the German Association of Patent Attorneys (VPP) and the European Federation of Intellectual Property Agents in Industry (FEMIPI).

Rudolf Freytag has a PhD in Physics and a Bachelor of Science in Business Administration from the University of Regensburg, Germany. He joined Siemens in 1992 and held various management positions in marketing, product management, engineering, strategy, and consulting in Germany and the United States. He was Vice President in the Angiography and X-Ray business of Siemens Healthcare and is currently CEO of Siemens Technology Accelerator GmbH (www.siemens.com/sta) and Head of Licensing at Siemens AG in Munich. He is also a guest lecturer on Technology and Innovation at the Technical University of Munich and regularly authors publications and speaks on related topics.

In addition, Dr. Freytag is a Qualified Member of the Supervisory Board (Certified by Deutsche Börse AG) and has been serving as a board member in start-ups for many years. He is furthermore a member of the Board of Directors of the collaborative innovation network "Munich Network," a member of ArMiD (Aufsichtsräte Mittelstand in Germany), and a member of AdAR (Arbeitskreis Deutscher Aufsichtrat).

Strategic Uses of IP: Applying Learnings from Large Companies to Start-Ups

Sonja London

1 Why Should Start-Ups Care About IP?

Large established technology companies usually have an intellectual property (IP) strategy in place, and they expect to receive various business benefits from their IP strategy. This chapter discusses what a start-up can learn from the *IP strategy of large companies* and *how start-ups can use similar business benefits for their business*.

Why is this important and why should start-ups care? Some start-ups say they are too small or that they lack money or other resources. Some say they are just too busy to care about IP. Some start-ups believe in an open-source approach and do not believe in patenting inventions. Some may wish to keep their innovation as trade secrets. Maybe some start-ups believe that winning the business is just a question of being fast and getting there before others do. What, then, is the strategic role of IP for start-ups anyway?

Start-ups should care about IP because it may help with building and protecting their local or global business. They should care because investing in IP can generate huge returns for them. They should care because without IP protection, at worst, their business can be copied, their intellectual property used without permission, or their business otherwise placed under serious threat of losing revenue and profit; they may even lose their business and cease to exist. If a start-up doesn't care about IP, their business might be exposed to business threats from others that do care. If IP is taken as part of a start-up's strategic plan, many business benefits become available.

S. London (✉)
TactoTek Oy, Oulunsalo, Finland
e-mail: sonja.london@fearless-ip.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_11

2 Strategic Uses of IP in Large Companies

Strategic uses of IP may be seen differently in small and large companies. This is to be expected, as some forms of exploitation of IP may require considerable resources, which only larger companies usually have. Resources typically consist of knowledge and IP-related know-how, as well as the financial means to hire people, establish processes, or use external people as resources. Whether or not such resources are available, the big picture is important for small companies seeking to expand, and they will need to understand their IP strategy going forward. This is an important learning point for start-ups: Think big and prepare yourself for the time when you will reach your targets. Even though resource constraints may be present daily, and the start-up life may require running toward the next financing round, it is key to lay the grounds for efficient and intelligent – meaning strategic – uses of IP. Start-ups need to find a way to balance the long-term work required by IP exploitation and the short-term working targets perpetually present in the start-up life.

There are many ways of using IP strategically, and it can be categorized in different ways as well. The categorization referred to in this chapter has been employed at *Nokia Corporation* from 2007 to 2018, perhaps longer. It has been used in many internal and external presentations by *Nokia*. The exact source of this categorization is unknown; it was likely a collaborative effort.

Nokia categorized the strategic uses of IP as follows: freedom of action, advantage over competition, influencing business environment, differentiation of products, and revenue creation (see Fig. 1).

The overarching idea of building shareholder value is the author's addition to this picture. It is especially useful from the viewpoint of smaller companies because it brings the strategic uses together with the ultimate goal of growing the business's value and therefore growing the shareholder value. It is important to understand that even the most high-level strategy must contribute to tangible shareholder value.

Building shareholder value is at the center of the diagram, as all the strategic uses of IP naturally aim to build shareholder value. Shareholder value is built through a portfolio of assets that directly or indirectly enable the strategic uses of IP. Using such assets effectively and proactively aims to achieve the strategic benefits and therefore shareholder value.

3 Strategic Uses of IP for Start-Ups

This chapter presents some considerations regarding strategic uses of IP and what can be learned from a large company's perspective, what kind of thinking and ideas may be beneficial for start-ups, and generally what start-ups should know and consider about strategic uses of IP in their growth journeys. The strategic uses discussed herein are according to the categorization used by *Nokia*, as indicated in the previous section.

Fig. 1 Strategic uses of IP, based on *Nokia* materials from 2007 to 2018 (developed by the author)

3.1 Freedom of Action

Freedom of action is sometimes understood to be the same as *freedom to operate*, but it is a more extensive concept than freedom to operate. Freedom of action can be understood as a more all-encompassing term: It includes the well-known concept of freedom to operate but is much more than that. As a concept, it is the freedom to act in the relevant markets in many strategic ways, depending on the company's wishes. It may comprise sales, research and development, the regulatory environment, product development, product launches, market entry, or mergers and acquisitions activity, to name a few. Freedom of action could, for example, mean that the company has access to the technology needed for the company's own products, manufacturing, or services. Sometimes cross-licensing with other patent holders is required for establishing freedom of action in the market. Sometimes freedom of action translates as litigation avoidance, if most of the value will come from concentrating on one's own business. In that case, being able to continue the

business without litigation and the threat of injunction is freedom of action. Freedom of action may also include elements of business continuity by ensuring that relevant technology and IP stay within the entity with no changes caused by people leaving the company. Sometimes freedom of action means a favorable regulatory environment or decisions, or even minimal regulatory supervision.

Freedom to operate, meanwhile, refers to the freedom to carry out the current business in question. Therefore, freedom to operate is a somewhat more restrictive concept. These two should not be confused. Freedom of action is ultimately the goal and freedom to operate is an enabler toward that goal. Smaller companies typically concentrate on freedom to operate while larger companies that have more market power may be able to build their own freedom of action. Oftentimes, freedom-to-operate (FTO) analyses are required from start-ups by investors. The aim of these analyses is typically to make sure the company's products or services are not infringing on patents or under imminent threat of litigation or injunction. Another viewpoint in these analyses may be to confirm that the company has IP and understands the value of that IP. There is no general or standard way to make an FTO analysis, so the contents may vary. An FTO analysis may answer questions that are relevant to the person who asked them but totally irrelevant for someone else. The problem with these analyses is also that they usually cannot be excessively costly because the investor or the company ordering the analysis does not want to pay a great deal for it. Every portfolio and business situation is different, and depending on the technology in question, there may be a number of patents in the area to be analyzed. An in-depth analysis costs money and the low-cost approach may produce a paper for a tick-the-box due diligence but not much value for evaluating a strategic IP position.

Freedom of action is an important aspect to understand as part of the business environment as well as a part of the IP strategy. Even if freedom of action feels out of reach for a smaller company or start-up, such a business needs to understand the benefits that IP can deliver if that goal is achieved. Normally, no company can have full freedom of action, but getting to a comfortable level is in itself a very good result. A start-up's view on freedom of action will differ from that of a growth company or an established company. As IP is a long-term investment, it requires a long-term strategic view too.

A few perspectives on how to enable freedom of action are discussed below:

Access to Technology The first benefit for any company with regard to freedom of action is to gain sufficient access to technology. The starting point is of course for the company to develop its own technology and IP portfolio. However, there is a limit to what it can do on its own. Most companies, even large ones, are not in the position to innovate for and on behalf of all the companies in their industry. In most industries, everyone must at some point rely on technology that others have invented and invested in. This is especially the case for start-ups. Access to technology is often a supply chain question: A company's supply chain may provide access to technology by supplying components, design, and technology. Many times, it's also a question of whether developing something inside the company or licensing it is

cheaper or faster. Sometimes acquiring another company resolves the question of access to technology. In-licensing may involve software, patents, or technology which are needed by the company. In connection with an IP strategy, access to technology usually means the possibility to use technology covered by patents owned by third parties. A company should consider whether it has access to the technology it needs and what should be done to gain access.

This question is also relevant to start-ups. A small company cannot innovate everything by itself, so it inevitably needs access to third-party technology. In software, this can be done by licensing commercial software or using open-source software. In the patent world, a start-up should evaluate whether it needs a license to patents or not. There are several points to consider. For example, would it make a better business story if the company has ensured that it has the required licenses and partnered with key technology innovators? Another point to think about is whether licenses are affordable and whether infringement litigation is an imminent or real threat. Start-ups should consider their IP risk position and potentially rapid changes to that position when they grow. A start-up may go "under the radar" for some time regarding infringement of IP, but a unicorn most definitely will not. Licensing questions typically arise before stock listing a company or before publicly announced acquisitions.

Cross-licensing For gaining freedom of action, one of the main uses of patents by large companies is cross-licensing. This typically means that a company can have access to its competitors' patents by cross-licensing: Both parties license their relevant patents (or all patents) to each other. Sometimes, these cross licenses are called zero-cross licenses, where neither party pays the other, so no money moves. Other times, the company that has more sales exposed to the other party's patents must pay a balancing payment to the other. Or, if both parties' sales are about equal, so that their exposure is equal, but one party has more patents, the party with the smaller number of patents pays the other. This is of course a very rough simplification, but one intended to provide the reader with a picture of the potential benefits of cross-licensing.

In the start-up world of small companies, cross-licensing is not a particularly topical question. It will become more relevant when companies grow, and the market matures so that there are clearly competitors in the same branch of technology owning patents that may be infringed on by others. However, understanding the concept of cross-licensing also enables start-ups to look at their patenting and patent management from this angle: Can a company's patents later provide access to competitor technology or save some cost when they need to pay for a license?

Standardization This chapter does not discuss standards and standard essential patents in depth but will briefly explain standardization as a concept because it is also useful information for start-ups.

Standardization means a process where standards for technology are created to enable interoperable products and services on the market. Standardization is important for allowing market entry for companies and not to limit it by technology

choices. Standardization enables access to technology because innovators contributing to standards will commit to licensing the technology on (fair,) reasonable, and non-discriminatory terms. Using standardized technology will therefore enable access to technology and market entry. Standardization is relevant to many industries, especially in telecommunications and consumer electronics. It is a very long-term process in which some large innovator companies take part. While it typically would not be relevant to start-ups in their early phases of growth, there might be exceptions, especially in the case of new, emerging technologies. If a start-up is working on a technology field that is not standardized, but the industry would benefit from standardization because it would enable interoperable products, then it is possible that over time some standardization efforts emerge. Even a start-up should carefully follow such developments, and whether to participate or stay out will be a strategic question later.

Depending on the industry, start-ups may benefit from understanding the available standardized technology. This is especially advisable if the company is operating in the field of devices or services using, for example, wireless connectivity technologies, video, or audio technologies.

Litigation Avoidance Litigation avoidance is a business strategy in its own, especially in the generic pharma industry, where companies seek to find unpatented territories for ingredients and manufacturing methods. In the electronics field, it may be nearly impossible to develop products which would not use technology that someone has already patented. For example, many electronics are connected and use wireless connectivity technology, which is also standardized and therefore a must for companies wanting to make interoperable and standard-compliant products. When companies use technology patented by third parties without ensuring access to technology by licensing, it is possible that litigation will follow.

Litigation avoidance is an important freedom-of-action strategy. The conventional tools to avoid litigation are to use cross-licensing between major players in the field or to license from patent pools, which provide licenses from many patent owners in one contract. Some companies seem to use protracted negotiation as a litigation avoidance strategy, but this will not serve the purpose for long and the courts will not appreciate such behavior from an infringer.

Business Continuity Being able to continue doing business irrespective of a changing business environment is vital for all companies. IP as a long-term investment supports this goal, as it provides protection for exploiting the patented innovation. For start-ups, IP and business continuity are highly relevant, mostly for ensuring that IP will stay in the company even if key personnel were to leave.

3.2 Advantage Over Competition

Companies aim to enhance their competitive position, an objective in which IP can be very helpful. With IP, a company may be able to develop several different kinds of advantages that will make it more competitive over other companies.

An advantage over competition means, for instance, being able to enter a market that competitors cannot, the benefit of premium brand, access to the technology needed, product differentiators (e.g., visual, brand element, or technological features), or a beneficial cost structure. The following examples provide a high-level understanding of what is needed in start-ups.

Excluding Others Patents will grant a right to exclude others from making, using, selling, offering to sell, importing, exporting, or otherwise disposing of a patented invention. This right to exclude others offers a company an enormous benefit over the competition because, in practice, it gives the company the means to prevent others from doing the same business, selling in the same market, or using the same technology in its products.

IP might be used strategically to block competitors from the market. The right to exclude requires that products are on the market (i.e., there are products), the selling or manufacturing of which can be prevented. However, the right to exclude others does not happen automatically. It requires active enforcement and resources to realize. The right is meaningless if the owner does not have the resources to enforce it or is unwilling to do so for other reasons. This is a critical consideration for start-ups that may not be equipped for enforcement, and resource constraints may be one of the reasons some start-ups are not keen to develop their IP portfolio.

Having restricted resources, however, does not mean a start-up would not be able to acquire the resources that are needed. Alternative ways to *fund enforcement* do exist, at least for those that have high-quality IP assets. Here are two examples of how smaller and resource-restricted companies may enforce their IP to exclude others.

First, in the U.S. market, there are entities that sue third-party infringers for profit share. While their business may not be generally appreciated in the market, they may be able to help a smaller company to enforce against a larger one. The typical model would be to sell a patent to the enforcement company which carries the costs and will provide profit share to the seller once the case has been won. This kind of arrangement does not come risk-free and requires careful consideration. For example, after selling the patent, there may be little control left for the seller in the litigation that follows. If the litigation touches supply chain or customer relationships, it may be detrimental to those relations. Also, the seller may be granted little or no transparency concerning the costs that will be deducted from the proceeds before a profit share. Such an arrangement is possible but requires expertise and usually bargaining power to negotiate.

Secondly, in United States and in the EU markets, there are also entities that provide litigation financing for companies seeking to enforce their patents. This kind of arrangement also requires very high-quality assets and a litigation team.

Both examples are opportunities which can be considered in the event that there are high-quality assets, risk-taking ability, and a large enough economic interest in question. They are not easy choices, and there are also consequences such as customer perception and reputation to consider. But at least there are choices, even for smaller companies.

An additional viewpoint to reflect on, especially for start-ups, is that even if the company itself is not willing, or even able, to enforce its IP, its potential acquiror may be. Large companies acquire small companies all the time and also do their due diligence on the IP portfolio. It makes sense for the acquiror not to draw attention to the potential value of the IP portfolio of the company to be acquired, as this would potentially raise the value of the acquisition deal. For the same reasons, start-ups owning IP, especially patents, should be aware of their IP's potential not only for themselves, but for the competitive landscape. This awareness should then translate into a value creation story demonstrating why this IP would have even more value to the acquiror than the current start-up owner. If a start-up is able, on technical and commercial IP-based grounds, to position itself as an important piece in the competition game between far larger competitors, then the start-up has really achieved good value creation with IP.

Finally, it is important to note that the right to exclude others will be at the center of any IP strategy because it will be the enabler for any licensing situation and the key to any litigation avoidance. Without this threat or potential IP risk, there would be no incentive to develop IP for a company's own protection or to pay royalties to an IP owner. Thus, the right to exclude others as a strategy to provide advantage over competition is in some way present in all IP strategies.

Access to Technology This angle to technology has been discussed at length elsewhere, so only the basic concept is mentioned here. Many companies make products and provide services that use inventions made by others. Ensuring access to such inventions or technology may provide competitive advantage, for example in the form of better products, cheaper manufacturing, and more sales. Sometimes ensuring exclusive access may provide the advantage; other times the advantage comes from a favorable price for technology that is widely available.

Favorable Cost Structure Another way to use IP for strategic advantage is for achieving a competitive bill of materials through favorable royalty rates. Typically, the aim is to have lower costs than the competition. The advantage over the competition may also mean being able to prevent free riders from having a cost advantage through licensing efforts.

Many start-ups are working on premium products, and the IP cost structure within their bill of materials may not be their top concern. However, when competition arises and the markets mature, the cost structure becomes a more important question. From this point of view, even small companies should seek to balance their royalty stack between access to technology and a favorable cost structure. In practice, they should carefully assess what technology they are paying for. Which license payment is the best investment for their access to technology, their reputation as corporate

citizens, the market perception of their products, and their potential and actual litigation avoidance and costs?

Preventing Free Riders In all industries, it is for the benefit of all parties to ensure a level playing field, meaning fair competition between different market players. Part of the level playing field touches on equal opportunity for market entry; part of it is about non-discrimination in the terms and conditions for access to technology. Standardization and related standard essential patents (SEPs) are trying to resolve these questions by establishing a system where technology access is available on fair and reasonable terms to allow market entry. Whether or not the question is about standardized technology, it is important for each of the market players to get access to technology at a price that is as favorable as possible, preferably a more favorable cost level than what others pay. IP can, in that sense, be used to balance payments to other IP owners.

However, if a company does not own IP, it will aim to ensure a lower or similar royalty payment level to what its competitors pay. In many industries, especially those using standardized technology, there is a growing problem of free riding, in other words, companies not paying royalties to IP owners at the level others are paying. Free-riding is a serious competitive problem where those using technology and paying for it will be in a less favorable market position than those who free-ride and do not pay. Thus, it is in the interest of all IP owners, irrespective of the chosen strategy, to prevent free-riding.

Many start-ups are not particularly interested in these industry-wide questions of free-riding and instead concentrate on their day-to-day activities. However, in this way, they do not realize the benefits of their larger IP ecosystem. If preventing free riders is beneficial, as it should be understood to be for anyone who is innovating and developing new technologies, then joining other companies in the effort will be advantageous, and smaller companies should benefit from being on the same side as larger companies and getting their support.

Asset Development To be able to use IP strategically, regardless of the chosen IP strategy, a company must have developed IP assets in the form of registered or unregistered intellectual property rights (IPRs). The different businesses may require very different approaches and investment in IP asset development, and each individual company will have to find its own path forward. The most effective way to strategically invest and build the portfolio is through strategic thinking on how the company will use its IP and what kind of strategic uses and benefits the company is aiming to obtain.

For example, if a company, even a start-up, knows that there will be a lot more competition emerging in the coming years, what should it do? It makes sense to develop IP not only in its core field, to prevent copying, but also to develop IP in the field of its competitors. A portfolio of patents, that could be infringed on by a competitor, would enable later enforcement or cross licensing. Another example is that if a start-up is or plans to be licensing its technology to others, it should take into account its own product road map in patenting, but also the larger industry road map

to ensure that its IP is relevant to customers. For licensing purposes, patents need to be of high quality. Companies should patent their best ideas, and not only for key concepts but potentially also for other existing or potential applications. A carefully designed and multi-layered patent portfolio will be more usable for licensing. Start-ups need to balance the costs of portfolio building with the expected benefits. Most companies are working under strict budgets and need to carefully evaluate what to patent. Finally, it is advisable to invest in internal and external know-how for portfolio building and management.

Technology Licensing and Patent Licensing may provide important advantages over competition. They are elaborated on in Sect. 3.5, where revenue creation as one of the strategic uses of IP is discussed.

3.3 Influencing the Business Environment

Influencing the business environment refers to ecosystem building or joining or supporting a favorable ecosystem, whether it is technological, related to standardization or the licensing ecosystem. Typically, influencing the business environment would include boosting the adoption of preferred technologies or taking part in standardization processes or collaboration and partnering for a preferable business environment. Sometimes this influencing can be positioning oneself as a value element in third parties' strategic plans. This could materialize, for example, when technology companies are being acquired as part of the technology road map of a larger entity.

Ecosystems: Building or Joining a Favorable Ecosystem No company, especially start-ups, can operate totally alone. Every company needs some kind of cooperation with others. There are many different support and cooperation vehicles available for start-ups, incubators, accelerators, and mentors. In connection with IP, these ecosystems refer to research cooperation with universities, research centers and other companies, joint marketing efforts, joint research projects, standardization projects, and more. An ecosystem may also be supply chain related. An ecosystem typically would include some form of cooperation with one or more parties, which could be research, marketing, selling, seeking funding, product development, testing, and so on. Usually there is some form of contribution to the activity, whether it is work, money, network, connections, access to technology, IP, or something else. An ecosystem typically offers some benefits for participants to incentivize their efforts, which are generally more extensive than a one-time project.

Regarding IP, ecosystems generally include research collaboration. In the European Union, there are various possibilities to join EU-funded research activities and funding vehicles. Many research funding facilities, especially those built for specific industries, want to offer "smart money" as well as accelerator services and access to potential investors and corporate customers. These are opportunities every start-up should be aware of. If the company is operating in an existing industry, it

may consider joining others in cooperation. If the industry is new, it is even more important to partner with others, as start-ups are too small to cater to the whole world.

There is one important point to be made for start-ups as compared to large companies. Large companies may want to create an ecosystem for controlling a technology environment, promoting its proprietary technology, or impacting standardization with all of its power and resources. Start-ups do not have that power, and the only way to impact a larger ecosystem is to build their own (as has been seen with some rare unicorn cases) or join the others in cooperation to create something more impactful. For start-ups, ecosystems can be optimal ways to benefit from the research of other parties and to promote their own technology for more widespread adoption. Small companies may also take part in standardization and impact the standardized technology. For start-ups, it is good to keep in mind what kind of ecosystems would support their business from an IP point of view. Below are some points to consider.

Sharing IP with Others and Getting Access to Third-Party IP The usual way to think about IP is that a company needs to own as much IP as they can in order to be able to gain a winning position in the markets. While this is a good starting point, start-ups should also understand where they are positioning themselves technologically. Many technologies have prerequisite and adjacent technologies that are also needed, but a small company may face difficulties in trying cover all of these technologies themselves. For example, if the company is designing new products, there might be manufacturing technologies needed to create the product. If the company is also manufacturing the products, they may need to benefit from material or component technologies. These steps would be taken by the supply chain or larger ecosystem of different operators. For a small company, it might be beneficial to partner with others, where supply chains and joint research can serve other companies' IP and competencies. In such arrangements, typical questions affect IP ownership: whether or not there is joint IP and what kind of rights of use are granted to others, if any. The best starting position is to own as much IP as you can, not have jointly owned IP (if possible), grant others only limited and non-exclusive rights to own IP, and get as extensive as possible license rights to other parties' IP. This may be easy in theory, but in practice it may be hard to negotiate. A start-up should take a critical look at what it is negotiating for. Often the real impact of an IP arrangement will unfold when the operating environment or the company's situation changes.

Sometimes IP arrangements include membership organizations where participants grant each other access to their technology by way of a license or just give a waiver of right to enforce. While this kind of arrangement may take away the risk of patent litigation, it may also leave participants without the means to react and use enforcement rights if the market and competition situation changes. For example, free *cross-licensing* between ecosystem members may sound like a good idea when a start-up does not yet have a competitive IP portfolio. The situation might be very different for a growth company or a future acquisition situation, when an acquiror's competitor is already licensed due to ecosystem rules. Free cross licenses

might create value in one situation and destroy value in another. Start-ups should think ahead to where they aim to be in the future and build their collaborations accordingly.

Sometimes it is beneficial to get others to adopt a company's own technology, use it widely, and start developing products based on it. In this kind of situation, it may be advantageous to grant access to a company's IP to other companies, even for free or for low compensation. This way, a company can use its IP for boosting the adoption of its own or other preferred technologies. Companies working in the same field may grant IP rights to enable collaboration and partnering for a preferable and more competitive business environment.

Regulatory Environment Often IP questions are also tied to regulatory discussions regarding, for example, market entry possibilities and whether IP will be used for preventing market entry, or whether some arrangement is restricting competition or is considered to be an abuse of dominant position in the market. From a start-up's point of view, these may be very distant questions, but they will become more relevant when the company grows in the future. It is important to understand the basics of dos and don'ts from a competition law perspective, especially if companies are actively building ecosystems.

Positioning Oneself as a Value Element in a Third Party's Plans Usually, companies build their IP portfolio to support their current and future business. Sometimes companies also build an IP portfolio so that their competitors may become infringers of the portfolio. Furthermore, it is possible that a company, even a start-up, has a platform technology on which numerous other applications are based. This means that many players, whether or not they are current competitors, may be infringers at a later point in time. A start-up may not be able or willing to utilize the full power of this kind of IP, but a future larger acquiror may be. As discussed in Sect. 3.2, if a start-up has IP that may, for one reason or another, be valuable to a potential acquiror, it may be able to realize great value for the IP in a later acquisition. Even better, if such platform technology could be a piece in a larger company's competition game, then the value of such a portfolio could potentially be high. Whether a start-up is able to demonstrate, or communicate, this value is a different question. And this leads the discussion to the topic of the perception of one's IP position.

Perception of IP Position For a large company, there is a need to be recognized as a strong player in IP because this supports many of the strategic uses of IP. It makes licensing easier and a company's voice heard by regulators and even courts. While this seems like the distant future to start-ups, it is advisable to take an IP position as part of strategic and marketing communications, investor relations, and so on. If an investor knows through a due diligence process that the company owns patents, this is more like a tick-the-box scenario. If they understand the strength and full potential of the portfolio, they will be able to consider this as part of the valuation and strategic plans to come. If a company faces a tough negotiation with its partners or customers,

the perception of a strong IP position may be helpful in resolving disputes. For example, the potential for counter-asserting against a company that sues might keep the lawsuit away. A reputation of a company defending its IP will send a strong message to other companies. The creation of such a perception is partly about acting to defend patents, partly about marketing, and partly about general communications and subject matter communications by the company. For any IP-owning company, large or small, better value for the IP can be found, if there are active communications to build and boost the value of IP.

3.4 Differentiation of Products

These are probably the most well-known strategic uses of IP: protecting unique features of a product, whether they are technical or about its look and feel. Differentiation may occur in the form of technology that is protected by patents or other forms of IP such as trademark/branding or even copyright.

Look and Feel Protecting the unique features of a company's product is important, especially in manufacturing and selling products and services, where success in the market is dependent on the attractiveness of the products and services sold. Regardless of how differentiation is done, it is an important part of a company's product strategy. Look-and-feel protection is usually a combination of protected trademarks, brand image, product designs, and also technological innovation, such as patented user interface or human/machine interface solutions. IP will be relevant to any of the chosen elements mentioned. If a company deems that IP would not be relevant, this should be an informed decision by the company.

This chapter specifically excludes trademarks and branding as they are discussed elsewhere at length. However, it is worth mentioning that branding is probably the most common way to differentiate products or services. A good brand strategy, including a trademark strategy, is important for any business. Even in a business where companies are not manufacturing products, companies need to define how they will differentiate themselves.

3.5 Revenue and Other Forms of Value Creation with IP

Finally, perhaps the most debated strategic use of IP is revenue creation. This includes licensing patents, copyrights, technology, or trademarks/brands. Alternatively, revenue might be generated by the sale of IP. New ways to create revenue are being developed, for example, through subscription-based participation in IP, but ultimately revenue generation comes down to licensing or the sale of IP (see Table 1).

For any business, it is worthwhile to consider what kind of IP revenue sources are or could be available to the company, both in the near future and the long term, and what kind of investments would be required to realize these revenue opportunities.

Table 1 Monetary and other value creation (author's own table)

Direct monetary value/revenue creation	Indirect monetary value creation
Technology licensing	Value creation in and for an exit
Patent licensing	Value in partnerships
Cross-licensing with balancing payments	Cross-licensing without balancing payments
Sale of IP	

Technology Licensing Technology licensing means granting specifically defined rights to use technology assets, which may include patents, designs, trademarks, and copyrighted software, but also many other things often protected by trade secrets, for example design rules, materials testing results, specifications, manuals, and other know-how elements. Technology licensing may be part of an IP strategy, but it may also be a business or an additional revenue-creating business on top of others. Generally, technology licensing is possible if the technology in question is mature enough so that customers want to pay for it. Typically, technology would provide newer, cheaper, or better features for a product, component, or manufacturing process. A licensor needs to invest in its technology assets to make them usable and attractive to licensees. These investments are mostly R&D investments but also include investments in protecting IP and licensing activities and skilled people.

Licensing technology from a third party may give a company a competitive advantage if the technology access results in better or cheaper products or other technology benefits, such as faster product development and faster time to market. Technology licensing as a business model is typically perceived as positive because the license provides for tangible benefits which would otherwise be unavailable. Thus, in-licensing to get access to technology may be part of an IP strategy. Technology licensing is a popular IP business model, as it enables market entry for technology without the need to manufacture products. Technology licensing also enables many kinds of pricing and royalty models and more pricing freedom for a licensor compared to, for example, standard essential patents licensing.

Patent Licensing Licensing only patents and not any other technology assets is called "pure" patent licensing. Pure patent licensing may be present in an IP strategy in the form of a patent licensing program, cross-licensing, or as part of settlements followed by third-party patent assertion. Pure patent licensing is somewhat popular as a business model, especially in the field of standard essential patent licensing. Patent licensing programs may also be an additional revenue source for a company.

Sometimes patent licensing is perceived to be a negative business model when compared to technology licensing, especially in the case of standard essential patents. This is because the investment in the technology has already been done and the patent is public, so users of the technology do not feel any urge to pay for the technology they have access to. Sometimes technology implementers do not even know – or want to know – which IP is included in the components they use. In some industries, the product manufacturers are not interested in securing access to technology but want their supply chain to take care of it. It is advisable for companies,

irrespective of the chosen strategy, to carefully assess their need for in-licensing or a strategy for out-licensing. Patent licensing is not an easy business, and to be commercially successful, it usually requires investment in high-quality asset creation, a solid team, expertise, and enforcement.

Cross-licensing with or without Balancing Payments This has been discussed in the previous sections in connection with enabling freedom of action, litigation avoidance, and creating a favorable cost structure. With cross-licensing, the aim is typically to reduce payments to other parties. However, cross licenses may also include one-sided balancing payments.

Sale of IP Sale of IP means giving the full ownership, right and title, to a third party, typically against payment or another consideration of value. Regarding any form of IP, this usually is only done once between the parties, so unlike licensing where only a right to use is granted, the sale of IP is not a repeatable or scalable business. It is typical that owners of large portfolios will at some point start to consider the maintenance cost of the portfolio and more carefully assess which IP they will need for their strategic uses, and which is less valuable to them in that strategic context. If a company does not want to carry the maintenance cost, they basically have two choices: either sell the patent or "trim"/"groom," meaning that they stop maintenance payments to some or all of the jurisdictions where the patent is in force and let the rest lapse.

A similar choice may also be topical to smaller companies, even start-ups. It might not even be purely a cost issue, but a company may want to stop payments or just seek a buyer for an IP asset that could have more relevance and value for someone else. It is also advisable to concentrate on building a portfolio based on relevant IP. In actuality, many start-ups have their portfolio building started around "whatever patentable ideas" there were at the time. Some may have built a small portfolio to gain a more positive perception from investors rather than really base the portfolio on good technology. Some start-ups became more organized in their approach to IP in their later growth phase. So, there might be IP that could have value.

As the value of IP is highly contextual and depends a lot on the buyer's situation and IP position, the best way to find out if there is value is to try to sell the IP. At least it is worth trying before disbanding the IP. There are several consultants, brokers, aggregators, and marketplaces for IP through which companies can try selling their IP. Also, industry players can sometimes be approached for this purpose, but based on this author's personal experience, they will be very selective in anything they acquire.

More and more companies are offering patents for sale. The prices per patent are generally not on a very high level, with the exception for IP that is of high quality and relevant to large markets or numbers of products, so that the economic value of the patent for its new owner may be high. Patent valuation is an art in itself, and it is prudent for start-ups to get advice before starting the sales process.

Value Creation in and for an Exit Monetary value can be created in an indirect way using IP. This refers to using IP in creating value, in other words, a better monetary outcome in a business transaction, for example an exit. This is especially relevant for start-ups. As discussed in the previous sections, even a start-up can create value with IP if it can position itself as an important piece in the game of other players. Sometimes this important piece is a software platform or algorithm, or even customers or an impeccable supply chain. Sometimes it can be IP, if the IP is strong and relevant enough to impact a larger industry of the new owner. For example, if an acquiror of a start-up gets ownership of patents relevant to new technologies used in its competitors' products, then the new owner may be able to benefit from them in cross-licensing or using them in enforcement to block competitor products. If the start-up can communicate these possibilities and prove the potential value, then value is created. If the acquiror does not see the value of the IP and is not ready to pay for it, can it be excluded from the deal? This is a relevant question to be discussed between the parties, although the bargaining power of a start-up in a potential exit may be limited in such details.

Value Creation in Partnerships This has been discussed in the context of influencing a business environment. Partnering with others to gain access to IP, or offering access to IP, may provide valuable indirect benefits to companies. These could involve, for example, cost savings, decreased IP risk, or litigation avoidance.

4 Recommendations for Strategy Implementation for Start-Ups

The previous sections have discussed a number of different strategic uses of IP as well as a number of viewpoints to consider, some of which are highly technical. Making the most out of an IP portfolio is difficult even for seasoned professionals, so how can start-ups implement IP into their company and IP strategies? This portion of the chapter provides some recommendations for IP implementation that start-ups will hopefully find useful.

These recommendations specifically include:

- Aligning the IP strategy with the company strategy
- Conducting regular scenario work
- Considering different ways of value creation
- Assessing risk and planning for its mitigation

4.1 Aligning the IP Strategy with the Company Strategy

Any IP strategy should be part of the company's overall strategy, start-ups being no exception. If the company strategy is unclear, the IP strategy will be unclear and most of the benefits will not be realized. Any strategy should have a target to achieve

and the means to get there in some anticipated time frame. The same goes for an IP strategy, although its main purpose should be to provide tools to support and realize the company strategy. Scenario work, as discussed below, is helpful in choosing the right tools. Here are some viewpoints to consider when aligning an IP strategy with the company strategy:

Value Creation The first and most important consideration is value creation within the company strategy. Does value creation with IP fit into the company strategy and in which way? What kind of monetary value, if any, could the company's IP create? Maybe it is not a good fit for the strategy now but does it have the potential to be in the future? If a company strategy changes, what happens to the IP value creation under the different options? What kind of road map for IP value creation would a start-up need to support and materialize its strategy? With the learnings presented in this chapter, a start-up should be able to create a few alternatives and use them as part of the scenario work, as discussed below.

Creating an Ecosystem Strategy What kind of IP-related ecosystems would support the company strategy? Depending on the business situation, start-ups may get additional IP benefits and growth by collaborating and building ecosystems. They may also need to rely on partnering with other companies and ecosystems. These opportunities should be carefully assessed, as often seemingly beneficial arrangements may involve IP terms and conditions harmful to future operations of the company when it has grown larger. Some ecosystems will have pre-existing IP-related terms and conditions which all participants need to commit to. It is advisable to seek professional guidance to help assess the situation, as usually the IP terms of these arrangements are complex and may have a far-reaching impact on the future of the business. If a company wants to develop an ecosystem of its own or together with others, it will be necessary for them to use the same careful considerations regarding the potential future IP terms and conditions they create.

Creating a Growth Road Map That Considers the IP Position A road map for growth is a useful tool for considering the strategic uses of IP and the company strategy. A company's strategy is a plan on how its targets will be reached; typically, the strategy evolves over time. This could be growth in revenue, value, number of users, or other metrics. When the anticipated growth is mapped over time and business actions, it is easier to understand where IP might be useful to enable or support the anticipated growth.

For example, freedom-of-action considerations can be put in the context of a start-up's anticipated growth road map. How will a start-up's freedom-of-action situation change when it grows? Big companies generally do not find it worthwhile to fight with small companies, but when small companies' revenues grow, they will inevitably draw attention from those whose technology contributed to that growth. Start-ups should consider this before they grow. What is their growth strategy and what kinds of IP considerations are relevant? For example, major IP issues should be

cleared before an IPO or exit, as they can otherwise have a negative impact on the company value.

If a company grows ten or a hundred times bigger in revenue and expands its global presence significantly in two or three years, what does that growth mean in practice to its IP risk position? What kind of opportunities to use IP strategically may open? Will litigation risk grow or diminish? What kind of portfolio might be needed to protect the business on new markets? Are copycats on the move? It makes sense to set forth a plan for growth and a plan for how to use IP as an enabler and protector during the journey.

Exit Strategy Not all start-ups have a clearly communicated exit strategy. Most founders do have at least some idea of the company's exit potential. As this chapter has established, IP has a lot to contribute to a company's value, and therefore it may also be a significant contributor to the exit value and exit strategy. Start-ups should consider their strategy of value creation and how to use IP to build the most value realization in the exit. Could the company provide value to its potential future owners with its IP portfolio? Can the company be positioned as part of a larger industry level game?

Staying Ahead of the Competition Every company needs to stay ahead of their competition. While some possibilities may seem to be in the distant future for start-ups, the seeds of the future harvest will need to be planted well before growing big. Bad technology or patenting choices, or not laying grounds for effective IP management and strategic benefits, will be costly mistakes that are hard or even impossible to correct. Planning for future IP and making such investments early will enable better value creation for the company. Be early in your strategic planning!

4.2 Conducting Regular Scenario Work

Scenario work is a widely discussed and recognized tool for strategy work, and it is also useful as part of IP strategy work. Scenario work can include, for example, identifying key matters in the business environment and identifying possible alternative futures. Key business environment factors may be customers, supply chains, the economy, presence in a specific country, the product road map, or the IP portfolio. Scenarios describe alternative futures with regard to selected subjects that are analyzed, for example, how a pandemic may be handled, or the alternative ways competitors might conduct new businesses. Strategic foresight is gained when the impact of possible alternative futures in the selected business environment items are analyzed. Turning the analysis around and thinking about how the selected business environment matters may impact alternative futures, is also useful. This approach makes scenario work proactive, seeking to impact the future in addition to just trying to understand or predict it.

Start-ups should create scenarios of possible futures for the company and to consider how IP, and especially the strategic uses of IP, may contribute to these

scenarios. What happens to the company's IP position if a major change takes place? Could using IP strategically in certain ways promote a chosen favorable scenario? Or can IP help the company later if a less favorable scenario materializes? Scenario work will help in assessing which IP tool and opportunities should be used in different situations, and it may also help in prioritizing the company's IP-related work and resources. As the company grows and industries and technologies change, it is advisable to repeat and continue scenario work on a regular basis. Scenario work is very contextual and will look different for each company. Below are a few points to consider when conducting scenario work.

Using Scenario Work for Aligning with a Strategy Regular scenario work is useful when analyzing options for using IP strategically for the company's strategy and business models. When a start-up is considering its business model and strategic options thereof, different IP-related scenarios will be helpful in the analysis. For example, the patent filing strategy may be different for a product manufacturing business model and a technology licensing business model. If a start-up chooses one strategy but needs to change it for whatever reason, it makes sense to understand the potential implications of the change, both on a strategic level and on a practical level. For example, if a start-up's chosen strategy was to manufacture products, but due to opportunities in a more scalable licensing business model it also chooses to start this new business, what would it mean for the company? Adding a licensing business to its value creation may not change the IP risk position much, but changing from manufacturing to licensing may change it significantly.

If a start-up is planning to acquire companies later in its growth phase, scenario work can help in understanding potential future opportunities of the new entity that will be formed. Even more so, if a start-up plans to be acquired later, scenarios involving potential acquirors would help in understanding the value of a company's IP in the bigger picture. Scenario work may be very useful as well for understanding ecosystems and their impact on a company under different circumstances.

Freedom of Action While it may be difficult for start-ups to reach full freedom of action in practice, it is advisable to form a view on what freedom of action might look like. How can the company define the best-case scenario that it is striving for and the worst-case scenario in which its possibilities would be very limited? For example, with regard to access to technology, if the company does not develop its own solutions to certain areas of business but chooses to depend on third parties, how many choices will be available? Will they be dependent on one party or can they select from many alternatives? What will this scenario look like if all goes well or if the worst-case scenario materializes? Start-ups should make the tactical decisions to allow them as much *freedom to operate* and *freedom of action* as possible. Scenario work can help provide an understanding of the situation and the right tools to use for pursuing the most favorable future.

4.3 Considering Different Ways of Value Creation

As discussed earlier, a start-up can create value in many direct or indirect ways. The chosen strategy for value creation must be put into action. Here are some practical viewpoints to consider, which can easily be integrated with portfolio management and strategy work considerations.

Developing a Portfolio Using IP strategically starts with generating a portfolio that can be used to create value. A start-up must find a balance of cost and benefit in creating IP. As creating a portfolio is a long-term investment, resources are needed for research and development, internal and external resources for filing patents, management of the growing portfolio, and mandatory payments for the patent offices. It is advisable to obtain professional assistance in drafting and filing patents and to explore whether government subsidies exist for this activity. Active portfolio management is a widely discussed topic. For the purposes of this chapter, it is sufficient to just mention that portfolio management should increase business management's understanding of exploitation possibilities. For example, a company should be aware of the scope of their patents in general to be able to decide how those patents are later used.

Developing an Approach to Licensing Understanding the scenarios as explained above and having a view on a start-up's technology road map should help a company develop an approach or a plan for licensing. This would include an approach to in-licensing, out-licensing, and cross-licensing, as well as open-source and other potentially relevant factors. The plan would consider access to technology and define whether licenses are needed from third parties and what kind of terms are preferable. The plan should define the company's approach to open source and also on what terms, if any, it will be licensing its own technology to third parties. Whether this would be a business or whether licensing would only be done in cross-licensing situations should be evaluated. Moreover, would licensing be relevant only for litigation avoidance or would it be an enabler of other businesses? The IP risk position is discussed in more detail below.

Developing an Approach for Selling and Acquiring IP When a company has developed its own portfolio, at some point in time, it will need to consider what to do with IP that it does not need anymore but which creates maintenance costs for the company. It is advisable to implement a portfolio management process to identify assets which are not needed and to understand the reasons why. These assets may be abandoned, but alternatively, a good strategy would be to try to find a buyer for such assets. Learnings from this article should be helpful in identifying which markets and potential buyers might benefit from the asset and find it valuable. Similarly, the company should be identifying potential gaps in its IP assets and plan for the potential licensing or purchasing of such assets, if available and strategically beneficial.

Trademark and Brand Strategy Even though this chapter excludes trademarks and brands, it's good to remind start-ups that it makes sense to protect the company name, product names, and brand in general. Buying a .com domain name is not enough. This may seem obvious, but it is largely overlooked. Companies should also consider patenting their technological differentiators, if possible.

Almost every start-up the author of this chapter has seen is aiming to build a global business, and a global business will require the global protection of your brand and company identity. The learning for start-ups is that this element of IP cannot be ignored, as doing so would lead to loss or would destroy value instead of creating it. It is advisable to seek professionals to help in this matter.

4.4 Assessing Risk and Planning for Its Mitigation

IP risk assessment should be part of all IP strategies. Learnings about strategic uses of IP will help in implementing these strategic considerations into IP risk assessment and mitigation plans. IP risks can include infringement of IP, misappropriation of trade secrets by the company or by a third party, loss of title, loss of value, invalidity of IP, costly litigation or other legal action, prevented market entry, recall of products, injunction for sales in a geography, threat to business continuity, and so on.

Assessment of IP Risk Position Start-ups should think about their risk position, especially in terms of access to technology. They should take risk assessment as part of their approach to licensing. Some technologies are not available without a license, so a license may be required for access to technology. On the other hand, many technologies are available in the form of freely traded components without a pre-existing license. Every company, even start-ups, should understand what components and elements they use in their products and whether licenses are needed and from whom. Being a start-up is not an excuse for not being aware of the technology and IP used in the start-up's products and services. Making an analysis on *freedom of action* (or more limited *freedom-to-operate analysis*, FTO) is advisable, especially when the company is growing and before products are sold in the market.

Assessing a risk position should also include understanding the litigation risk position of the company and how that could change when the company grows. Are some technology areas or industries riskier than others? What does the litigation and IP risk landscape look like for a start-up in a particular business?

Litigation Strategy as Part of Risk Mitigation One of the most important learnings for start-ups in the context of IP is to understand the centrality of the IP owners' right to exclude others with IP. Start-ups need to understand their current IP risk scenario, especially in terms of litigation risk. This means that threat of litigation by others needs to be considered, as well as a company's own litigation threat against potential infringers. It is also advisable to consider a start-up's approach to alternative dispute resolution, such as mediation and arbitration. Alternative dispute

resolution (ADR) is discussed at length elsewhere, so it is only mentioned herein that depending on the scenario, it might offer beneficial alternatives for dispute resolution than in the courts. To enable enforcement scenarios within their chosen strategy, start-ups should ensure the development of high-quality IP assets. They should consider the company's IP position and enforcement possibilities, and evaluate the company's position as part of the larger industry game and technology landscape.

Considering Business Continuity For start-ups, business continuity may be one of the most critical IP risks. Small companies are often more dependent on individual contributors, such as founders and key personnel, than large companies. IP risk assessment should explore the impact of key people leaving and how this may impact a company's IP in the future. If one or more key persons leave the company with all the knowledge that they have, this may be detrimental to the company. In case such key people leave, and patents were not filed in the name of the start-up company, or transferred properly to the start-up, the start-up may end up not owning the IP important for its business. In this case, protecting IP in a timely and diligent manner helps to mitigate the business continuity risk: If a key person leaves, IP protection has secured the rights to technology for the company's use. This is a critical IP management issue, especially in start-ups. Often, companies start in a more or less messy environment with not all of the paperwork, filings, agreements, and documents in place. Start-ups should always secure, first of all, the filing of critical patents, if possible, and ensure the filing and transfer of title to the company.

5 Learnings and Takeaways

Start-ups should care about IP and learn to use it strategically because IP offers great business potential which can lay the foundation for entire businesses, enable them to grow, protect them from copying by third parties, and help in partnering with others. Strategically used, IP can create value in many ways, whereas ignoring IP as a strategic tool may lead to loss of value and many business risks materializing.

The strategic uses of IP are *freedom of action*, *advantage over competition*, *influencing the business environment*, *differentiation of products and services*, and *revenue creation*. All of these together build shareholder value.

For enabling implementation of the strategic uses of IP, it is advisable to first align the start-up's IP strategy with the overall company strategy. Conducting regular scenario work is useful for strategy work, as it helps to understand the opportunities and alternatives the strategic uses of IP present to the start-up's strategy. Start-ups should consider the strategic uses of IP in the context of value creation and define how IP is used to create value optimally. Finally, these learnings will help in IP risk assessment and making a plan for risk mitigation.

The next summary table aims to present at a high level the strategic uses of IP and some of the key considerations and questions to help start-ups in implementing the learnings provided in this chapter (see Table 2). These points are presented based on

Table 2 Strategic uses of IP – key considerations for start-ups (author's own table)

Strategic uses of IP	Key considerations for implementation for start-ups
Freedom of action	Get an understanding of your freedom to operate/freedom of action. Does the company have sufficient access to technology and markets? Develop an approach to licensing. Balance litigation avoidance and business benefits. Maintain core business's continuity.
Advantage over competition	Understand what kind of competitive advantage the road map can give you as the company grows. What would be the best possible competitive position gained with IP? Pay as little royalty as you can, or less than what others do. Prevent free riders, if possible. What would be an advantageous licensing position?
Influencing business environment	Understand the possibilities to leverage ongoing ecosystems in your industry. Can ecosystems enable access to technology and markets? Partner and collaborate prudently, protecting your IP position. If relevant, take part in standardization. Evaluate how to optimally position the company within the larger industry game. Determine how to create and maintain a positive perception of the company.
Differentiation of products	Understand the possibilities of brand and technological differentiation of products' "look and feel." A strong IP position will differentiate the licensing business. Consider brand and trademark protection.
Revenue creation	Enable maximum direct revenue or indirect economic value with IP. Consider required investments to realize the revenue-making possibilities.

experience and are not intended to be exhaustive. Every company should carefully evaluate its specific situation and IP position.

Takeaways

Using IP strategically allows companies to build shareholder value by securing optimal freedom of action in the relevant market, enabling an advantageous position over competitors, influencing the business environment to be more favorable, helping with differentiation of products and services from those of the competition, and creating maximum revenue or other economic value.

Strategic uses of IP:

- Freedom of action
- Advantage over the competition
- Influencing the business environment

(continued)

- Differentiation of products and services
- Revenue creation

Taking full advantage of the strategic uses of IP requires an in-depth understanding of the possibilities they offer, as well as the insightful implementation thereof.

Recommendations for strategy implementations for start-ups:
- Aligning the IP strategy with the company strategy
- Conducting regular scenario work
- Considering different ways of value creation
- Assessing risk and planning for its mitigation

Sonja London is General Counsel and Licensing Executive at TactoTek, the world-leading innovator in the field of smart surfaces and structural electronics. She has global responsibility of TactoTek's legal and compliance matters, as well as IP, licensing, and standardization strategies. Before joining TactoTek, she worked with the Nokia Patent Business for 14 years in various roles, in her latest position leading Nokia's Consumer Electronics licensing globally. She has been heavily involved in the licensing of various technologies for consumer electronics, mobile devices, and infrastructure products. Her experience also covers patent pools, joint licensing, patent transactions, as well as digitalizing and managing licensing businesses.

In addition, Ms. London is involved in deep technology and software start-ups and IP and growth companies as a board member, investor, and advisor. She serves as a Non-Executive Director of Licensing Executives Society International. She holds a Master of Laws from the University of Helsinki and an Executive MBA from Aalto University. She is ranked in IAM Strategy 300 as one of the world's top IP Strategists.

How the Life Sciences Industry Handles IP in Start-ups

Jörg Thomaier

When Sevim and Martin asked me if I would be interested in contributing to their handbook on intellectual property management for start-ups, I asked myself, "After nearly 25 years with a global blue chip's IP department, what knowledge related to start-ups can I share? How can I help guide them?" But then I realized what providing an industry's view of start-ups might mean here: In this chapter, I will thus try to explain what a life sciences blue chip might expect a start-up to deliver or have in place regarding intellectual property (IP) when cooperating with them, investing capital, doing a joint venture, or even taking over. I will also share what I have seen lacking when *Bayer* did such deals with start-ups, what mistakes I remember having observed in the past with such opportunities, and how I think those could be avoided: This type of information may inspire the leadership of a start-up to see IP as the requisite for success that it indeed is.

Maybe first I should clarify what I mean by "life sciences." Life sciences in my context refers to pharmaceuticals for humans and animals, chemical crop protection, as well as seeds and traits in the agrobusinesses. So, anything related to treating or breeding living creatures. In addition to my overarching focus on the life sciences, I will discuss the IT arena, as digital health and farming are in fact new areas of business my company is growing in, and digital is taking up more and more space in our daily lives and businesses.

Why do I contribute from this perspective? I do so because the R & D and innovation strategy of many, if not most, companies in the life sciences area, among others, is including more and more what is called "external innovation." Inter alia this means collaborating with, investing in, and taking over start-ups. Start-ups are thus increasingly a focus of my industry. This triggers, on the other end, a growing number of start-ups to try getting into relations with big industry players and making use of the opportunities they offer. Therefore, I think it makes a lot of sense to help

J. Thomaier (✉)
Bayer IP GmbH, Monheim am Rhein, Germany

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_12

by sharing my views to bring the start-ups into the right position in terms of their IP, which is to their benefit and also to the benefit of my industry when interacting with them.

The first and most important thing from my point of view is to be clear and aware of the fact that IP – at least in the life sciences, but also in other business areas – is the core asset we are looking for when interacting with a start-up. Secondly, we look for the knowledge (also IP but not registered and put in writing) of the experts within the start-up and any regulatory-relevant data, if already available (frequently, our relationship with a start-up begins earlier so that we can participate in creating that part, but sometimes there is already some data available).

1 Building the Relevant IP for the Life Sciences Industry

The core IP of relevance to us concerns patents and patent applications. For those, we will check if the technology is covered sufficiently. First, we look for protection of the broad technology platform used by the start-up. If there is already a prototype or something under development, we check for specific protection of the more specific technology. So, for example, besides the active molecule under development or the device intended to be used, it is also of utmost importance to protect the way it is made, the potential or intended uses, formulations, mixtures, and everything else around such a subject matter that needs to be covered and protected as extensively as possible. All aspects need to be covered if and as far as they are susceptible to patent protection. This is an important point, as any additional aspect protected may enhance the economic value of your idea and, in turn, your business.

Don't forget, if applicable, to think about design patents (*Geschmacksmuster* in German) and a good trademark if you already have an idea. (Outside the United States, you have to register them; using a trademark is not sufficient.) However, this could also be created later on together with an investor/stakeholder, but if there is already a powerful idea in place, it should be secured.

The other decisive aspect of protection is the geographical scope of it. A major mistake of the start-ups I have observed is that they focus too much on their home jurisdiction. Specifically, U.S. start-ups tend to have their IP horizon ending at the U.S. border. Otherwise, if the home jurisdiction is not the *United States*, they focus too much on the United States. However, if we look after a technology, we do this to create a global success. So, the minimum coverage for the basic technology and, in turn, the platform should be all jurisdictions that are potentially able to compete in such a technological area – generally, the *United States*, *Europe*, *China*, *India*, *Japan*, *South Korea*, and *Brazil*, to name the absolute minimum – but should be defined case by case, depending on the technology you are in. Once it gets more concrete, say by protecting the potential product specifically, at least 80% of the potential markets should be covered as well (i.e., candidate compound protection; or antibody sequence or trait sequence – for any life sciences use). In pharma-relevant businesses, as much as 90% of markets should be protected, as here even the smaller ones may be attractive enough for copycats to produce. Missing this and having a

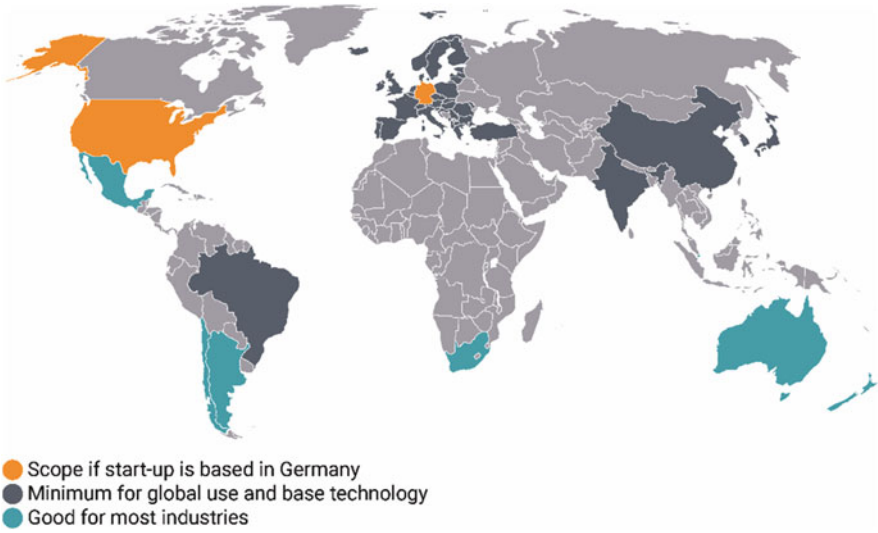

Fig. 1 Creating an appropriate IP portfolio of a start-up that fits business requirements of the life sciences industry (author's own figure)

too-narrow scope of countries protected than what I mentioned here is the most commonly observed mistake regarding creating an appropriate IP portfolio (see Fig. 1):

- Scope if start-up is based in Germany designating only the United States and Germany (as an example for a typical start-up filing strategy);
- Minimum additional scope for global use and base technology: Europe, China, India, Japan, South Korea, Brazil;
- To be added to be good for most industries: Mexico, Singapore, Argentina and Chile, Australia and New Zealand, South Africa.

Why is it that start-ups frequently do not cover enough technological and, even worse, geographical space? If we were to check in the due diligence process history and business plans, we would find that most of the time, it's because there's just not enough capital allocated for the IP "investment" – a really big mistake. It is severely underestimated that IP merits investment and, on the other hand, that it's the core asset for start-ups. So, it's important to allocate enough of the budget for the IP investment and to avoid lacking capital to do it appropriately. To ensure that your stakeholders understand why you allocate that much money to IP, you have to be transparent during your fundraising efforts that a meaningful amount of the cash burned will not be burned but will rather mature into IP – assets that can even be sold on their own in an emergency. It's imperative to explain to the potential investors that IP is a kind of insurance for them that they will keep or receive some value, even if the start-up fails and will be dissolved. If we are the investors (and other

sustainable investors), we will appreciate and value this. It shows a highly mature approach to the topic on how to ensure success and return on investment.

As I have established, we need sufficient IP protecting the core of the start-up so that any investor can be sure of the fact that it is – exclusively – owned and available to the start-up. Here are some important things to observe to make sure you do own all of the assets needed:

In the event that the whole enterprise is based on some spin-off from universities, other institutes, or even larger corporations, it is of utmost importance that the transfer of intellectual property rights from those sources is rock-solid documented and unambiguous. If not transferred but licensed, the scope of such licenses and their costs needs to be very clear: The scope must cover content and geography, as described above for self-created IP in the course of start-ups' own research. Ideally, those are fully paid-up licenses, so any further development or exploitation would be free of any additional charges. If this was not possible, then an already agreed upon and clearly defined royalty should be part of the license so that it could be included in the calculation of any business case of a potential product. However, it is always best to have it fully transferred instead of just partially licensed.

Speaking of complete transfer of rights, there is a special thing mainly for German-based start-ups and any other start-up which entertains R & D and innovation in *Germany*. It may also apply to other countries with extensive employee's invention laws, like in *France*, but from my observations, such flaws mainly arise in Germany. If any IP of the start-up has been created in Germany, the company needs to secure transfer of rights from the employee inventor through a legally required process which ends with full ownership of the IP with the start-up. This process has recently been simplified so that the company does not have to call for transfer actively anymore, which means that mistakes have become less frequent. However, there are still obligations regarding proactively informing inventors about what is happening with their invention. There is a duty to apply for a patent, at least in Germany (some exceptions apply), and to transfer rights and patents to the inventor in case you decide to abandon applications/patents. From some of those obligations' the employer can buy relief from the inventors upfront by closing a separate contract under German law. However, some are untouchable and will stay with the inventor. Additionally, you need to pay a part of the sales price as remuneration to the inventor if you sell the IP. In instances where products are sold under those IP rights, a certain extra remuneration is due to be paid as well. Both payments are in addition to the regular salary the inventor receives. The exact rules and calculation should ideally be agreed upon, based on the law, and in writing between the company and the inventor so that the interested entity knows the encumbrances coming with the IP. You need sound counsel from a German patent attorney to make sure that everything is lined up strategically; otherwise, an investor will see the risk that a savvy inventor, once he or she has left the company, will find a way to enforce some additional payments of remuneration, at least once the project is commercially successful.

Excursus: "Public Inventions"

Here, I may add some critical remarks to founders/technology owners who contribute their IP to a start-up. Specifically, sources like publicly funded institutes or universities frequently overestimate the value of their IP, which most of the time is basic technology and even expires before any product will reach the market. So, if you are, for example, representing a university, rest assured that most of the inventions coming from academic research are, as described above, still basic. This is because there is still a long way to go for the start-up or any other user of the technology to end up with a commercial product; the investments to be done on that pathway are, specifically in the life sciences arena, much larger than what has flown into it before you should stay rational with the pricing. Not every invention is an MP3 technology.

To make sure the technology is explored to the benefit of humankind and society, the best approach to transferring the rights is doing this for a humble but fair lump sum and therewith giving the start-up or any acquirer the absolute freedom to use it and not having burdened their business case with an open royalty. While a defined royalty is at least something anyone can take into account when calculating the business case, it's still a "pending encumbrance" for the technology; an open "arm's length" or "fair market value" license is even more cumbersome. Many of these early technology providers tell me: "But if we sell humble at an early stage, we may not get a fair part of the final value of the technology." This is of course a risk which they try to circumvent by the royalty solution; however, that could kill the case for any later investor and block the true exploration of the technology.

What I've seen only rarely, except in the case of some spin-offs of U.-S. universities, is indeed a solution which I would prefer and combines both: lump sum but participation on success (or failure!). The solution is being a shareholder of the start-up, either by being a co-founder anyway (U.S. spin-offs) or (only seen once) by getting the lump sum due for a fully paid off transfer of rights being paid in equity of the start-up. In the event that the start-up becomes operational and economically successful, the shareholder gets either its part of the profit if the entity becomes self-operational with the product or its share of the takeover revenue if an investor takes over the whole shop. The attractiveness of this approach is that you neither burden the future business with royalties nor give up on the upsides if successful. My plea to those "public inventors" is: Get realistic advice on the proper value of your invention and then sell it for such value in equity to the start-up. It helps exploring technology but not to burden the start-up with cash out nor the business case with royalties, and if it is successful, you get a fair chunk via the equity. ◄

2 Dealing with National Employee's Invention Law

A very special and frequent mistake in *German* start-ups is based on the same employee's invention law: While regular R & D employees have to – and kind of automatically – transfer the right and title to the invention to their employing company, here, with the start-up, this doesn't work for top management. Managing directors and board members don't count as employees under German law and therefore are not covered by the aforementioned employee's invention laws processes. So, if nothing is done via contract, they will stay the owner of their inventions or their part of an invention. As in small start-ups, the managing director or board member is usually one of the founders (and base researchers). This means their right and title only move to the start-up if explicitly transferred by contract. This doesn't happen frequently, and in the event of a takeover or licensing deal, the partner has to buy or license twice – the start-up-owned IP and (surprise, surprise) the "private" one from the managing director or board member. This happened twice in my career. One time it was found during due diligence and included in the calculation – no problem. But one time it was realized only after signing, and to make the investment effective, we had to buy the second piece separately, making the deal more expensive, here still worth the money but sometimes such a deal may not take place anymore because it's too expensive. Often, such a flaw is considered a so-called *major incident*, entitling the buyer to walk away from the deal. In short, make sure you have it "all in" so you can offer the partner company interested all it needs to agree and pay an appropriate price.

To succeed, you need proper IP advice from respected patent attorneys. Another mistake observed here is that a start-up thinks it has a law firm or a legal department and believes the lawyers will make sure the IP is appropriately covered. Unfortunately, many lawyers think they understand the specifics of IP sufficiently to cover this as well. But they can't. The mistakes regarding ownership described above occurred exactly for that reason; filing only in the home country also frequently fell under such "advice." You need IP-savvy specialists in-house or as outside counsel to make sure these topics are appropriately covered. Do not believe a law firm when they allege "we can cover patent law" if they do not have a well-known practice that encompasses drafting patents and patent prosecution – not just IP litigation. Make sure they are really into IP.

3 Achieving Freedom of Action

Switching gears, we come to what is – based on my experience – sometimes a bit neglected by some if not many start-ups: freedom to operate (FTO). How are you positioned/prepared in relation to any third-party patent rights? Are you entitled to use all the IP you need but owned by third parties through appropriate licenses? Keep this in mind not only for research but more importantly for later commercialization because this is what investors are investing for or why they are taking over the start-up. If you do not already have an appropriate license, at least an exercisable option

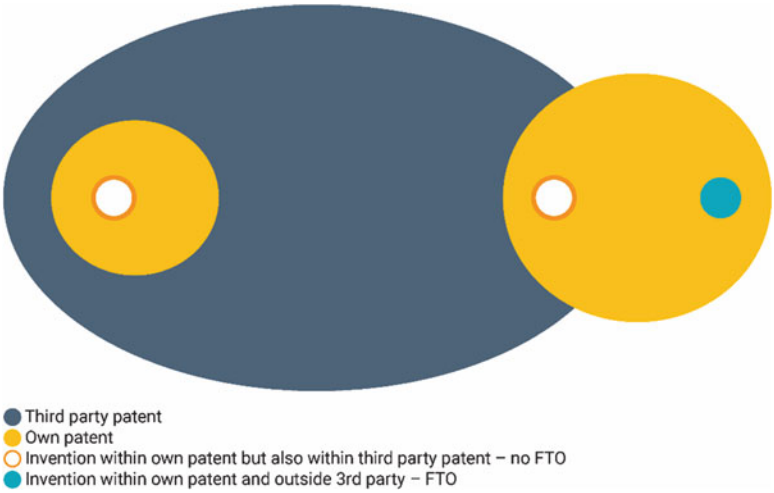

Fig. 2 Visualizing the patent overlap problem (author's own figure)

with negotiated final conditions would also be appropriate and sometimes for the time being the cheaper solution, leaving more money for R & D and ownership of IP. Frequently, as a start-up, you may get such options cheap or even free of charge; however, once exercised, the royalties will become due and should be in a commercially viable amount. Again, you need to make sure to get good professional advice for this as well, not only for a proper analysis but also for proper contractual solutions.

Why do I mention this as a common theme for start-ups? Some don't realize that even if your own innovation has been granted a patent, you are not automatically entitled to use it. There could be third party rights which overlap, or which built the basis for your innovation, and you do not automatically receive the right to use those by getting your own patent granted (see Fig. 2). This is sometimes the wrong conviction of some start-ups.

On the other hand, start-ups – at least as long as they are small and do not yet have a product on the horizon – are flying under the radar screen and are less likely identified as patent infringers. Alternatively, as they do only research and don't have a lot of money, patent owners may not act, and the start-ups take the risk for the time being.

However, once they become visible either by cooperating/joint venturing or being taken over by one of the big players, the third-party patent owner will see competition, or at least patent infringement, coming and show up. Litigation risk, an injunction prohibiting sales, or at least unexpected costs will arise.

So, potential partners will check for this and usually will ask for warranties in this regard before entering into any interaction. To avoid breach of contract litigation/damages on the one hand or, even better, to have the full picture already available for the partner, the start-up should take the freedom-to-operate analysis seriously and

have it well documented at least. Of course, the target should always be to have rights under the identified relevant third-party rights by license or an exercisable negotiated option to a defined license as described earlier. In this way, you will be considered a trustworthy partner who did their job and who is in the position to negotiate an appropriate deal.

4 Reaching Out for Professionalism

Now, to make sure you get all these things right as a start-up, from my experience and observations, there are frequently some flaws due to – let's call it – "lack of professionalism or expertise." The main cause for this is most of the time that the senior management of the start-up (usually the scientific brains and founders of the start-up) are convinced "I know what I am doing, IP is not so difficult" and do it based on their own understanding.

In fact, IP is not that difficult: If you are smart, you can learn it; however, the smartness of the start-up's brains and scientific founders should run into the technology and the business. That's what they should do and usually do focus on, missing out on the IP. To avoid this, the start-up needs to get appropriate IP experts' advice. Because IP for real start-ups in new fields is a special thing and the strategy behind it as well, I would strongly recommend – while you may have hands on drafting and prosecution of the patents done by outside counsel – that the strategic part, decisions on filing scope, evaluating the freedom to operate (certainly with external support), and last but not least advice to start-up management should come from internal resources closely connected to the tech people and the R & D of the start-up. This is the only way to get real optimum IP lead. How can this be achieved without pushing too much money into it? Well, you could think about an almost-retired experienced individual being attracted by some share options and the chance to make the money when exiting the start-up to an investor. In other words, a business angel, or the like. However, this may also work with young talented IP experts who prefer to be at the cutting-edge of technology instead working (like me) for established blue chips or a law firm (rather boring from my perspective).

But the core of my message here is to take IP very seriously. It's usually the core asset of start-ups and the earliest available asset you may fund it upon. Therefore, do invest in it – more than many would usually do. And use/engage experts – don't think the innovators can do this as well (sometimes they can but this is rare).

As IP is the earliest asset in ownership of the start-up, it is frequently all the basis for the funding rounds. Why is that? Actually, if the investment goes south – the project is not successful, there's no money left, and the start-up goes into insolvency – the IP will guarantee that by selling it, some money comes back and at least some funding (depending, of course, on the structure but many investors may for this very reason provide some money as a loan instead of as shares) may be recovered. So, for investors, it also represents an "insurance" of some of the investment.

This may be the right place for some specific thoughts/tips for investors. In deciding about investing in a life sciences start-up, they really need to put a lot of focus on the IP assets. They typically represent the core and true value of the company because there is no real business yet and no real product – most of the time at least. As in the life sciences arena, profitability of a product to a large extent – in the pharma sector even more than in the crop science sector – is dependent on the advantage of having a legal monopoly: IP protection. So, the investor needs to support the start-up – financially and maybe by strategic advice – to achieve an optimum IP portfolio. Scrutiny on how the company deals with IP as well as the preparedness to see a substantial amount of the investment going into the IP is crucial. Awareness that IP is a positive contributor to the value and not a consumer of the value is decisive. Do not hamper but instead foster IP within the start-up you invest in.

Excursus: Digital Start-ups

I would like to devote some discussion space to start-ups in the digital – IT – world because while all I said generally is still applicable, there are some differences which we should be aware of. The first thing is that digital inventions are hard to protect by patents in many jurisdictions, such as in *Europe*, while in the *United States* and to a certain extent in *Japan* or *South Korea*, algorithms and software are fully eligible for patents. Therefore, the strategic discussion about geographical scope is a bit different, as the *United States*, *Japan*, and *South Korea* are a "must," while places like *Europe*, *India*, and *China* are only a "must try." Within the "must try" jurisdictions, the expertise of the IP attorney is even more important than described above because in those places, it is of utmost importance to describe the invention and to claim it in a "patentable" way. For example, in *Europe*, the digital invention must be claimed within a more tangible invention where it represents the inventive feature only. This is a rough description of a possible solution in such jurisdictions. However, this is the reason why the patent portfolio of digital start-ups may be comparably smaller in geographical scope as well as in number of patented inventions, as within more classical life sciences start-ups. The second difference is regarding the freedom to operate of products and particularly products in development. This is because searching the landscape of IP in the digital space is much more difficult and less defined – similar to the early stages of biotech inventions where, in part, the terms used for the same features are different, not yet being standardized. This leads to incomplete searches of state-of-the-art and therefore a higher risk of having third-party patents out there blocking the start-up's technology and having not been licensed yet. This may also be true, as within the analysis of IP identified as being relevant may be difficult for the same reason. Also, here very specific expertise of the IP colleagues is needed.

On the other hand, the digital space is in general much more characterized by the willingness to cooperate. This means it is much less likely that a third party will use its IP to stop you but is prepared to negotiate a license – whether for fees

or for cross-licensing of technology. Therefore, you can bear with less safety here but need to be ready to invest some additional value in case it turns out that something has been overlooked.

The third and, for me, last aspect is the fact that the IT/digital projects are frequently eligible for copyright and other protection, so this needs to be part of the strategy and, of course, the evaluation by investors and/or collaboration partners. ◀

5 Learnings and Takeaways

Take IP more than seriously and be aware of the fact that it is at the core of your company. Do all you can to have an optimal portfolio of IP covering your business.

Takeaways

1. Ensure proper protection in scope – content and geography.
2. Ensure proper advice – have IP specialists, internal and/or external.
3. Ensure full ownership.
4. Employee invention law, if applicable.
5. Ensure full freedom to operate.
6. Get enough money ready to pay for IP.

Dr. Jörg Thomaier studied Chemistry at the University of Heidelberg (Germany). He went on studying this field of research and science at the Universities of Freiburg (Germany), Utrecht (Netherlands), as well as the ETH Zürich (Switzerland), receiving his PhD in the field of Phosphorus-Organometallic Chemistry. Dr. Thomaier joined Bayer immediately thereafter to become a patent attorney. After being trained at Bayer and through certain other trainings in different places, he passed the European Qualifying Examination at the European Patent Office in 2001 to become a licensed European Patent Attorney. In his trajectory through Bayer's diverse business areas, as a patent attorney as well as heading some of the patent departments, he ultimately reached the top of Bayer's Global IP Team.

Mind the Gap: Business and Cultural Aspects for Start-Up Collaboration in Japan

Robert Alizon

1 Influence of Business Culture Over a Start-up Mindset

In the absence of a strong and long-lasting presence in the market and with a focus on disruption, the value of intangible assets dominates that of tangible assets and forms the majority of the value and potential of a start-up.

The inventory count of tangible assets (offices, equipment, number of staff, products, etc.) is kept fairly up-to-date and trustworthy, as the start-ups rely on it regularly to comply with various business needs and accounting standards, appears on the balance sheet, and has a recorded book value. On the other hand, intangible assets (trademarks, patents, copyright, data, relationships), which are not physical in nature and do not have a recorded book value, are much more difficult to list, although they dominate the value a corporation may see in a start-up. In addition, start-ups usually and understandably have not been able to invest in a team of IP experts like those that exist at corporations to develop a state-of-the art IP strategy and IP management principles.

This gap in resources will surface at the time a corporation and a start-up engage in a collaboration and the corporation studying the value and the potential of the start-up by running a due diligence on the IP assets. The level of scrutiny applied by the corporation may not significantly vary with the scale of the investment. However, we observe that the ability to compromise on gaps and defects varies according to the level of both investment and the risk the opportunity represents for the corporation. The culture of a corporation is of significant influence on the decision-making process when balancing the opportunity against the risk that it is willing to take.

R. Alizon (✉)
Fairway Family Office AG, Zürich, Switzerland
e-mail: robert.alizon@fwfo.ch

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_13

The culture of a corporation includes a set of norms, values, assumptions, behaviors, and beliefs that come from its employees and its leadership style. The culture is shaped by past experiences, mostly by the lessons learned in the course of years of business in the field with their competitors but is also significantly influenced by the national culture the corporation originates from.

Japanese corporations have been and are still extremely successful in bringing to the market innovations of extremely high quality. However, Japanese corporations have been less successful in following the global trend that appeared about 15 years ago that has seen start-ups take a fair share of the innovation effort, especially when looking at disruptive innovations. While Japan is the third largest economy in the world behind the United States and China, the number of unicorns – start-ups that are valued at over $1 billion – which is considered by many as a measure of the success of the start-up economy is lagging far behind. According to the Japan Times, in 2019, the United States had 179 unicorns, China 93, and Japan had just two, with India having 18 although being the fifth biggest economy in the world. That led the Japanese government to take a series of measures to strengthen the start-up ecosystem in Japan and set a target of creating 20 unicorns by 2023. Those measures have had moderate success so far with Japan reaching six unicorns in 2022, but it seems Japan is now headed to having more unicorns and a stronger start-up ecosystem.

One reason is the measures that have been introduced try to change some traits of the Japanese corporate culture and, like for any cultural shift, the change of a culture usually follows the timing of a generation rather than just a few years.

To avoid stereotypes, it is of interest to refer to Hofstede's cultural dimensions (1980, 2015) and, in particular, the uncertainty avoidance dimension. Uncertainty avoidance deals with a society's tolerance for uncertainty and ambiguity and indicates to what extent a culture programs the members of an organization to feel either uncomfortable or comfortable in unstructured situations that are novel, unknown, surprising, and different from usual. According to this dimension, Japanese society is significantly more inclined to avoid uncertainty than the U.S., Indian, and Chinese societies. Kaasa (2013) studied European societies against the Hofstede's dimensions and found that the dimensions of masculinity, power distance, and uncertainty avoidance negatively correlate with the innovation indicators. As the scores of uncertainty avoidance and of masculinity are significantly higher in Japan than in those three other countries, this might explain the gap in the number of unicorns.

Further, an aspect which is unique to Japanese corporate culture is called *"Ringi."* According to Sagi (2015), Ringi is a decision-making process where it is expected to reach a consensus toward a final decision that emerges as a balance of views of different employees and has many informal and formal layers. It is advantageous in that decisions are made, thanks to a collective effort that reduces biases, but is at the cost of decision-making speed. Such a consensus-driven approach may also by design reduce the ability to differentiate from competitors and take risks.

While Japanese corporations share many aspects of international corporate culture, this book chapter can assist start-ups in optimizing their management of IP to

increase their chances to partner with such corporations by better understanding the perception that materializes within the teams of the future partner.

2 IP Ownership and Cultural Implications

2.1 Principles

In the absence of a legislative or contractual obligation, the general rule is that IP is owned by its creator. This principle leads to a number of situations where a start-up may need to take steps to control or own the IP it creates directly through its staff or indirectly through commissioning work to third parties. The status of the people who contribute work to the start-up will influence how to address the situation.

- **IP creation prior to incorporation:** Unlike at a corporation, the majority of people involved in a start-up, in particular in the early days of its existence, may not be employees in the sense of the labor law. Namely, start-ups cannot rely on most local labor laws that provide for a default assignment of IP to the start-up for the staff who do not qualify as employees. Non-employee people are, for example, founders, administrators (such as a CEO), or interns, and may be the significant and valuable IP creators prior to the incorporation of the start-up or shortly thereafter. In the start-up's infancy, founders often create fundamental IP prior to any formal business structure is in place. When proceeding with the incorporation of the one or more legal entities, the founders should identify and transfer this IP against the opportunity to receive shares, the amount of which is dependent on the value of IP contributed. In case this IP is registered IP, it is important to update the register at the IP offices, a point which is often overlooked in practice. Another situation that may be faced with the founder's IP and which may trouble a corporation seeking to partner with the start-up is whether the founder was moonlighting[1] at a prior employer. Concerns may come up especially if the start-up is in the same space as the founder's prior employer, in which case it is likely the prior employer is a competitor of the corporation. It is rare that the founder(s) had any malicious intent, but it is recommended to avoid any hidden trap with a careful review of contracts, handbooks, and the like of the prior employer. Firstly, the founders will avoid personal exposure. Secondly, it will avoid bringing anxiety to the corporation that the risk of IP theft litigation materializes after the transaction takes place and suffer a possible write-off of its investments and reputational risk. Deal teams pay specific attention to this point, as the opportunity of developing a new business on top of the existing business may not outweigh the risk of harming the reputation of the corporation.

[1] The act of working at an extra job, especially without telling your main employer (source: Cambridge Dictionary) (accessed July 07, 2022)

- **IP creation after incorporation:** Once the legal structure is in place, start-ups need to continue aiming at having IP automatically assigned upon creation as much as possible. To that end, it can be advantageous to include IP assignments clauses in employment-like contracts for people such as founders, employees, or consultants who work regularly at or for the start-up. Such clauses can include obligations for the staff to collaborate with the start-up in all administrative proceedings before the IP offices that relate to registerable IP, as those can extend over several years and reduce the chances for the start-up to get the IP registered. Another good practice is to include clauses in a contract of departure or of dismissal of an employee. In the first place, it is good to oblige the person leaving to provide reasonable assistance to the start-up in the registration proceedings of the IP he or she was involved in. Moreover, as start-ups may experience a relatively high amount of turnover in their staff, confidentiality clauses should be included in the departure contract to avoid both the leakage of IP outside of the start-up, e.g., know-how, and mitigate the effects of possible moonlighting that may have occurred shortly before departure.
- **The specificities of commissioning work to third parties:** In addition, when start-ups commission work to a consultant not employed at the start-up, it is important that the consultancy contract grants a license to use the IP owned by the consultant as well as an assignment or at least a license to the one created by the consultant under the contract. For example, if a consultant is hired to develop new code over a historic code owned by the consultant, a license to the historic code must be put in place as well as a license or an assignment of the newly developed code to ensure at least an access to the IP vests in the start-up. Chasing a consultant to discuss licenses or assignments at the time the start-up is about to enter into a partnership with a corporation can be difficult or even impossible and could lead to the corporation not entering into a partnership. What is mentioned above in relation to a person also applies to a legal entity when the start-up commissions work to a service provider company or a consultancy company.
- **Perception at a Japanese corporation:** Leadership teams of Japanese corporations are especially sensitive to risk related to the proper chain of title over the ownership of IP.

  Directors of a company in Japan are subject to a duty of care that is one of the most stringent in the world, which means there should be no occurrence of a risk that can be removed or limited through a thorough process and explains the thoroughness of the due diligence exercise on that point.

  In addition, Japanese corporations have a collectivist sense to society, meaning that any employee's number one priority is not to bring any inconvenience or risk to their colleagues, hierarchy, and corporation. In that regard, a defect in the chain of title may lead to a reduction of value of the opportunity, additional work to their colleagues to remedy the situation, and reputational risk over the corporation.

  Altogether, those aspects materialize in having executives up to the CEO of large corporations from time to time apologize in the form of a press conference to their shareholders and to the public for the wrongdoings of their company.

Case: Facebook

Facebook, now an established corporation, was once a start-up and some of its early operations led to legal disputes years later over the ownership of IP. Actually, one of the most renowned cases that *Facebook* or, more precisely, its founder, Mark Zuckerberg, had to face was brought by the founders of *ConnectU*, Tyler Winklevoss, Cameron Winklevoss, and Divya Narendra, in relation to the *HarvardConnection* website. The latter accused Zuckerberg of breaching an oral contract they had entered into for Zuckerberg to further develop the code of the *HarvardConnection* website after their software developer had left.

The suit filed in 2004 alleged that Zuckerberg had copied their idea and illegally used source code intended for the website he was hired to create. Zuckerberg and the founders of *ConnectU* settled in 2008 (ConnectU L.L.C. v. Zuckerberg, 2008). This situation arose from the fact that no agreement, or only an oral agreement, was in place while commissioning work to Zuckerberg. It was alleged that he breached confidentiality and stole IP, such as the original source code, to advance the *Facebook.com* website.

What may have happened reinforces the need to have clear undertakings on IP ownership while commissioning work to third parties and also to ensure there is written evidence of both the contract terms as well as the IP created. ◄

2.2 IP Portfolio Construction and Strategy

Corporations approach or react to solicitations of the start-ups because the start-ups own IP know-how and skills the corporation does not have and see an opportunity to develop their business. According to Harrison and Sullivan (2011), more than an IP asset should be viewed as a (future) mini-generator of revenue and income. The corporations expect that this IP will grant exclusive access to the stream of revenue and income of the newly created business model or product and avoid sharing it with the competition.

If we treat the IP as a means to block or control access to a market, we can illustrate how best for the start-up to build and manage its IP portfolio by referring to a hiking journey between a starting point A and an endpoint B. Let's imagine that in its early days the start-up is at a certain starting point A and has identified the end of their journey at point B to deliver their idea to the consumer. A start-up should build its IP portfolio primarily to create fences or walls all along this path, to prevent competitors from following on the same path and therefore secure the revenue and income-generator potential.

Start-ups will navigate to point B by an iterative process that will define a number of waypoints over time as they try to follow the most strategic path in terms of speed, cost-efficiency, etc. However, it is likely to be influenced by failures and redirection efforts; hence, it is most likely not to be a straight line from A to B (see Fig. 1). IP rights should be placed in particular on the critical waypoints which are selected to

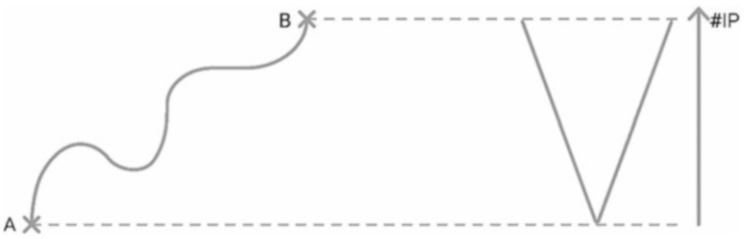

Fig. 1 Representation of the innovation journey between the start of the development to the market-ready product and number of IP rights filed on the innovation journey (author's own figure)

be contributing to the protection of the business model of value to the consumer. In the case of a patent, the waypoint at which a patent is placed may not be the most scientifically evolved solution but rather the solution that is thought to be at the core of protecting the end result.

The IP rights that are placed the closest to point A are likely to be the IP rights that are fundamental and may generate a broad scope of protection (e.g., relative to the core technology), while those placed nearer to point B are those that are likely to protect consumer-centric attributes and may exhibit a narrower scope of protection (e.g., relative to use cases). When charting the number of IP rights against the position between point A and B, we may observe an inverted pyramid such that a large number of IP rights with a limited scope of protection may be filed to protect the immediate surroundings of the end solution in comparison to earlier filed IP rights on the journey (see Fig. 1).

The construction of the IP portfolio may evolve over time. Indeed, the path on which the start-ups navigate is dynamically evolving for several reasons.

A first situation may be that the end point to reach is no longer point B but a new point C due to changes in the operating environment. For example, the endpoint B may shift "sideways" in case of a change in regulations that prevents bringing the original solution in its current form to the market. For example, point C may be brought "further away" from point A in case the market newly expects for an improvement to the product or portfolio expansion over the solution brought at point B. This will require the start-up to file new IP rights on this new section of the path to keep control over the path from A to C1 that has become the path of most importance to retain a competitive edge on. In case point C is a "side-way" shift relative to B, for example because of changing consumer preferences there will be a question whether the IP rights filed nearest to point B and that do not lead to point C2 become obsolete and can be dropped so that IP investments are directed on the new best path A to C2 (see Fig. 2).

A second situation start-ups can face is when the endpoint remains point B but the waypoints need to change. For example, it may occur that an alternative development path is designed to mitigate the risks of an infringement of third-party IP (see following section). This situation may arise either when a company tries to reach the same endpoint B as the start-up, in which case that company is a competitor, or when a company is engaged toward another endpoint we can call D but coincidentally

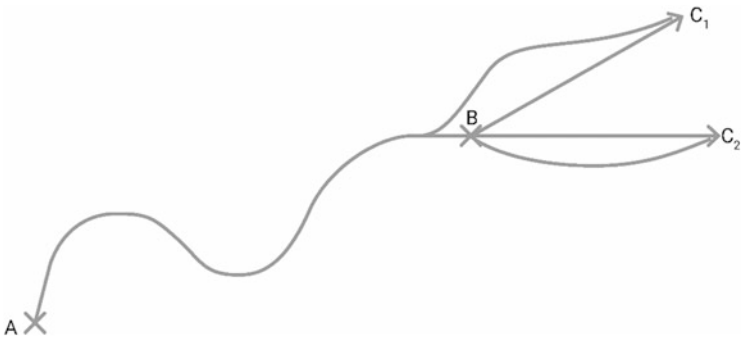

Fig. 2 Representation of the innovation journey in the event of a change in the operational environment (author's own figure)

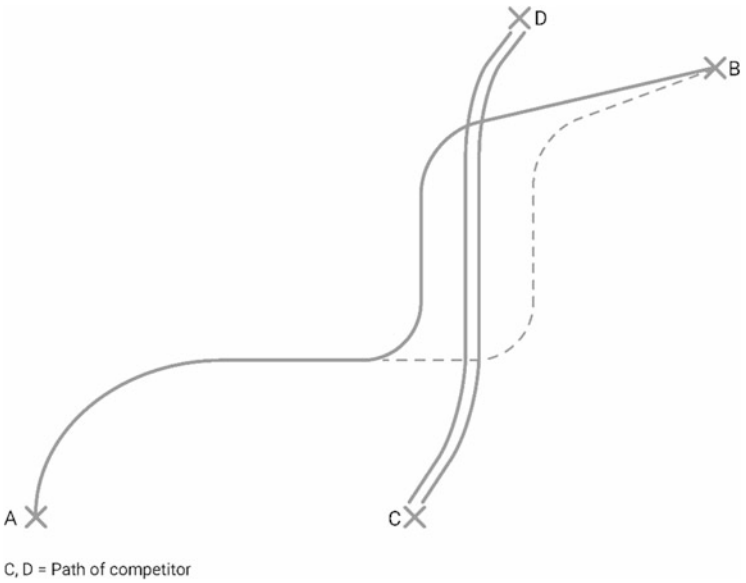

Fig. 3 Representation of the innovation journey in the event of a change required to avoid IP infringement (author's own figure)

crosses the path and a waypoint of the start-up and has filed IP. In that situation, it is recommended to seek IP protection for the alternative or workaround waypoint the start-up will find and work on maximizing the scope of protection of the original IP that can remain. It will enable future transactions (e.g., cross-licensing of IP) the IP owner may decide or need to conduct in the future (see Fig. 3).

If resources are available, the start-up may have been able to develop alternative paths that lead from A to B, bringing a further level of sophistication in the development of its IP portfolio. By protecting these alternative waypoints and

paths, start-ups will be able to further ring-fence the access to endpoint B and keep competition further away from the optimal path and force competitors to follow a sub-optimal path to deliver a solution to the consumer. It might be sub-optimal in that the solution delivered is perceived to be inferior by the consumer or in that it is more difficult or expensive to produce.

Finally, construction of the portfolio should be guided by finding a balance between two opposing ambitions. On the one hand, start-ups should try to seek IP protection as early as possible to safeguard it from a third party protecting that IP first and reduce the level of control the start-up would have over the path from A to B. On the other hand, start-ups should try to keep IP protection to key waypoints pending and with scope of protection not finally set as long as possible. This will disrupt competitors in gaining certainty while assessing the risk of launching competitive products and may enable the IP owner to match protection over evolutions of the market. This is of particular interest to corporations that may, in addition, have certain preferences in how to shape final protection granted by the IP rights.

In case of patent IP rights, it is possible to adjust the pace at which the examination of the patents occurs by requesting extensions of time to reply to office actions issued by patent offices and avoid having an issued scope of protection too early before entry in the market by the start-up. Further, it can be advantageous to use the Patent Cooperation Treaty (PCT) patent filings to push back the choice of countries in which to validate protection by about 30 months from filing and allow the start-up to match better the country filing strategy of a corporation.

In case a patent is issued ahead of entry in the market or ahead of partnering with a corporation, filing derivations of the patent (called divisionals or continuations) can help keeping options open to shape the final scope of protection of a patent. As a summary, start-ups may need to find the best compromise between getting the earliest date of filing when generating IP and maximizing the potential to best align with the interest of the corporation which they would like to partner with in the future.

Following these IP portfolio construction approaches will especially resonate with a Japanese corporation, as it will minimize gaps in IP protection along the path to deliver the product to the consumer and therefore fulfill the function of deterrent to patent litigation in addition to high protection of the start-up's business proposition. The options of offering some possibilities for the corporation to shape final scope of protection will be considered by a Japanese corporation as a sign of respect and consideration which will be greatly appreciated.

2.3 IP Risk Identification and Mitigation Strategy

Identifying IP risks is an area where a significant gap in culture and understanding may exist between a start-up and a corporation, further emphasized when dealing with a Japanese corporation. In materializing, an IP risk can lead to a civil proceedings claim that would see the losing party having to pay damages for past

infringement, having to halt operations deemed infringing and suffering reputational damage through a public announcement that it has infringed an IP right.

2.3.1 Principles

The assessment of whether a technology or an IP right infringes upon third-party IP is challenging. If we focus on the patent IP rights, the concept of property is somewhat complex because of the function of a patent is to forbid a third party from copying the technology and not an absolute right of property. The result is that property cannot be conceptualized by referring to pieces of land as represented in Fig. 4, where each IP owner has a discrete piece of land which does not overlap on the land of a third party. Brought back to the IP world, if each piece of land were to be a patent, that would mean that if within the scope of its own patent, an IP owner would not be seen to infringe other IP.

In fact, the concept of patent IP rights follows rather a scheme that can be pictured as a set of Matryoshka dolls, as represented in Fig. 5. The dolls are meant to fit into one another, by having the doll to the right being able to fit in the doll immediately to its left and so on. That means it is possible to successfully fit all dolls into one other until those fit in the doll at the far left of the figure. That leads to having the owner of a doll on the left of another doll to have the right to prevent access to the dolls fitted into it such that the owner of a doll may not be able to enjoy freely its possession. Bringing this metaphor back to the IP world, where each doll represents a patent, then if a start-up owns the third doll from the left, it may then infringe and be dependent upon the two patents that are on its left and represented by dolls one and two.

Fig. 4 Representation of a farmer's land from the air

Fig. 5 Representation of Matryoshka dolls to illustrate IP patent infringement

This means that building its IP portfolio is not enough to guarantee a technology is free from infringement; a separate IP assessment is required to safeguard from this risk and is called a freedom-to-operate (FTO) study. An FTO study results in the ability to map the competitor IP landscape upon which the technology of the start-up may be dependent upon and infringe. FTOs can be resource-intensive and an effort which a start-up may not be able to perform as regularly as a corporation would. However, it is recommended to perform FTO studies at least at the time of reaching a significant milestone in the development.

If infringement issues are detected, it is recommended to mitigate the risk to avoid diminishing the value of the IP portfolio of the start-up. There are two main options to mitigate a patent infringement risk: build a legal case to invalidate or reduce the scope of protection of the IP that is infringed, and/or to alter the technology in such a way that it is arguable that the third-party IP is no longer infringed. Due to the resources the first option involves, start-ups may tend to prefer the second option to the extent that the alteration of the technology does not diminish the value of the technology to the consumer.

2.3.2 Cultural Reasons for the Gap

The phasing between the moment investments – which can be sizeable – are made and the moment returns materialize may lead to a gap in expectations between a start-up and a corporation. Indeed, an FTO investigation requires cash to have been invested long before entering the market and over an extensive period of time. On the one hand, corporations that have a continuum of developments entering the market can maintain such efforts, thanks to the cash flow generated by their sales. On the other hand, start-ups may only be able to afford to perform such tasks occasionally, and it is often the case that corporations shed light on certain risks during a due diligence that were not identified previously. Said differently, start-ups expect they can produce a time-to-time best effort assessment while corporations would expect at all times certainty. Because of *risk avoidance culture* in Japan, corporations tend to allocate significant resources that help understand how they benchmark against

competitors in many areas including IP and can therefore avoid the risk of writing off development costs.

Another reason for this gap stems from the *risk tolerance culture* at a start-up and at a corporation. While the risk of failure is somewhat accounted for at a start-up from its inception, failing at a corporation is feared by numerous stakeholders. It can seem a paradox at first if we consider a start-up usually has a limited or nonexistent backup plan in case of failure, but at corporations, what may be at risk is the reputation and trust at the employee level (vis-à-vis the corporation) and at the corporation level (vis-à-vis the industry and its clients). This causes two significant issues in the context of Japanese corporations. Firstly, even though the job market in Japan is now more open to individuals changing employers during their career, it is still frequent that employees spend a significant proportion of their career at only one corporation. Thereby employees may fear that corporations perceive an IP infringement instance as a failure at their individual level, hindering their career with long-lasting consequences. More importantly, employees at Japanese corporations that live in a collectivist culture place the desire and needs of the group, i.e., the corporation, before their own individual desires and needs in a concept called "amae" describing a strong social interdependence (2022). Also, Japanese corporations are humbly and deeply concerned about their customers and consider it important that their actions do not negatively affect the customers that have entrusted them. As seen previously in conjunction with the section discussing IP ownership, individuals at Japanese corporations have the goal of avoiding the corporations to make public apologies and damage the reputation of the corporation.

All in all, start-ups that identify and avoid impeding on third-party IP enhance the value of their IP portfolio. An IP portfolio having limited to no dependency on third-party IP will ensure the highest exclusivity to its owner. It is thus advisable to perform regular screening if resources allow.

A strategy to bridge this gap, especially with a Japanese corporation, is to be honest about what has been done and what has not. In particular, explaining not only the end result but also the process that was followed can enhance the building of trust with the corporate partner. In Japanese corporate culture, documenting the process can be seen as important as recording results because it is the foundation to continuous improvement. Politely and respectfully allocating this task to the corporation during the partnership while offering assistance in collecting and reviewing the necessary data may be a good strategy to follow and an opportunity to enhance the partnership.

3 Learnings and Takeaways

Japanese corporations have a strong interest in start-ups and their ecosystem because start-ups are admired for the value they could bring to the corporation but are also frightened by the risks that collaborating with a start-up could convey. Japanese corporations and the Japanese government are firmly decided to enhance their culture to follow the path of developing the start-up ecosystem, which may still

take several years to catch up on economies of similar strength. Start-ups that are willing to understand this evolving Japanese culture and differentiate their IP management from their peers to remove as much uncertainty as possible and present a reasonable strategy in a detailed manner to the corporation are more likely to successfully partner with a Japanese corporation. With the momentum instilled by the initiatives taken a few years ago at the governmental level in Japan, there is no better time to seek partnerships with Japanese corporations.

Takeaways

1. Make sure to acknowledge the cultural gap.
2. Start-ups should be aware of risk avoidance and risk tolerance positions and respect cultural aspects when negotiating.
3. The IP strategy should aim at securing with IP all significant waypoints that are reached on the path to market.
4. Ensure that IP rights are unequivocally owned by the start-up.

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Robert Alizon has an MSc in Electrical Engineering and Optics from the École Nationale Supérieure des Sciences Appliquées et de Technologie (ENSSAT) in Lannion, France, and a Master's in IP Law from the CEIPI in Strasbourg. He started his career working in R&D on semiconductor technology at the Technion in Haifa, Israel, after which he moved to work in IP at Renault-Nissan in Paris, where he qualified as a French and European Patent Attorney. In 2010, he moved to Switzerland to join Japan Tobacco International to set up the international IP patent operations and team and to work closely with his IP colleagues in Japan on a daily basis. During that

time, numerous partnerships with start-ups in various forms contributed to the growth of the patent portfolio. In 2022, he became Chief IP Officer at Fairway Family Office in Zurich, Switzerland.

Mr. Alizon is a member of the Association Romande de Propriété Intellectuelle (AROPI) and a regular speaker at IP conferences. He teaches in preparation courses for the Swiss patent attorney qualifying examination and at the European Patent Institute (EPI), where he tutors candidates taking the European Patent Attorney examination.

Part IV

The University's View

It makes a difference whether the time horizon is up to product maturity or up to the market entry and if it is five years or 15 years. That is always a case-by-case consideration.
—TTO Licensing Manager (anonymized)
In: Fink, Arbter and Wagner, 2023

Experimentation in Academic Technology Commercialization

Fernando Gómez-Baquero

1 The Joan and Irwin Jacobs Technion-Cornell Institute Experiment

Technology commercialization is now one of the cornerstones of the experience in the academic environment. Universities and colleges are now highly dedicated to understanding and giving priority not only to creating new technologies but also to commercializing them. To do so, a university doesn't necessarily have the right skills, people, or resources. So, the question is not how a university can understand how to perform commercialization better, but rather how it can achieve it in the first place. And the answer seems to be the same way that start-ups battle the challenge of growth: through systematic experimentation.

In 2010, the *City of New York* issued a competition for institutions around the world to propose a new applied sciences and engineering campus in New York City to expedite the growth of NYC's tech sector. *Cornell University* and the *Technion-Israel Institute of Technology* jointly submitted a proposal, as did 27 other institutions from eight countries. In 2011, Mayor *Michael R. Bloomberg* announced the Cornell/Technion consortium as the winner of the competition. The winning proposal outlined plans to establish a new entity, Cornell Tech, comprised of a new campus on Roosevelt Island in Manhattan, several innovative graduate programs in the applied sciences, and the *Technion-Cornell Innovation Institute*. This early iteration of the Jacobs Institute created an academic partnership between Cornell and the Technion intended to directly foster technological innovation in key New York City industries. In 2013, Dr. *Irwin Mark Jacobs*, Founding Chairman and CEO Emeritus of *Qualcomm*, and his wife, *Joan Klein Jacobs*, announced a

F. Gómez-Baquero (✉)
Jacobs Technion-Cornell Institute at Cornell Tech, Cornell University, New York, NY, USA
e-mail: fernando@cornell.edu

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_14

$133 million gift to expand and rename the Technion-Cornell Innovation Institute as the *Joan and Irwin Jacobs Technion-Cornell Institute*. Since then, the *Jacobs Institute* has fostered experimentation at the intersection of research, education, and entrepreneurship (Jacobs Technion-Cornell Institute at Cornell Tech, 2022).

In this chapter, I will describe some of the experiences and empirical evidence that we received as we were building the *Runway Startup Postdoc Program*[1] at the Jacobs Technion-Cornell Institute at Cornell Tech (hereafter referred to as the Jacobs Institute). These experiences can help other universities and licensing professionals improve the way that they do technology commercialization. Each university and technology transfer office should consider through the lens of the community their own values and their own incentives so that they are able to more effectively apply learnings from our program to the design of their own commercialization endeavors.

2 The Problem of Entrepreneurship in Academia

Academic entrepreneurship has changed from being deemed an activity unrelated to the pursuit of research excellence to a key component of an academic curriculum. Even further, studies now consider commercial work by academics to be drivers of important advances in science (Fini et al., 2021). Although seeing a university as a place of fundamental entrepreneurship is not new and can be traced back to the 1990s (Clark, 1998; Zucker & Darby, 1996), seeing entrepreneurship as the role that the university should play in an emerging entrepreneurship society has only been considered since the 2010s (Audretsch, 2014). It is not uncommon now to see universities creating incubator programs, fostering academic commercialization, and even using a *triple helix* model for their incubator operations (Nerva Blumho, 2021).

It is now understood that entrepreneurship requires an active behavior and not just intentions (Adam & Fayolle, 2015), a set of actions that motivates both institutions and entrepreneurs to act to create the new companies that are part of the necessary entrepreneurship journey. This means that universities are now challenged to experiment and intentionally create to be able to fulfill their aspirations as drivers of entrepreneurship and economic growth. And doing so requires engaging faculty, staff, and most of all alumni. There's evidence to suggest that a recent graduate (at least in science and engineering degrees) is twice as likely to start a business than a professor (Åstebro et al., 2012). It has also been reported that greater success in the incubation of start-ups from the academic environment is achieved when academic inventors are engaged during the development phase (Agrawal, 2006).

Not all academic engagement with industry has the purpose of entrepreneurship. Studies have also shown that academics can engage with industry motivated by furthering their research and not by commercializing their knowledge (D'Este &

[1] Selected content in this chapter has been used from https://tech.cornell.edu/programs/phd/startup-postdocs/. Used with permission

Perkmann, 2011). Even in some cases the main motivation can be of academics trying to enhance their academic position and standing (Fini et al., 2008). Therefore, it's not a given that having an academic incubator or starting an academic entrepreneurship program would yield the desired outcomes or would enhance the academic ecosystem.

Previously, our team at the Jacobs Technion-Cornell Institute had reported on an experimental program called the *Runway Startup Postdoc Program* (Haan et al., 2020). This program is aimed at filling an unmet need from a well-known academic population (postdoctoral researchers) and is in essence an experiment that could have failed. But experimentation should be a core activity of the academic endeavor, not just in the interest of science but also in the pursuit of entrepreneurship excellence. This is the same as with start-ups, which necessarily experiment to succeed. We can draw from the field of technology management (Rancic Moogk, 2012) to ascertain that to achieve a successful academic incubator minimum viable product (MVP), universities need to experiment. In this chapter, I will draw upon our experiences in the *Runway Startup Postdoc Program* and other incubator programs to recommend some areas in which experimentation might be beneficial for academic incubators and technology transfer offices.

Runway Startup Postdoc Program at Jacobs Technion-Cornell Institute at Cornell Tech[2]

The *Runway Startup Postdoc Program* is part business school, part research institution, and part start-up incubator. Based at the Jacobs Technion-Cornell Institute, Runway ushers recent PhDs in digital technology fields through a paradigm shift – from an academic mindset to an entrepreneurial outlook. These postdocs arrive with ideas for unproven products and markets that require time and specialized guidance to develop. These start-ups demand more than a few months to launch. They need a bit of a "runway." That's why our program lasts 12 to 24 months and incorporates academic and business mentorship. The Runway Startup Postdoc Program provides an impressive package valued at $277,000 that includes a salary, research budget, housing allowance, space, and more in the first year. In addition, each postdoc receives significant benefits, perks, and corporate support valued at $300,000. ◄

3 Experimentation

Experimentation in technology transfer requires three major phases (see Fig. 1):

[2]The content of the Runway Startup Postdoc Program example section has been used from https://tech.cornell.edu/programs/phd/startup-postdocs/. Used with permission.

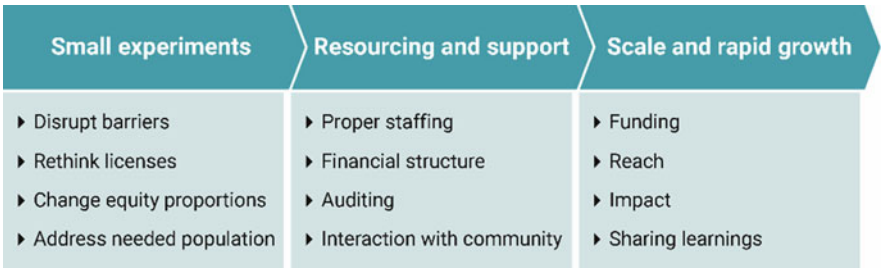

Fig. 1 The three phases of creating an experiment in technology commercialization include small experimentation, resourcing the program, and finally scaling up (author's own figure)

1. An initial phase where small but significant experiments are targeted to disrupt barriers in the traditional tech transfer process or are aimed at building a base for new tech transfer programs.
2. A phase where successful changes are maintained in time through proper resources and support from the academic environment.
3. A final phase for scaling and rapid growth, where changes and experiments become the norm and the drivers of entrepreneurship growth.

In this chapter, I will draw from our experiences at *Cornell Tech,* the *Jacobs Institute,* the *Israel Institute of Technology*, and from the literature on other incubator/accelerator academic programs to organize the process of experimentation and provide useful recommendations to successfully achieve meaningful change in technology transfer systems.

3.1 Hiring

The most basic experimentation in the process of academic entrepreneurship should be a commitment to rethinking the way we hire in an academic setting. Building a successful academic entrepreneurship system already requires us to rethink the roles and incentives of each actor involved, such as faculty, students, transfer officers, and postdocs (Siegel & Wright, 2015). But most universities never think of changing their hiring habits, which is fundamental to the population and skills that you will require for a successful entrepreneurial academic population. Studies have suggested that academics with a more entrepreneurial personality can only be recognized by a person-oriented approach rather than a variable-oriented trait approach (Obschonka et al., 2019), meaning that we have to start using models like the "big five" personality traits, not to understand our current faculty but rather to decide our future faculty. A university that wants to be successful in creating a new model of technology commercialization should start by changing hiring practices of academics and working with university management to establish new criteria for entering faculty and staff (Obschonka et al., 2012).

Of course, such change at an institutional level is easier said than done. At the Jacobs Institute, we initially focused on postdocs because it's a population that has a more accepted variety in hiring requirements. We focused on keeping the standards for academic excellence and scientific background, requiring that any postdoc be as good as if they were being considered for a postdoctoral position in any other unit of the university. But we also added entrepreneurial traits and personality profiles to the application process (Jacobs Technion-Cornell Institute at Cornell Tech, 2022). These traits comprise two out of five of the critical requirements for being hired as a Runway Postdoc, making entrepreneurial personality a large component of the selection process. Further experimentation will be done on the weight of these traits, on personality profiling, and skill assessment. But changing the established thinking on who was hired has been an immensely relevant component of the success of a novel tech transfer endeavor.

3.2 Licensing

Licensing practices and technology transfer offices (TTO) in universities have been extensively studied (Thursby et al., 2001). The traditional tech transfer and licensing approach follows, more or less, a defined series of events:

1. Faculty/staff disclose a technology to TTO.
2. TTO studies the feasibility of such technology and potential for commercialization.
3. TTO informs faculty of intention of pursuing patenting.
4. TTO and faculty pursue patenting (provisional stage).
5. TTO evaluates commercialization avenues, potential royalties.
6. TTO negotiates licenses, including royalties and equity participation.

This system of licensing has been predominant since the introduction of the *Bayh-Dole Act* (Mowery et al., 1999). And there's evidence that this system has not necessarily increased the creation of new technologies but has driven universities to more technology marketing activities which were not a previous focus (Thursby et al., 2001). From our experience, this series of licensing steps is unnecessary and uncorrelated with the creation of new technologies or new spinouts. In our experiment, we focused on the entrepreneur as the driver of the commercialization potential and flipped the script on tech transfer activities to create this new process (see Fig. 2):

1. Postdoc (staff) receives a blanket license for any technology created during the fellowship. License is standard, equal for every postdoc, and contains no royalty payments.
2. License is signed in a day.
3. If a postdoc has a technology to patent, no disclosure is necessary. Preliminary patent application is drafted using a selected IP patent law firm.

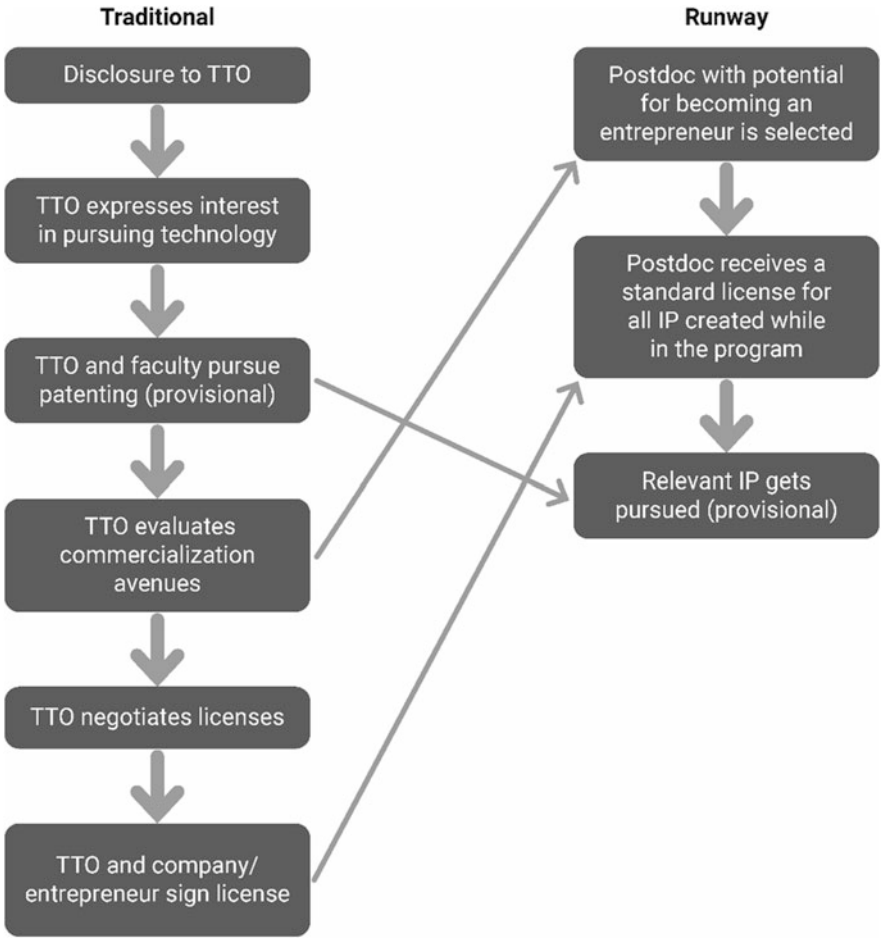

Fig. 2 In the *Runway model*, some steps of the traditional tech transfer process are eliminated, some are simplified, and the order is reversed, giving priority to find the entrepreneurs that will be the vehicle for commercialization (author's own figure)

This experiment was done to eliminate the complexity of trying to understand optimal royalty agreements or payments in early-stage companies. Although many studies have tried to understand patterns in university licensing (Thursby & Thursby, 2007), it was not clear to us that we could have accurately predicted the revenue potential of such early technologies. Therefore, we eliminated those royalty calculations and focused on licenses where the university would share in equity of a new start-up created by the postdoc. We believe over the long term, the resulting return on equity will be the relevant component in a successful commercialization effort. Adopting a standard license model is now becoming a norm in university systems. Fast-track licenses are appearing (Cornell University, 2012) in recognition that early-stage ventures are difficult to predict, and that speed in licensing might be

more beneficial for a start-up to succeed. Changing the process also yields an immediate benefit for key performance indicators (KPIs) of TTOs: In our model, 100% of technologies are licensed. TTOs could adopt similar experiments in licensing and shift resources to systems that train and guide academic entrepreneurs.

3.3 Patenting

Patenting has been not only a long-standing practice of universities even before the Bayh-Dole Act (Mowery et al., 1999) but an integral part of their goal of creating and protecting what would be considered "profitable" discoveries (Coupé, 2003). Nevertheless, there are studies that have found little or weak correlation between the act of patenting by universities and technical change (Pavitt, 1998). So, should an experiment in technology transfer focus on patenting? We believe yes, but only by providing incentives to patent useful knowledge and by reducing the barriers to patenting from start-ups. In our *Runway Startup Postdoc Program*, we decided to experiment with two components that would reduce the barriers to patenting:

1. We introduced the cost of one patent into the equity received by the university upon licensing. The cost of a patent was determined to be $25,000 and was to be included in the amount of the simple agreement for future equity (SAFE) (YCombinator, 2022).
2. We created a vehicle by which the *Jacobs Institute* can pay for patent costs in return for an additional $25,000 SAFE instrument.

These two experiments had an interesting effect. First, academic entrepreneurs understand that they are giving equity to the university and don't want to lose the opportunity to file for intellectual property that is already included in the license agreement. The result in our program was that 37 postdocs have filed for 48 patents, a 1.3 patents/postdoc average. The second experiment helps reduce the burdening costs of patenting for early start-ups. In our program, we had a single entrepreneur file for five patents that were required for a strong IP position (for a medical device), which would likely be a prohibitive cost for an early start-up with early-stage angel funding.

Incubator programs should work closely with TTOs to create similar experiments that motivate academic entrepreneurs to create useful patents and to build strategic IP positions necessary for commercial success. In fact, there are studies that show that strategic patenting has been positive in increasing the market value of software firms and that this type of approach does not lead to excessive or unnecessary patenting (Noel & Schankerman, 2013).

Case: Shade

In 2014, *Dr. Emmanuel Dumont* came to the Runway Startup Postdoc Program right after finishing a PhD in Biophysics. In France, he had worked understanding

the effect of radiation in human tissue and wanted to explore entrepreneurship in this field. The Runway Program helped in ideate and find the right market. In 2015, Dr. Dumont founded *Shade*, a company that has invented the smallest and most powerful UV sensor that can help people with immune diseases like lupus reduce and control their exposure to sunlight. *Shade* works with renowned hospitals including *Northwestern Medicine* and the *Hôpital Européen*. The Runway Program supported the filing of seven patents that were needed to build the hardware and the IP position of *Shade*. Without the ability to file such a wide portfolio of patents, *Shade* would have been a non-starter. The Runway Program took additional equity participation in the company and paid for the patenting costs. This allowed *Shade* to build a strong IP position that has been necessary for their commercial work. Under the traditional IP model, a company like *Shade* would have been constrained by too little initial capital, and IP costs would have consumed the company. ◄

3.4 Investment

It is a widely accepted notion in entrepreneurship communities that early investment and access to the right capital are a competitive advantage in the creation of successful academic start-up ecosystems. The important role of early-stage venture is well studied (Jeong et al., 2020), and the emergence of academic venture funds, such as *MIT's The Engine* (MIT, 2022), demonstrates the importance of providing the right early investment to academic teams. But not every university has the resources, connections, or capacity to raise such early-stage venture funds. In our program, we decided that early-stage investment should serve two primary functions:

1. To pay for basic sustenance of the entrepreneur. By providing funding as salary, an entrepreneur is forced to allocate a basic amount to the cost of living, and the stress of basic living expenses is reduced.
2. To give an initial amount of money for basic corporate expenses.

With this in mind, we created a simple incentive table (see Table 1) in which an entrepreneur would have two options between salary and research budget. The idea of this experiment would be to motivate entrepreneurs to choose a lower salary to have more funding per company expenses.

Table 1 Two salary options are used to gauge the commitment of the entrepreneur to allocate capital the right way depending on their product/service

Option	Salary	Research budget	Total
Option 1	$61,000	$46,000	$107,000
Option 2	$80,000	$20,000	$100,000

We found that most entrepreneurs preferred *Option 1*, which gave them more funding for corporate expenses and pushed them to raise venture capital sooner. Entrepreneurs that were building *Software as a Service (SaaS)* companies tended to prefer the higher salary due to low corporate expenses. This experiment did not provide a large amount of capital. Rather, it allocated capital in a way that made the entrepreneur own the choices and plan for future expenses. Most universities will not be able to provide large capital funds to academic start-ups directly, but they can certainly experiment with a simple funding structure that motivates academic funders to seek the necessary capital.

4 Growth

These four areas of experimentation set the foundation for a second stage of growth. Once academic start-ups are provided with that support, the TTO or incubator can begin focusing on experiments that will support the growth of the portfolio of early-stage companies. Table 2 shows the investment progress made at the *Runway Program*, per cohort, and a simple way of how a portfolio can be tracked.

The portfolio manager can track the details of each investment, and it would be optimal to use professional portfolio management software such as the ones offered by *Carta*, *Shoobx*, or others. However, a simple tracking system can have:

- **Cohort:** Tracking by cohort is important to understand market changes and the progression of value of the program through time.
- **SAFE value:** This is the addition of all SAFE instruments signed within a cohort. It includes SAFEs signed for the initial investment and SAFEs signed for other purposes, such as for additional patents.
- **Jacobs equity valuation:** It is the valuation of the equity (preferred stock) that has been received when conversion from SAFE to stock occurs. This is calculated as the number of shares times the share price.
- **Difference:** This is the difference between all SAFEs issued and the equity that has been prices. Since price equity can be liquid in the future, it indicates the potential for return on invested SAFEs.
- **Current company valuation:** The valuation as reported by companies in their latest financing round.
- **SAFEs outstanding:** The value of SAFEs not yet converted into preferred stock. SAFEs are inherently risky, and any unconverted SAFEs can become write-offs for a TTO.

Financial performance is only one part of a successful program. During the growth phase, the right mentoring and staffing are necessary to continue with the experiment.

Table 2 Example of a simple *Runway Program* investment tracking table. Even though more financial information can be gathered, this simple table can be used to track the economic performance of the portfolio

Cohort	SAFE value	Jacobs equity valuation	Difference	Current company valuation	SAFEs outstanding	Difference – no value
1.1.2014	$1,440,000	$1,352,952	$932,952	$149,000,000	$360,000	$(920,000)
1.8.2014	$960,000	$310,000	$150,000	$46,000,000	$235,000	$(650,000)
1.1.2015	$150,000	$ –	$ –	$ –	$ –	$(150,000)
1.8.2015	$570,500	$534,383	$793,520	$8,500,000	$ –	$ –
1.8.2016	$709,000	$1,304,757	$745,757	$49,000,000	$150,000	$(150,000)
1.8.2017	$831,000	$546,045	$269,045	$10,500,000	$554,000	$(554,000)
1.1.2018	$209,000	$1,622,032	$1,413,032	$40,000,000	$ –	$ –
1.8.2018	$1,283,000	$732,431	$28,043	$15,146,068	$831,000	$(831,000)
1.9.2019	$1,018,750	$ –	$ –	$ –	$1,018,750	$(1,018,750)
1.9.2020	$678,000	$ –	$ –	$ –	$678,000	$(678,000)
1.9.2021	$875,000	$ –	$ –	$ –	$875,000	$(875,000)
	$8,724,250	$6,402,602	$4,584,739	$318,146,068	$4,701,750	$(5,826,750)

4.1 Mentoring

Mentoring is a complex process that is composed of interest-based processes as well as altruistic motivations (Yitshaki & Drori, 2018). Good mentoring programs are also difficult to staff, manage, structure, and execute (Sanchez-Burks et al., 2017). Good mentoring networks are perhaps the number one competitive advantage of most sought-out incubator programs, such as *YCombinator*, *Techstars*, *500 Startups*, among others. University incubators traditionally reach out to their alumni networks and close networks to create a mentoring network capable of supporting early start-ups. But this is easier for universities that are around mature ecosystems like *Silicon Valley*, *Boston*, *New York*, and the *Research Triangle*.

In our experimentation with mentoring, we recognized that mentoring has a natural churn or change dynamic. In fact, we expect that there will be a mismatch between mentor and mentee for the simple reason that a mentor relationship is not only based on industry knowledge but also requires a personality fit. While other programs would remove a mentor for a bad fit (Sanchez-Burks et al., 2017), we decided to normalize potential mismatches but provide opportunities for mentors to interact in structured settings such as weekly scrum sessions or quarterly board meetings.

Entrepreneurs are also encouraged to find at least four types of mentors: academic, industry knowledge, venture capital, and practical entrepreneur. While they might not find these four during the initial year of incubation, the structure makes them aware of the complementary skills required in long-term mentoring.

Case: Biotia

In 2015, *Dr. Niamh O'Hara* was working on next-generation sequencing technologies and wanted to find a way of transforming that knowledge into a company that would use the power of sequencing. Dr. O'Hara came to the Runway Startup Postdoc Program and teamed up with *Dr. Chris Mason* at *WCM* to begin creating the largest sequencing database of pathogens in the world. The Runway Program supported her as she explored product-market fit until finding it. Dr. O'Hara is now the CEO of *Biotia*, a company that has raised over $4 million and has sequenced pathogens and viruses swabbed from the subway of New York all the way up to the *International Space Station*. *Biotia* required three years of work to find the right product-market fit. Under a traditional TTO model there would have been no economic support for an entrepreneur for such a long time to continue to build the product. *Biotia* required time and investment to get to the stage where the product was able to be deployed commercially. ◄

4.2 Staffing

Studies in key factors affecting the success of an entrepreneur while inside an incubator program have recognized the assistance provided by incubator staff as one of the five most important success factors (Isabelle, 2013). Staff members that are experienced, are former entrepreneurs, or have extensive networks to an ecosystem of funders, founders, institutions, and strategic partners are necessary for an early-stage academic incubator to succeed (Todorovic & Moenter, 2010). But having staff can also be expensive and ineffective. It is therefore important to understand what the optimal resource allocation can be, especially when constrained by staff budgets.

In the beginning of the Runway Startup Postdoc Program, a staffing budget was nonexistent. The only staff member was the director of the program, making it difficult to provide the level of services required by companies. One experiment that we ran to relieve some of the staffing pressure was to use each cohort as the staff/mentor resource for the incoming cohort. For early-stage start-ups, most of the resources given by staff are access to partnership programs and effectively replying to questions regarding incorporation, funding, partnerships, etc. Alumni founders and even cohort members that are farther along in their entrepreneurship journey can take over some of the roles that staff members play in incubators. This relieves monetary budget pressures and builds cohort unity. The role of early founders, meaning founders in their second or third year of entrepreneurship, is key to building an incubator that is effective even with a low staffing budget.

Proper staffing can also become a key factor in connecting entrepreneurs with relevant capital sources. And staffing requirements may vary significantly depending on the geographical location of the incubator program. For example, a program in *New York* or *Israel* might require staff who are acquainted with the local ecosystem, while a program based in *Thailand* might benefit more from staff members who know foreign ecosystems (Solan et al., 2021).

Case: OneThree Biotech

In 2018, *Dr. Neel Madhukar* was a PhD candidate in Computational Biology and Medicine when he became interested in entrepreneurship. He started by attending the *Bioventure eLab program* and participated in its *Business Plan Challenge*. With the support of *Dr. Olivier Elemento*, *WCM*, and the Runway Startup Postdoc Program, Dr. Madhukar continued to explore the use of computational algorithms developed by him and the *Elemento Lab*. Dr. Madhukar soon founded *OneThree Biotech*, a company that now works with some of the largest pharmaceutical companies in the world (including *AstraZeneca*, *Boehringer Ingelheim*, *Oncoceutics*, and *Jubilant Therapeutics*) to help them improve their drug discovery pipeline, particularly for rare cancer diseases. *OneThree Biotech* has raised over $2 million and is headquartered in New York City. When Dr. Madhukar entered Runway, he knew he needed to license IP that had been generated at *Weill Cornell*. Runway allowed him to have the time and support needed to build the

strategy to effectively license IP in the traditional TTO model while simultaneously licensing IP in the new model. *OneThree Biotech* shows that the Runway model can also work with traditional TTO offices and build a path to improving commercialization without changing all TTO practices. ◄

5 Scaling

The last and most critical part for a long-term technology transfer and incubation operation is to achieve scale. There's not a single definition of what output constitutes scale, but with more and more start-ups coming from the academic environment, more attention should be paid to how services and resources can be deployed in a scalable manner. In the same way as for early start-ups, scaling brings challenges in terms of human resources, capital, and general resources (Reypens et al., 2020). Our programs are presently going through this challenge, and we have identified two large areas where experimentation can help our scaling efforts.

5.1 Curriculum

Curriculums in tech transfer programs or incubators can be seen from two angles: They can be thought of as uniquely developed programs (not related to degree-granting curriculums) to increase the success rate of academic start-ups (Wiradinata & Antonio, 2019), or they can be seen as extensions of current degree programs, such as undergraduate and graduate business entrepreneurship programs (D'Cruz & O'Neal, 2003). Both approaches can be optimal and contribute to the success of academic entrepreneurs. Currently, both approaches rely heavily on the curriculum set by the *National Science Foundation's iCorps Program* (National Science Foundation, 2021), and while this curriculum is a good foundation, it does not address all the key success roadblocks of academic entrepreneurs.

In our *Runway Startup Postdoc Program*, we went beyond *iCorps* and focused on developing a curriculum that addressed key aspects that hinder academic entrepreneurs. Through observation, mentor feedback, and data gathering, we recognized a few areas where a targeted curriculum would yield extremely positive results for our entrepreneurs:

1. **Decision-making:** Academic entrepreneurs have years of training on data gathering and analysis. During a PhD program, for example, a scientist can gather vast amounts of information and has months or years to analyze and make decisions about it. But that's not the time frame of a start-up, and academic entrepreneurs suffer greatly from analysis paralysis (Stagars, 2014). We have focused on a specific training using executive coaches that addresses decision-making and gives entrepreneurs a methodology for making decisions (Strauss Einhorn, 2017).

2. **Selling themselves:** Entrepreneurs tend to understate their achievements or hide their achievements in technical jargon. Effective communication of value requires retraining for a technical person, one who has spent many years in academia focusing on technology. We experimented with different ways of providing this training, from hiring marketing agencies or actors to PR consultants. We now provide training with an entrepreneur who specializes in building "irresistible organizations."
3. **Self-kindness:** Entrepreneurship is brutal. It requires relentless commitment and nonstop work. The best qualities of successful entrepreneurs, such as grit, discipline, and commitment, can also be the worst. There is nascent literature on entrepreneur burnout (Sheperd et al., 2010), but it should be a growing area of concern, especially for high-performing TTOs and academic incubators. We have experimented with providing a variety of community-based mental health trainings and resources to our entrepreneurs. Also, we take an empathy-first approach to mentoring where mentors support an entrepreneur in hard times. Universities should have a mental health strategy before starting incubator programs and a strategy that goes beyond the employee resources normally provided to staff and faculty.

5.2 Resources

The last challenge concerns how to scale resources. As mentioned earlier, financial, and staffing challenges arise (Reypens et al., 2020) when these programs start to work with dozens of entrepreneurs per year. The best strategies for resource scaling might have come from learnings from the COVID-19 pandemic: Online tools can be as effective as in-person ones, and hybrid, flexible approaches will be preferred by entrepreneurs moving forward. In our program, we are currently experimenting with transitioning most of our content and trainings to online modules that can be offered as flipped classrooms. We also changed in-person scrums and meetings to a virtual format, and program meeting times to suit the schedules of mentors on the *West Coast*, *East Coast*, *Europe*, and *Israel*. This has allowed us to bring more alumni entrepreneurs into relevant strategic discussions and to build a larger resource and support community. We still have much to learn about the right approach and the limits of full online resourcing, but we are ready to pivot or allocate resources to experiment as new communication technologies become preferred.

6 Learnings and Takeaways

The process of incubation and acceleration in academic settings is analogous to the challenge an early start-up has, one of *building*, *growing*, and *scaling*. Thus, experimenting should be a natural component of incubator programs and the most effective way of producing meaningful change in technology transfer systems that are decades old and that, through university policy, have no motivation to change.

The experience of the *Runway Startup Postdoc Program* at the *Jacobs Institute* has demonstrated that constant experimentation can create small yet powerful changes that eventually permeate through the larger academic institution. Our recommendation to academic incubators and TTOs is to embrace experimentation and build a technology transfer culture that is less concerned about the traditional output metrics (i.e., patents, licenses, revenue) and is more geared toward providing people with the *resources*, *connections*, and *knowledge* they require to create a start-up.

Takeaways

- **TTOs:** Understand that a more effective strategy for technology commercialization is based on finding the entrepreneur who will be the vehicle of commercialization, not in promoting technology disclosures.
- **Start-ups:** Reduce the time it takes to negotiate licenses by agreeing to standard and simple licenses that consider the unknown nature of start-ups. Negotiate simple equity stakes and payments that do not deplete the company of cash early in its life.
- **Investors:** Help TTOs select entrepreneurs, show them your tools to create effective teams, and join universities with funding in the stage of the commercialization process which suits better your investment thesis.
- **Corporations:** Use the same runway or new experimentation model and discover populations within your company (e.g., scientists) that are underserved and have a high potential for becoming new product/company leaders.
- **Universities:** Allow for institutional programs that experiment, fail, and push the boundaries of technology transfer. Motivate these programs to build an ecosystem of mentors that augments the university as a whole.

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Fernando Gómez-Baquero holds a PhD in Nanoscale Science and Engineering from the College of Nanoscale Science and Engineering at the University at Albany SUNY. His research has focused on advanced nanomaterials for energy storage applications, on the economic impact of pervasive nanotechnologies, and on tech entrepreneurship. Dr. Gómez-Baquero has more than 15 years of experience in the nanotechnology industry, starting with the production and characterization of carbon nanotubes and the development of polymer/nanotube composite materials. Dr. Gómez-Baquero is recognized as a leader in the fabrication of nanoengineered electrodes for lithium-ion batteries using semiconductor processes and using nanotechnology to improve the performance of lithium-ion batteries. Dr. Gómez-Baquero has several publications in nanomaterials research and on the economic impact of nanotechnologies, and has a number of patent applications in diverse applications of nanomaterials. Dr. Gómez-Baquero has been a co-founder and early technology lead of various companies, such as Besstech, NanoColombia Ltd., Innovate Prefabricate, Dendron Nanomed, Midstate, Revela Medical, and FlashCharge Batteries, among others. He is also the Director of Runway and Spinouts at the Jacobs Technion-Cornell Institute at Cornell Tech, where he is helping postdoctoral entrepreneurs build companies out of digital technologies in diverse fields, including digital health, telecommunications, education, cybersecurity, and IoT.

A University Perspective with a South African Flavor

Madelein Kleyn

1 Introduction

Universities conduct a vast array of research across many disciplines and, in addition to their traditional educational function, play a significant role in technology transfer, realizing the importance of delivering entrepreneurial education and developing entrepreneurial knowledge and skills. The commercialization of intellectual property rights from universities has an impact on sustainable socio-economic growth. University technology licensing and the formation of start-ups are effective commercialization vehicles to support a knowledge-driven economy based on research and innovation.

2 Technology Transfer in the University Environment

There are many definitions for the term *technology transfer*. In a university context, the *Association of University Technology Managers (AUTM)* defines University Technology Transfer as "*the process of transferring scientific findings from one organization to another for the purpose of further development and commercialization*"; Hockaday (2020) defines University Technology Transfer as being "*all about identifying, protecting, and marketing university research outputs in order to shift opportunities from the university into business.*"

There are two types of universities, i.e *public* and *private*. A *public university* is a university that is predominantly funded by public means through a national or subnational government. In other words, the funding is largely from taxpayers. Whether a university is considered public varies from country to country.

M. Kleyn (✉)
Technology Transfer, Stellenbosch University, Stellenbosch, South Africa
e-mail: madeleink@sun.ac.za

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_15

A *private university* is a university whose funding comes from tuition fees, investments, and private donors. The funding is not from taxpayers. These for-profit universities are managed as businesses with the purpose of generating revenue.

Intellectual property (IP) management at public universities is closely regulated by national legislation. Policies emanating from the dominant role of the government institutions funding academic research and the technology transfer process is a complex one. Private universities are generally guided by internal IP policies.

Regardless of whether the university is public or private, policies and procedures are central to the management of intellectual property and to technology transfer.

2.1 Policies and Legislation

Legislative and policy frameworks that facilitate IP management and technology transfer provide predictability and legal certainty along the innovation value chain, thereby enhancing the commercialization of inventions, whether emanating from privately or publicly financed research and development.

Most academic and research institutions have formal technology transfer policies. These policies often extend to consultants and contractors engaging with the university. It is thus important to understand the requirements of the institution you engage with to determine if you must disclose your invention to the institution or if you can independently commercialize your innovation. Most IP policies are freely available on the websites of the relevant *technology transfer offices (TTOs)*.

2.2 Legislative Background

The *USA Bayh-Dole Act* of December 12, 1980,[1] fundamentally changed the system of technology transfer for public universities. The ongoing aim of this legislation is the regulation of intellectual property ownership and commercialization (through licensing) of technology development and innovation sponsored by government funding. Many other countries followed in the footsteps of the United States with similar legislation to the Bayh-Dole Act to encourage university-based innovation. These include China, Brazil, Russia, Japan, the Philippines, Germany, the United Kingdom, Italy, South Africa, South Korea, Malaysia, Singapore, Denmark, Finland, and Norway. Today, a wide array of cooperative programs has been created by the various countries' governments to promote economic development through technology development and deployment. University technology transfer policies

[1] In the case of the United States, there was also the *Technology Transfer Act* of 1988 governing *cooperative research and development agreements (CRADAs)* between universities and industry that provided additional incentives for the development and commercialization of technology.

are fundamental to the R & D ecosystem that has fostered the development of many innovative technologies of great impact on the economy and society.

As a result of the Bayh-Dole-like IP legislation, technology licensing and related technology transfer activities began to emerge from universities and research institutes. Although technology is commercialized, the main strategy for universities is to retain the right to continue with research. In research relationships with industry, universities have to carefully guard their ability to disseminate knowledge and find the fine balance between academic freedom and incentives for corporate sponsors to be assured that the results of the research are available for commercial exploitation.

The Bayh-Dole-like IP legislation did not, in all countries, automatically grant universities ownership of their inventions but established clear rules and guidelines for the intellectual property resulting from publicly funded research while granting sufficient autonomy to research institutions. As a result, it was necessary for universities to develop and implement IP policies and procedures.

In the South African context, the *Intellectual Property Rights from Publicly Financed Research and Development Act*, Act 2008 of 2010 *(the "IPR Act")* came into force in August 2010.

The objective of the IPR Act (Section 2(1)) is to "*make provision that intellectual property emanating from publicly financed research and development is identified, protected, utilised and commercialised for the benefit of the people of the Republic, whether it be for social, economic, military or any other benefit*." The IPR Act is modeled on the Bayh-Dole Act. Figure 1 summarizes the legislative environment in which the South African TTO operates.

In a South African National Survey[2] by the *National Intellectual Property Management Office (NIPMO)* between 2014 and 2018, 37 publicly funded research institutions were governed by the IPR Act (NIPMO, 2021). To summarize the impact of technology transfer in the South African context as a consequence of this legislation, on a total R & D expenditure of approximately ZAR60 billion, more than 100 start-up companies were formed, 72 of which are still operational; an estimated 300 IP licenses resulted that generated more than ZAR185 million, with more than ZAR23 million in revenue paid to IP creators.

2.3 Policy Frameworks and IP Management

As mentioned in the introduction to this chapter, university research covers a wide range of academic and scientific fields and (often) serves the direct needs of industry by developing new products and processes. In this way, universities are key to the academic research community. Intellectual property rights protecting the innovation derived from university research allow universities to safeguard intellectual property

[2] https://nipmo.dst.gov.za/resources/south-african-national-survey-of-intellectual-property-and-technology-transfer-at-publicly-funded-research-institutions-2014-to-2018.

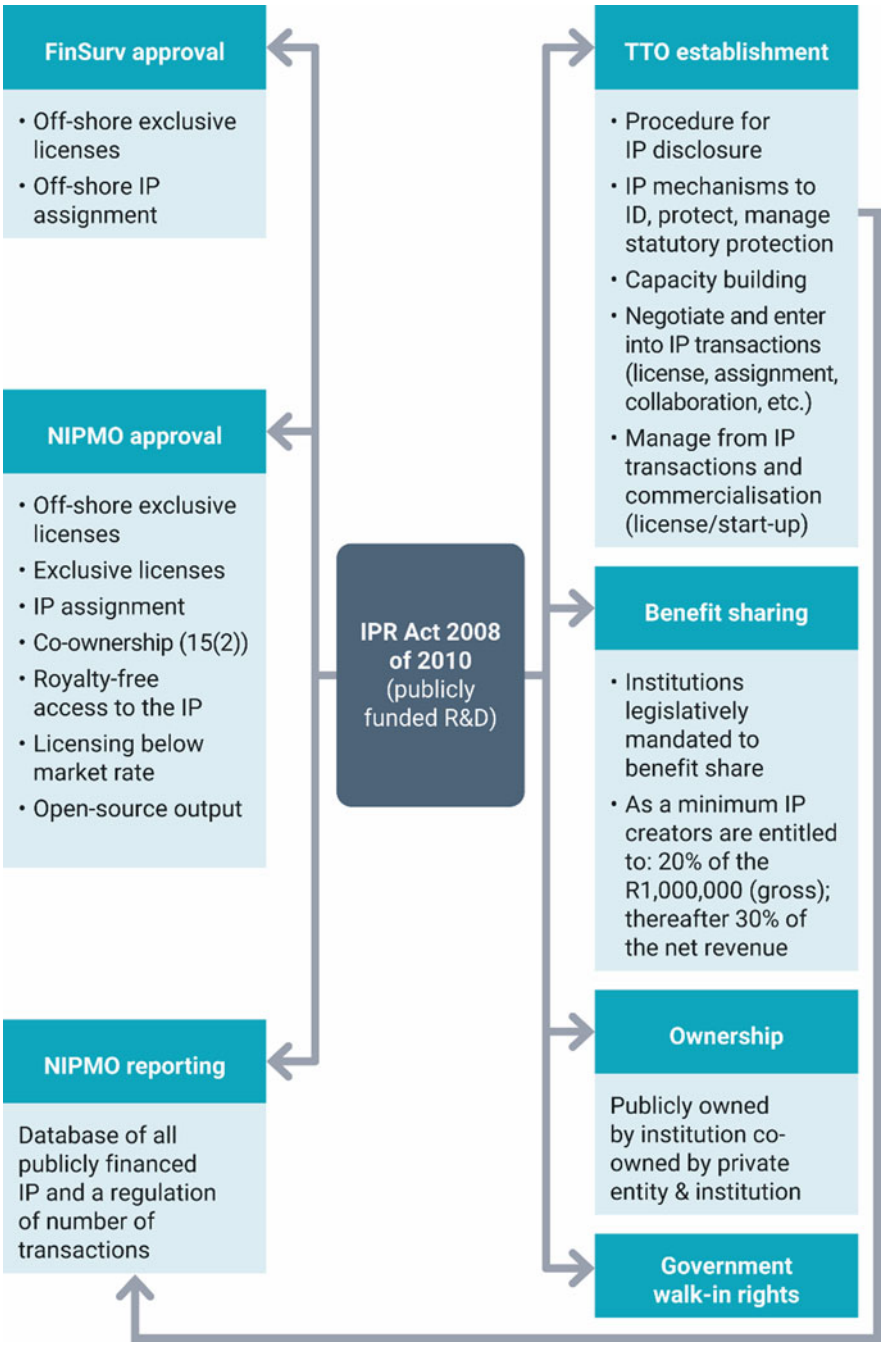

Fig. 1 Legislative environment: Scope and working of the IPR Act (author's own figure)

and at the same time ensure the availability thereof for the benefit of society. An IP policy is essential for the strategic management of intellectual property and the effective transfer of technology and knowledge. Although IP policies are implemented at most universities, the policies are diverse with respect to ownership and commercialization models associated with the different forms of IP, engagement with industry, third-party IP risk assessments, and benefit and reward sharing with the individual researchers and research teams.

Common across most university policies are procedures that involve the voluntary disclosure of inventions and assignment of ownership in the associated IP right to the university by explicit agreement and the establishment of the necessary infrastructure and expertise through TTOs to foster the transformation of university research with a commercial value into commercial goods. This is done through protection of the intellectual property, often patents, overseeing and managing the prosecution and maintenance of the IP, and by engaging in productive commercial relationships with private companies and investors to create revenues for the university, either through third-party technology licensing or spinning out university start-up companies.

3 The Technology Transfer Process

Central to the technology transfer process at universities are the *technology transfer offices (TTOs)*, also referred to as *technology licensing offices (TLOs)*. In some countries, the formation of TTOs and their functions are regulated by legislation, and in others, they are not. The main role of TTOs is to support research faculty disclosures, select the most appropriate IP protection mechanism, enforce intellectual property policies, engage with, and often manage, the university-industry relationships, and, most importantly, promote the commercialization of academic knowledge within the private sector to create and increase revenue associated with technological innovation through license royalty income or commercialization in university start-ups for the benefit of society.

In essence, technology transfer entails identifying new technology and innovation resulting from funded research and then finding the means by which to commercialize these. There are traditionally two routes for commercialization:

1. Licensing of the intellectual property to existing companies in the private sector (i.e. industry partner); or
2. Spinning out (i.e. creating) a university start-up venture and contributing the technology under a license to the start-up in exchange for equity and royalty payments, often with an option to later assign the IP to the start-up.

The start-up ventures, more often than not, rely on external funding from sources such as government funding programs, venture capitalists, or angel investors.

Table 1 Proportion of funding per R & D spending for American universities (AUTM, 2019)

Total R & D exp (USD)	Government funding (USD)	Industry funding (USD)
$76,690,595,365	$39,067,745,198	$5,163,195,672

3.1 Funding

Universities are reliant on government funding, grants, and contracts as well as on non-grant private and industry funds and investments to financially support research and the commercialization of research. Industry funding supports university research with the incentive of developing new products and creating innovations for commercial benefit. Governments invest in universities to realize tangible economic benefits in the interest of society. There are many governmental as well as private funding agencies and institutions that support universities in the development and commercialization of intellectual property. The *National Science Foundation* (NSF, United States), *National Research Foundation* (NRF – many countries have these), the *National Institutes of Health* (NIH), and the governmental *Department of Agriculture* generally provide research funds to universities. *Datalab*[3] and U.S. Government funding of colleges and universities[4] list a few for the United States; for the European Union, see the *European Innovation fund*,[5] the *European Investment fund*,[6] and the EU funding and grants[7] and data on research funding at European universities.[8] The *Global Innovation Fund*[9] is an investment fund that assists any project that can make a social impact and has government departmental support from the United Kingdom, South Africa, Australia, and the United States.

Universities leverage these external funding sources to produce, co-produce, and directly bring to market critical innovations.

According to the *Association of University Technology Managers (AUTM)*, survey results[10] for American universities show that more than 50% of the R & D expenditure was funded by government and less than 10% was funded by industry (AUTM, 2019, see Table 1).

[3] https://datalab.usaspending.gov/colleges-and-universities/ last visited March 18, 2022.

[4] https://www.bestvalueschools.com/rankings/government-funded-colleges/ last visited June 23, 2021.

[5] https://ec.europa.eu/clima/policies/innovation-fund_en last visited June 23, 2021.

[6] https://www.eif.org/ last visited June 23, 2021.

[7] https://europa.eu/european-union/about-eu/funding-grants_en last visited June 23, 2021.

[8] https://www.topuniversities.com/student-info/student-finance/research-funding-european-universities last visited June 23, 2021.

[9] https://www.globalinnovation.fund/who-we-are/about-us/ last visited June 23, 2021.

[10] http://www.autmsurvey.org/statt/searchResults.cfm last visited June 23, 2021 (membership access required) – infographic for earlier years can be viewed here: https://autm.net/AUTM/media/Surveys-Tools/Documents/AUTM_FY2017_Infographic.pdf.

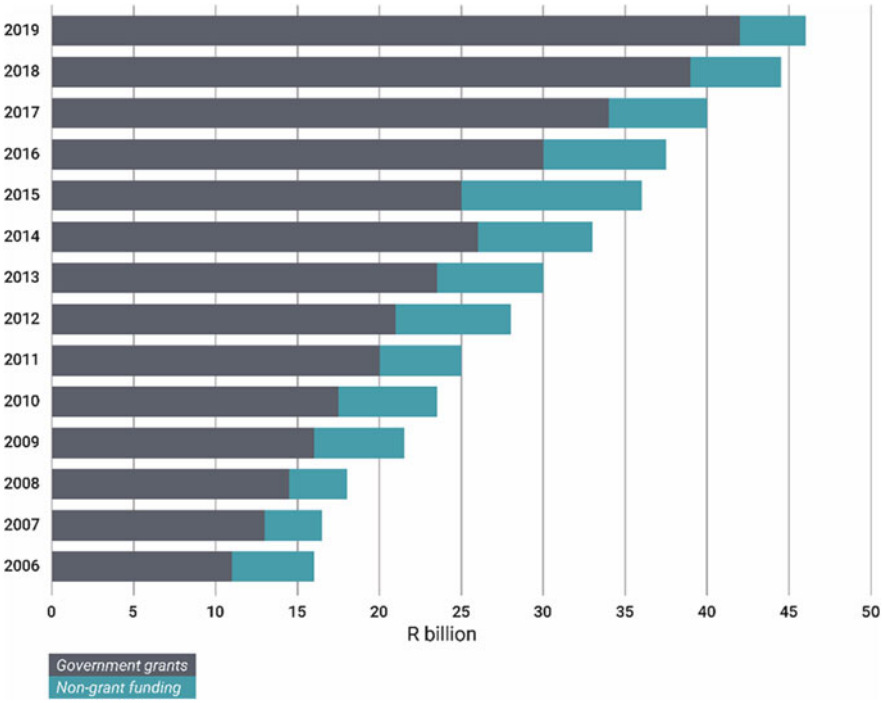

Fig. 2 South African government funds and grants. Higher education funding over time and sources of revenue: Government grants vs. non-grant funding (South African Government, 2020)

There are various sources for *EU* grants and funding. They can be viewed on *EuroActiv.com* or the *Research and Innovation Observatory – Horizon 2020 Policy Support Facility* statistics portal.

In the South African context, Fig. 2 displays the South African government funds and grants from 2006 to 2019.

Another significant fund is the *University Technology Fund (UTF)*, which was launched on January 31, 2020. The UTF is the first fund of its kind for the African continent. It was initially established by the SA SME Fund in its endeavor to partner with South African universities to commercialize the technologies and business concepts arising from these institutions. The UTF funds projects that possess tenable patents, prototypes, and intellectual property originating from South African universities.

3.2 Interaction Between Universities, Government, and Industry

Universities and/or research institutions' basic research resulting in inventions, or other intellectual property, more generally, requires significant further development

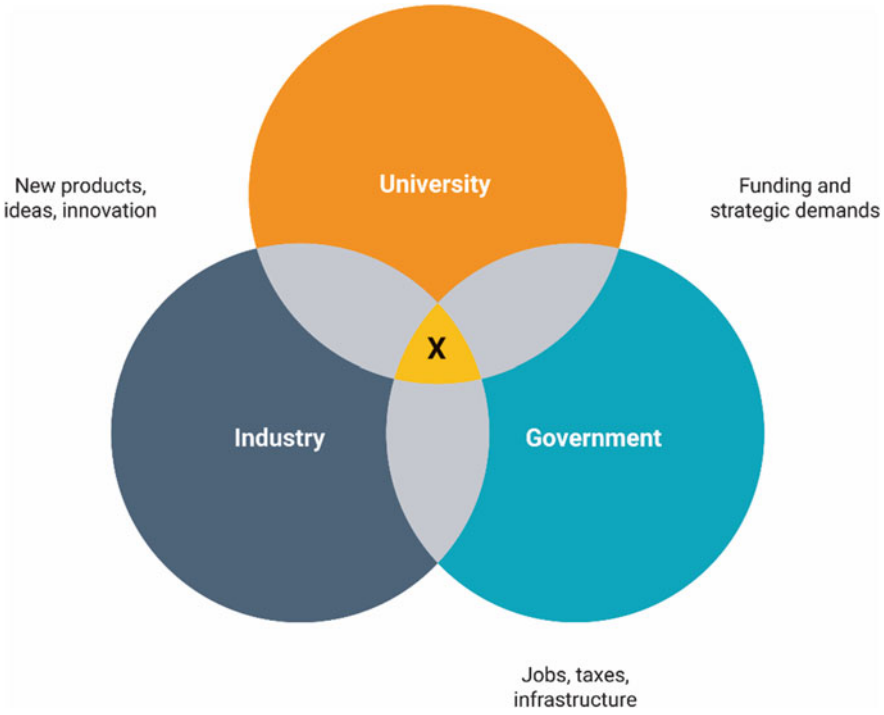

Fig. 3 Triple Helix strategic interactions in a developed country (X indicates a science park) (adapted from Kimatu, 2016a, 2016b licensed under CC BY 4.0)

before such inventions can be commercially exploited and also socio-economically relevant.

While there are various models illustrating the interactive concept, the Triple Helix model best defines the emergence of the role players.

The *Triple Helix* model of innovation was developed in the 1990s by Henry Etzkowitz and Loet Leydesdorf (1995). This model illustrates the constant interaction between universities, industry, and government to foster economic and social development to boost innovation. The model is not stagnant and due to the interaction between and among these three elements, hybrids are formed with the roles of the entities adapting as required. While the university's main role is the source of research outputs and the production of knowledge and know-how, industry is generally the vehicle of commercialization, and the role of government is regulatory. Through technology transfer activities, the university often takes on the role of commercialization and fundraising, while the government assumes the role of funding and support in addition to its purely regulatory role. The *Triple Helix* model has been adapted by various users over the years, but in principle the basic model is as illustrated in Fig. 3.

The university collaborates with industry to develop and transfer scientific research to industry.

Government and industry define certain needs for new products and processes which the university delivers on, provided there is funding. These strategic demands result in the development and growth of businesses, the inception of new businesses, new technological developments which create jobs, and infrastructure that supports a government's tax base and, through commercialization, returns funds to the university and incentivizes further research and development.

The technology transfer process and managing the different interactions in the university context are very complex. The complexity of the interrelationships is well reflected in the following model from the *National University of Singapore (NUS)* (Allen & O'Shea, 2014; Wong et al., 2011) illustrating the evolution of the interaction (see Fig. 4).

3.3 Licensing

Publicly funded research institutions or universities that are governed by Bayh-Dole-like legislation must offer license rights to innovations to industry for commercial development.

Although universities license new technologies to a broad spectrum of organizations and individuals ranging from large for-profit companies and other research institutions to early-stage start-ups, small businesses generally receive preference.

In most countries, the government retains certain walk-in rights to acquire ownership of intellectual property that is necessary for public health and safety; it also receives a non-exclusive, irrevocable license to the invention. Universities must share with the inventor(s) any income derived from the commercialization of intellectual property.

The benefit-sharing model will depend on national legislation and university IP policies, but generally the income distributed is calculated as the remaining income after technology management expenses.

Universities often license the innovation to the spin-out company that is formed as a technology start-up; the founder-entrepreneur-innovator has the strongest desire to make the technology a success in all stages of product development and during the licensing process.

The university license model includes the principal value of the university retaining control of the patent (or intellectual property) rights and the obligation on the licensee to take all further responsibility for the payment of intellectual property prosecution and maintenance costs in addition to the payment of a royalty.

Licensing fees can be upfront or running royalties, or both. These lump sum upfront royalty payments can range from anywhere between a few hundred to several hundreds of thousands of dollars.

Royalty rates range from anywhere between 1 and 10% and would very much depend on the market potential for commercialization. Most often royalty rates are set between 3 and 5%. Royalty rates are generally levied on net sales. Universities may also set milestones for deliverables and payments which are specified over a

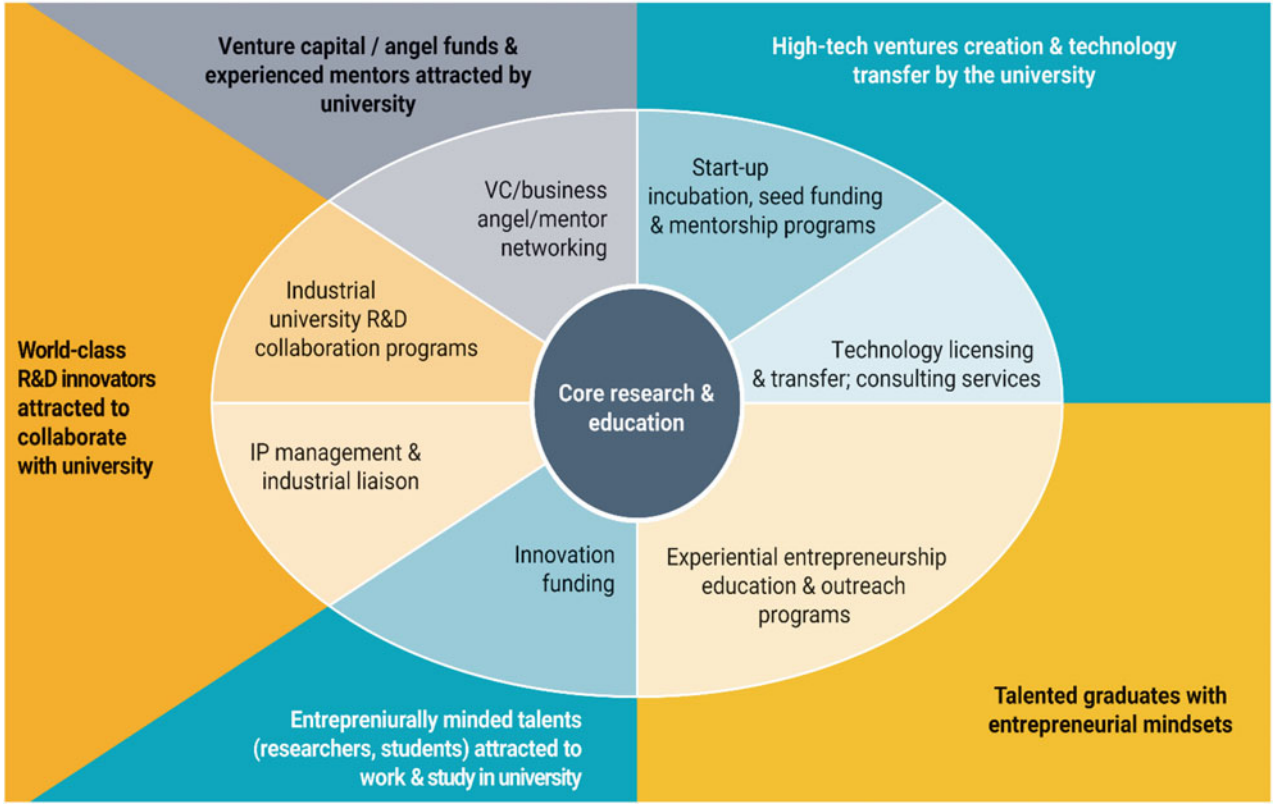

Fig. 4 National University of Singapore (NUS) interrelationship model (Wong et al., 2011)

Table 2 For the year 2019, license activities in US$ from U.S. universities and research institutions (AUTM, 2019)

Nr of licenses	Nr of exclusive licenses	Nr of non-exclusive licenses	Nr of active licenses	Licenses to start-ups	Licenses to SMEs	Licenses to large companies	License revenue (running royalties)
8,016	2,060	5,645	49,477	1,481	4,684	1,809	1,226,497,326

period of time and may not necessarily be linked to actual sales. These are often used in case of exclusive licenses to allow the university to cancel exclusivity, or the license altogether, in the event the milestone targets are not met. Generally, licenses will include a report and auditing provision to allow the monitoring of the performance of the licensee by the university. The term of the license will depend on the nature of the intellectual property and the specific termination provisions. Most licenses will be for a relatively long term, for instance from 5 to 10 years, with the option to review and renew the terms. Licensing terms are, however, case-specific, negotiable, and vary from institution to institution; they heavily depend on the field of technology, its maturity, the level of technology development, and the value (or perceived value) of the intellectual property. According to AUTM, 2019, U.S. TTOs continue to license primarily to small companies as compared to large companies and start-ups (AUTM, 2019). The reported share of licensing from small companies grew from 44.4% in 2015 to 58.7% in 2019 (see Table 2).[11]

4 University Start-Ups

Creating a successful new business is challenging in any circumstances; balancing the various interests of academic founders, the university, investors, and managers makes this especially so with university spin-outs.

Not all technologies coming out of universities are appropriate to spin off into start-up companies. It is important for TTOs to recognize which technologies should seek venture funding and which are more appropriate for licensing transactions.

To determine whether intellectual property commercialization is suitable for licensing or start-up, the TTO assesses which technologies are suitable for venture funding and which are not. In this strategy, the TTO would consider the desirability, viability, and feasibility of the technology to succeed in the market. For early-stage technology, the risks associated with the technology in terms of getting it from the lab, proof of concept, or prototype into a commercial product or service must be evaluated.

[11] See https://autm.net/surveys-and-tools/surveys/licensing-survey/2019-licensing-survey/licenses-and-options.

Once a technology has been identified as suitable for a start-up, it is the role of the TTO to educate the founders on the process for forming a new company and how to engage with and meet the investors' expectations.

4.1 University Equity in Start-Ups

Spinning out a new company from the university as a start-up for developing research outputs from the university generally involves the founding university, the founding researcher, and funds.

Universities almost always takes equity in these start-ups. Some universities form related companies or foundations specifically to hold equity in university start-ups; or the university itself takes equity in the start-ups.

Equity models vary vastly and can be anything from 5 to 50% of a company's total issued shares, depending on the university IP policies, investment partners, and founding partner. *Oxford*, for example, used to take up to 50%, but has changed its approach and now only seeks up to 20% from Sept 2021,[12] whereas *Stanford* never takes more than 10% equity. Some universities appoint a director to the board of the company; others choose not to interfere with the direct management of the company.

Some universities expect their initial ownership interest to be protected from dilution for either a defined period or may set certain milestones to be achieved before any share dilution will be considered.

Overall, the strategy is more or less that the university takes some equity, either at a cash buy-in or, more often than not, in exchange for access to the university-owned IP linked to a **royalty based on the sales** of products using the licensed technology. Royalty rates can vary anywhere between 0.5 and 5% and are usually linked to a minimum annual payment which could be any amount the parties negotiate. It is expected of the start-up to pay for the prosecution and the further **maintenance of the IP** from the effective date of the IP license.

Negotiating equity-based deals between the university and the start-up founders requires having a firm grasp of the full implications of equity dilution scenarios, how to deal with the valuation of shares, the type of shares issued, and rights in future funding rounds. This calls for a solid understanding of the IP license deal and the complexities of funding arrangements and investments that are needed to grow the business. It is thus essential to involve drafting experts for shareholder, IP licenses, and funding agreements. University start-ups have the advantage of access to the resources of the university, especially the technology transfer office, which assists with and facilitates the spinning out of the company, the incorporation of the company, and the provision of access to advisors and experts for the drafting of the appropriate agreements; more importantly, it has networks that allow access to funds, investors, and clients.

[12] https://researchsupport.admin.ox.ac.uk/innovation/ip/equity.

Table 3 Total number of university start-ups in operation among all U.S. universities and research institutions in 2019 (AUTM, 2019)

New start-ups	Cumulative operational start-ups	Number of start-ups with university equity
1,040	6,725	823

According to AUTM 2019 1040, new start-ups were formed overall in the United States during 2019 (AUTM, 2019). Table 3 summarizes the total number of university start-ups in operation among all U.S. universities and research institutions at the end of 2019 and indicates the number of start-ups for 2019 where universities took equity in the start-ups (see Table 3).

With South African universities, models differ. Most active universities in start-up formation are *Stellenbosch University* and *University of Cape Town (UCT)*. Stellenbosch established a separate entity to hold equity in the university spin-outs, whereas UCT has no separate legal entity for this purpose. There are currently 37 publicly funded research institutions (Higher Education Institutions and Science Councils).[13]

4.2 University Incubation Programs

Universities' efforts to align their participation in innovation and entrepreneurship, incubators, accelerators, and fund programs are essential.

Through incubation programs, the technology transfer office assists the university faculty, staff, and students in the services and support needed to create start-ups, bring products to market, and provide access to critically needed funding.

The availability of, and access to, entrepreneurial infrastructure facilitates university spin-outs. University incubators, accelerators, science parks, and fund programs are tools used in support of creating start-ups, bringing products to market, and providing access to funding.

Incubators and accelerators are different. An incubator fosters an early-stage start-up, whereas an accelerator aims to grow an already partially developed start-up quickly and efficiently.

Most university incubators are either on campus or nearby and typically include office space, laboratories, and additional support, such as training, mentors, and access to investment funding for start-up companies. Oftentimes, these incubators provide a pre-accelerator component to help develop the entrepreneur students and the associated start-up over a short period of time to prepare the start-up for the accelerator program.

Accelerators expedite the growth of existing companies with a minimum viable product; they are designed to prepare the start-up for investment.

Figure 5 illustrates the differences and the overlap between an incubator and an accelerator (MakerSource, 2018).

[13] NIPMO Survey 2014–2018 *supra* (NIPMO, 2021).

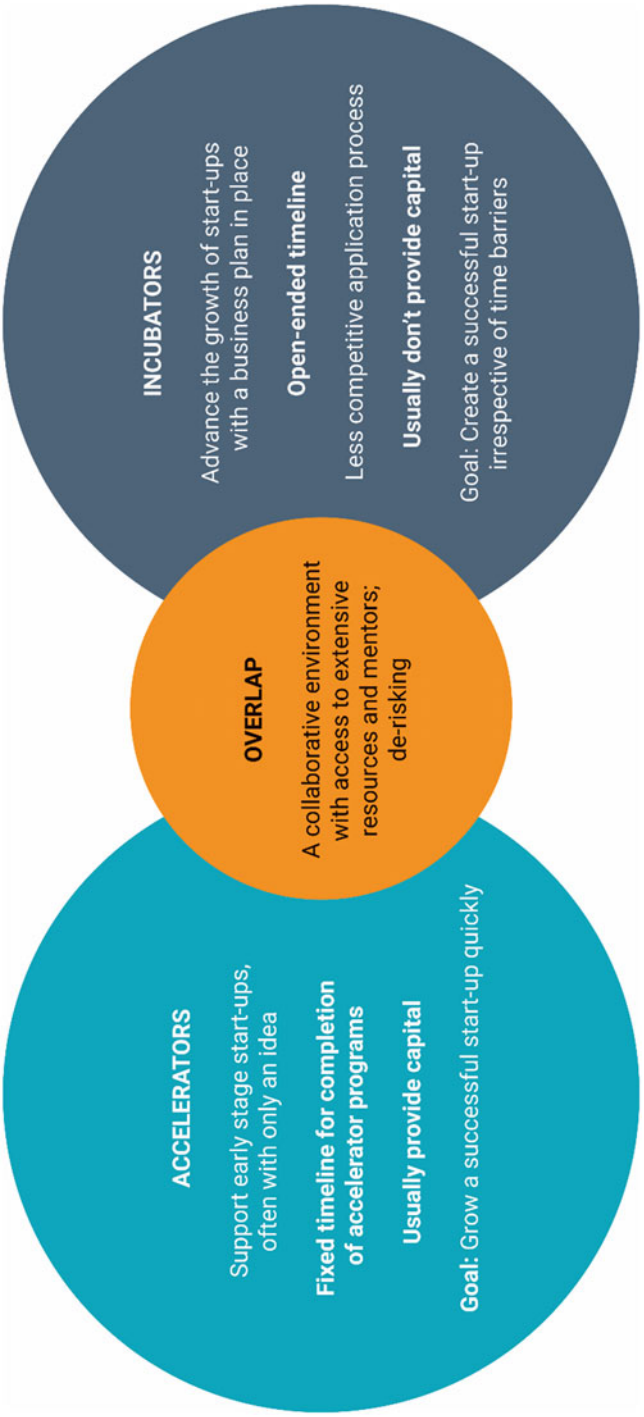

Fig. 5 Differences and the overlap between an incubator and an accelerator (adapted from MakerSource, 2018)

University incubators not only focus on the commercializing of intellectual property originating from research but also provide the mechanism for bringing together sources of innovation and sources of entrepreneurial knowledge developed both inside the university and externally, through the support of new ventures that have direct and indirect university affiliations (Nicholls-Nixon et al., 2020). According to Forbes, the five top university incubators are *Berkeley (Sky-Deck)*, *Harvard (Venture Incubation Program VIP* and *Launch Lab X)*, *Massachusetts Institute of Technology MIT (delta v)*, *Stanford (StartX)*, and the *University of Pennsylvania (VIP-C)* (Legatt, 2019).

4.3 Example: From Invention to Commercialization – A Stellenbosch University Start-Up Technology Transfer Journey with Nanofibers

Eugene Smit is an inventor, scientist, and entrepreneur. He completed his PhD in polymer science from *Stellenbosch University (South Africa)* in 2008 with a focus on electrospinning and studies toward high-throughput production of nanofiber yarns. Dr. Smit founded the *Stellenbosch Nanofiber Company (SNC)* in November 2011, a university spin-out from the Stellenbosch University. The company focuses on the commercialization and further development of various nanofiber technologies developed at Stellenbosch University. These technologies include two processes for the high-throughput electrospinning of polymeric nanofibers, as well as a process for making continuous nanofiber yarns. The company is the exclusive licensee of two university-owned core patents with 32 patent families of which Dr. Smit is the inventor.

The nanofiber materials produced using these processes can be applied in a broad range of areas, including high-performance filtration of liquids and gases; biomedical materials, including wound dressings, drug delivery materials, cell culture, and tissue engineering scaffolds; energy, including high-surface-area electrodes for next-generation batteries and fuel cells, battery separator membranes, and supercapacitors; and lightweight structural composites, such as those for automotive and aerospace applications. This was not a success story from the start. Dr. Smit grew up in an entrepreneurial home and always wanted to make a difference and change the world. As a child, he wanted to create a teleportation machine and decided to study nuclear physics as his first university degree. He has started numerous companies on the side since 1994. In 2003, he launched a materials company that sourced and sold nanomaterials. Along the way, he realized that to be successful in a technology business, you need the expertise in the core technology to build and grow the company. That led him back to academia each time, and he ended up in material science. In 2007, after enrolling in a doctoral program, he read an article on the electrospinning of nanofibers. The possible applications of these materials and the technique itself were limited because the materials made through

electrospinning were usually obtained in the form of non-woven webs of randomly oriented fibers.

In a breakthrough development, Dr. Smit devised a technique whereby continuous yarns that consist of parallel bundles of nanofibers can be produced in a continuous process. This paved the way for their application in fiber-reinforced composite materials, similar to the carbon and glass fiber materials used in sports equipment; it was also a step closer to providing production houses with nanofibers in a manageable form for producing nanofiber textiles using traditional textile production methods, such as knitting and weaving.

He disclosed his invention to the technology transfer office, which filed for patent protection and assisted with the development of business plans, the marketing of the invention, and introducing it to investors and funders. With the assistance of the TTO, the first patent application was licensed in 2007 to a large European company. Licensing of IP is not the best option for all, and for specialized technology, it can even be rather risky. The licensing process is also time-consuming and slow. In the case described, the technology was too specialized, and it soon became apparent that the licensee did not have the expertise to scale-up and commercialize the technology. The continuous yarns, while scalable and an improvement over known technology, did not produce large amounts of product in a short enough time to reach all the markets Dr. Smit had in mind. In 2010, his continued research resulted in the development of the ball electrospinning technology. It then became possible to produce large sheets of nanomaterial in a matter of minutes. He approached the TTO with his second invention, for which another patent was filed. He proposed cancelling the 2007 license and spinning out a new company where the IP could be commercialized under an exclusive license from the university to the start-up business with the technical expertise, being in-house. The company was formed with the university, a venture capitalist company, and an angel investor. In exchange for the university taking equity, it brought not only exclusive use of the IP but also its collaborative networks of international TTOs, investors, and access to funds. In collaboration with *Isis Enterprise*, a division of *Isis Innovation Ltd*, the TTO of *Oxford University*, and *Innovus TTO of Stellenbosch University*, the business and market plan were developed, which included the introduction to potential licensees, investors, and industry partners. Government funding and grants were obtained as well as industry investment funds, which were used to set up laboratories for prototype testing and later to scale-up purposes for manufacturing (Govetribe, 2021, see Fig. 6).

The company started with a core team of three full-time employees. The first target market was the medical industry, as this market was potentially the largest and most lucrative. It was soon realized, however, that although the medical industry took great interest in the products, it would take a long time to reach the market due to regulatory requirements. During the period in which the product line was being deployed, the company's survival was at risk, and it was necessary to consider alternative product lines.

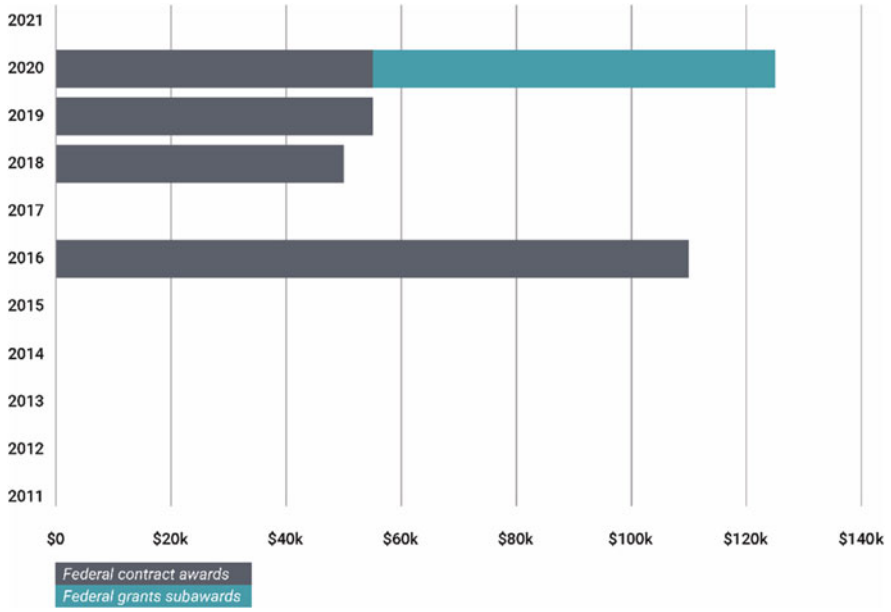

Fig. 6 Government funding and grants (Govetribe, 2021)

In expanding, the start-up collaborated with an existing SME that had a team of engineers, industrial designers, and larger facilities. This new symbiotic arrangement resulted in direct access to the know-how and services of an additional 15 skilled staff.

The business focused on research and development working in a few key areas and identifying collaboration opportunities with other institutions to develop new materials and/or products. The *Stellenbosch Nanofiber Company* (*SNC)* identified an industry collaboration partner (a multinational cosmetics manufacturer headquartered in Japan) in the cosmetic industry and launched various nanofiber-based cosmetic products, including a revolutionary facial cleanser which they described as the "*Face Wash of the Future*." The nanofiber cosmetic product was selected by *Time Magazine* as one of the 100 Best Inventions of 2019.

Today, as both the exclusive licensee of 32 patents (of which the CEO and founder is the inventor) and the proprietor of various successful product brands, the proudly *South African SNC* team has developed various medical nanofiber products, ranging from wound dressings that help burn wounds heal faster to resorbable tissue scaffolds for generating replacement parts for the human eye. In collaboration with their cosmetic industry partners, they have also diversified into advanced skincare.

During the COVID-19 pandemic, the product range was expanded to spinning nanofibers onto polyester fabric to produce high-quality, medical-grade reusable

masks to counteract the single-use aspect of surgical masks, which creates waste management problems and can present health and environmental threats.

The company leveraged its intellectual property assets that allowed them as an SME to innovate and disrupt large global top-20 medical device and pharma companies. It enabled them to venture into the highly competitive cosmetics industry. They provide a flexible customer engagement model that facilitates rapid product development while accommodating different IP ownership agreements. They have a professional team of scientists and executives that continue to develop the technology and build industry relationships.

According to Dun and Bradstreet, the company's annual revenue in 2020 was US $1.20 million. The company employs 30 people (Dun and Bradstreet, 2021).

SNC illustrates the application of a university-industry-government interaction in a diversified Triple Helix model (see Fig. 7).

5 Learnings and Takeaways

University technology transfer is complex. No successful business is simply a fairy-tale of an inventor developing a new technology in a small back yard workshop and having an immediate commercial success. The reality is that it requires significant capital in terms of funds, time, and support from the right people to really get that idea out of the small back yard workshop. Even with the most brilliant idea, you will achieve very little if you don't have others who believe in its success and who are willing to assist you. The university technology transfer office is invaluable in the journey of an idea to the market and can open many doors to investment funds, the protection of IP, and commercialization opportunities.

Having a diverse intellectual property portfolio that is strategically managed investment potential is unlocked. Through patent licensing, trademark branding strategies, and retaining know-how and technical expertise, IP assets can be used to leverage business opportunities and attract funds to be able to build a product line that is both sustainable and exploited in the interest of society.

Takeaways

Don't spend all the time in the lab. Researchers tend to over-develop and want to make the invention perfect. Build the prototype and make sure the technology is sound and the IP is secured, but then get to market. Having expert sales staff can make all the difference for a technology start-up, but it is a fine balance between the lab professor and the skilled salesperson.

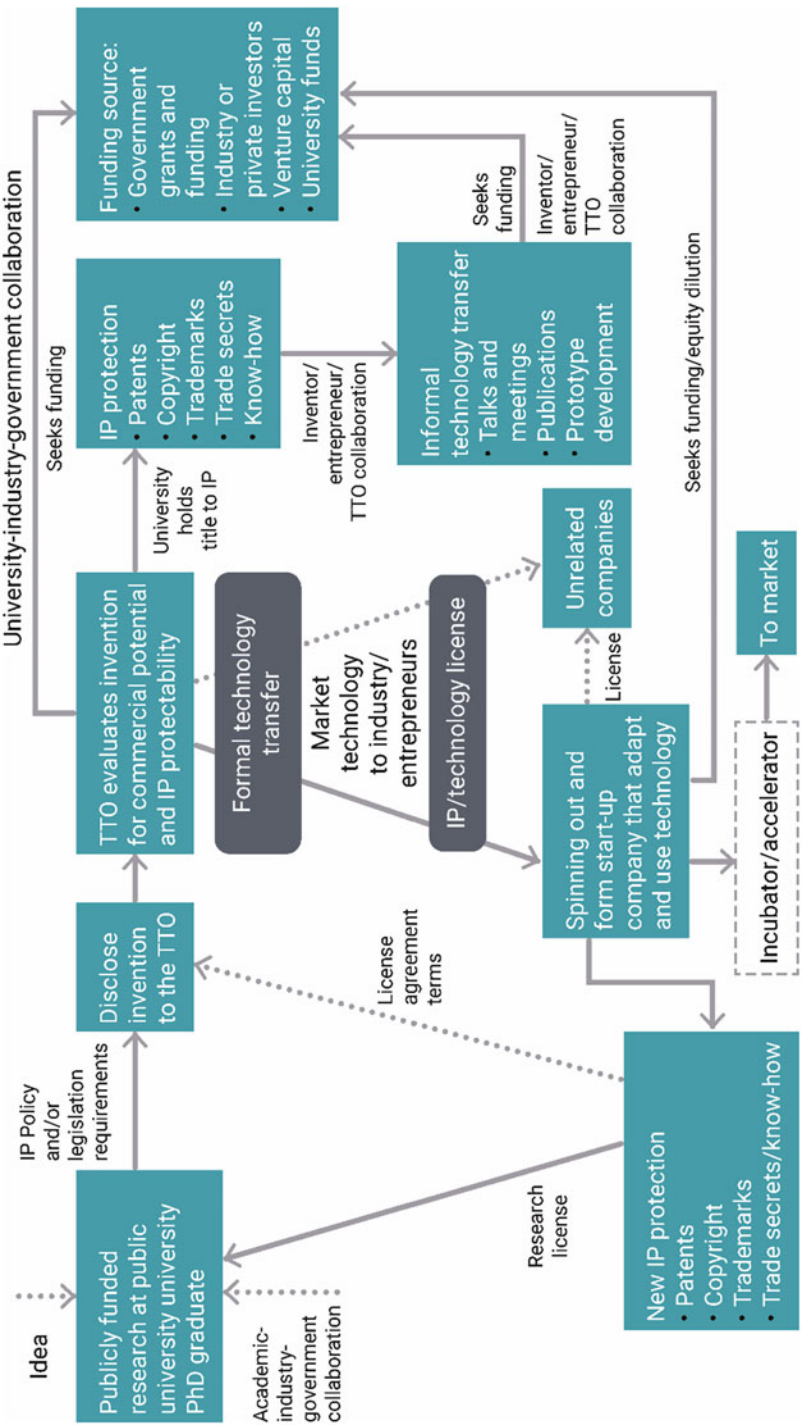

Fig. 7 Application of a university-industry-government interaction (created by author)

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Dr. Madelein Kleyn has more than 27 years of experience as an international intellectual property practitioner, patent attorney, and in-house legal corporate counsel in the petrochemical and agri industries. She is presently the Director, Technology Transfer at Innovus, Stellenbosch University, a Research Fellow at the Anton Mostert Chair of Intellectual Property of Stellenbosch University and also the CEO and founder of Mad K IP Consulting (Pty) Ltd, a private company advising clients on IP matters. She is a qualified chemical engineer (BSc Chem Eng), an admitted attorney of the High Court of South Africa, and a registered South African patent attorney. She holds an LLM in Tax Law and a PhD in Intellectual Property Law. She is also a Registered Technology Transfer Professional (RTTP). Her technical expertise includes petrochemicals, chemistry, process engineering, explosives, and agriculture. Her main areas of IP expertise include IP portfolio management, IP policy, and strategy development and implementation. She regularly advises on corporate governance and IP risk management and specializes in drafting and advising on IP-related business transactions, including technology transfer and licensing. She has authored and presented various articles, papers, and publications on IP matters internationally, specifically on technology and IP licensing and commentaries on national IP-related legislation, and is the course director of the Patent and Design LLM module at Stellenbosch University. Since 2014, she has served as the co-editor of the textbook *International Pharmaceutical Law* and is a co-author of the South African Chapter of this publication. She is a member of the SAIIPL (and also the editor of the SAIIPL newsletter IP Briefs®). She is additionally a member of INTA, SAIIPL, CCASA, ACS, and SARIMA (Southern African Research & Innovation Management Association). She is a member of LES SA and a Past President. She is a Vice President of LES International and a past chair of the LESI Patent and Technology Licensing Committee.

Dr. Kleyn has been included in the IAM Strategy 300 – The World's Leading IP Strategists since 2015 and featured in WTR300 World's leading trademark professionals since 2016.

The Technology Transfer Office as Facilitator Between Researchers and Investors: A German Perspective

Alexandros E. Papaderos and Oliver Bücken

1 Leveraging Commercial Value from Science

Universities around the world have as their fundamental mission to educate their students, to generate scientific, technological, professional, and "meaning-giving" knowledge through research, and to ensure that the knowledge developed on a public-funded research base is utilized effectively for the benefit of economy and society. As part of the so-called "third mission" of universities, they are irreplaceable stakeholders in their innovation ecosystems. Universities are conducting both basic and applied research; they educate experts and create innovation. Especially by educating new generations in technology transfer and entrepreneurship through research-based education and through interacting with the economic sector, universities are best positioned to aggregate innovation ecosystems and actively involve their researchers and their students. Research results need to find their way to the public, not only by publishing scientific papers or by giving presentations in scientific symposia. Here is where university technology transfer takes effect. By university technology transfer, we understand all measures to transfer research results from the university out to business, where the results are developed into new products and services that benefit society (Hockaday, 2020).

Entrepreneurship is the driving force behind innovations, new business models, and social progress. Entrepreneurs significantly influenced human and social development. Universities play a key role in this context because young, talented students and researchers jointly develop and implement innovative ideas, products, and

A. E. Papaderos (✉)
Tach2yone GmbH, Munich, Germany

O. Bücken
UnternehmerTUM Academy for Innovators, Garching (greater Munich area), Germany
e-mail: buecken@unternehmertum.de

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_16

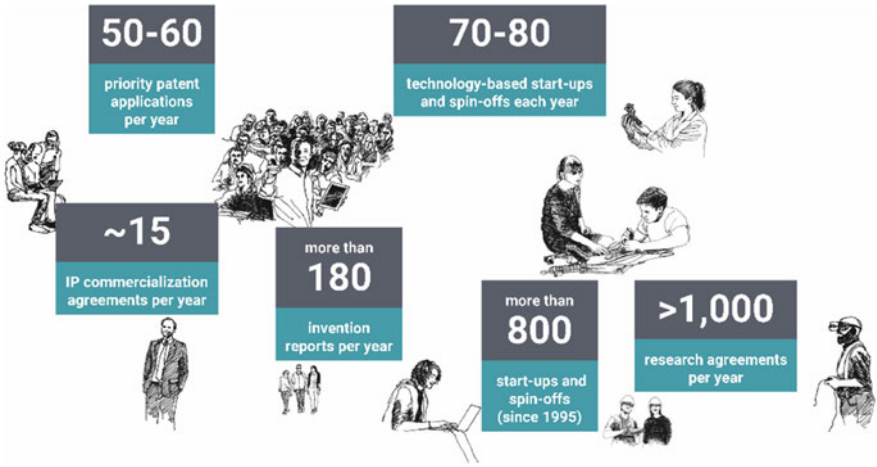

Fig. 1 *Technical University of Munich (TUM)* collaborates with its affiliated institute, *UnternehmerTUM* (source: used with kind permission of TUM)

solutions in order to solve current problems. Entrepreneurs in universities become active by transforming their research outcomes into products and services and establishing these new enterprises. Knowledge-based spin-offs are essential key players for successful structural changes and are therefore an appropriate transfer path for bringing research results into the market and shaping the future of the economy and society.

The promotion of entrepreneurship in academia has therefore become a key mission for universities. Universities, where entrepreneurship and close cooperation with industry is lived vigorously, often offer support, such as consulting and funding opportunities, for entrepreneurial students and scientists and help them turn their innovative spin-off ideas into successful companies. Such universities are important stakeholders in local and regional innovation ecosystems, where investors increasingly show interest in university spin-offs.

The *Technical University of Munich (TUM)* in Bavaria, Germany, launches 70 to 80 technology-based start-ups and spin-offs each year and offers aspiring founders, in collaboration with its affiliated institute *UnternehmerTUM*, a wide range of consulting, research, and qualification services as well as a strong support network (see Fig. 1). In 2021, *UnternehmerTUM* and *TUM* start-ups raised over $3.5 billion in 2021 after $1 billion in 2020 (*UVC Partners* is an early-stage venture capital firm that invests in technology-based start-ups in Europe, focusing on B2B business models; see Fig. 2).

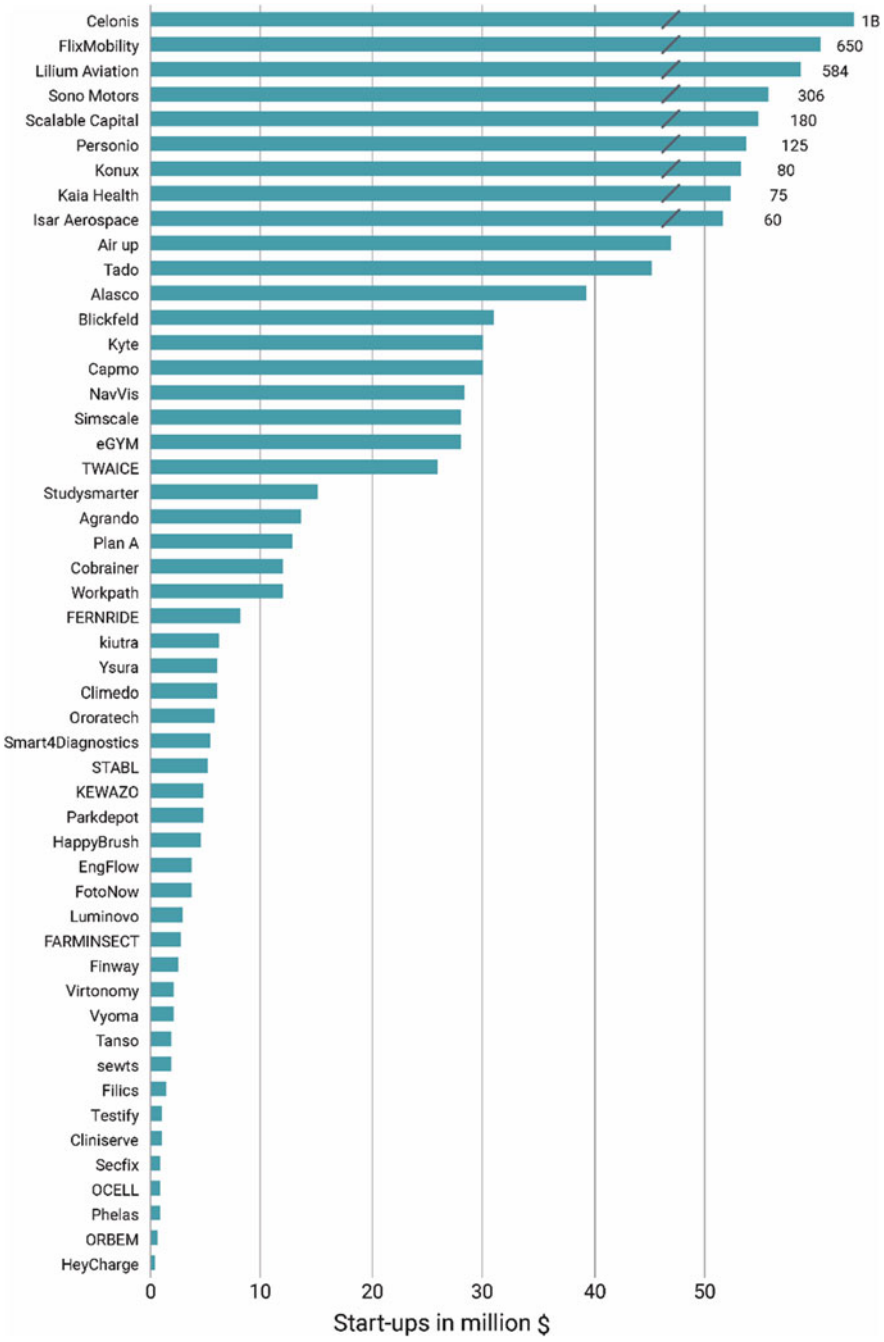

Fig. 2 *UnternehmerTUM* and *TUM* start-ups raised over $3.5 billion in 2021 (UVC, 2022)

2 IP Management in Academia

The above-mentioned missions of universities have a strong link to intellectual property (IP), especially the commercial utilization of research results, which often requires protection by using the patent system. Figure 3 presents a very simplistic view of the life cycle of a university invention.

In a nutshell, an effective system for the protection and commercialization of research results in academia needs well-defined policies, a nourishing culture, and an infrastructure for dealing with the demands of the researchers/inventors/founders and of the entities, which will bring the research results into the market.

University inventors are key players in the generation, protection, and commercial exploitation of IP. In their majority, they fail to recognize the commercialization potential of their research results because:

- Traditionally, they concentrate on their academic career and their responsibilities on teaching, research, and publishing;
- They lack knowledge of the legal and especially the intellectual property rights (IPR) system; and/or
- They lack entrepreneurial skills.

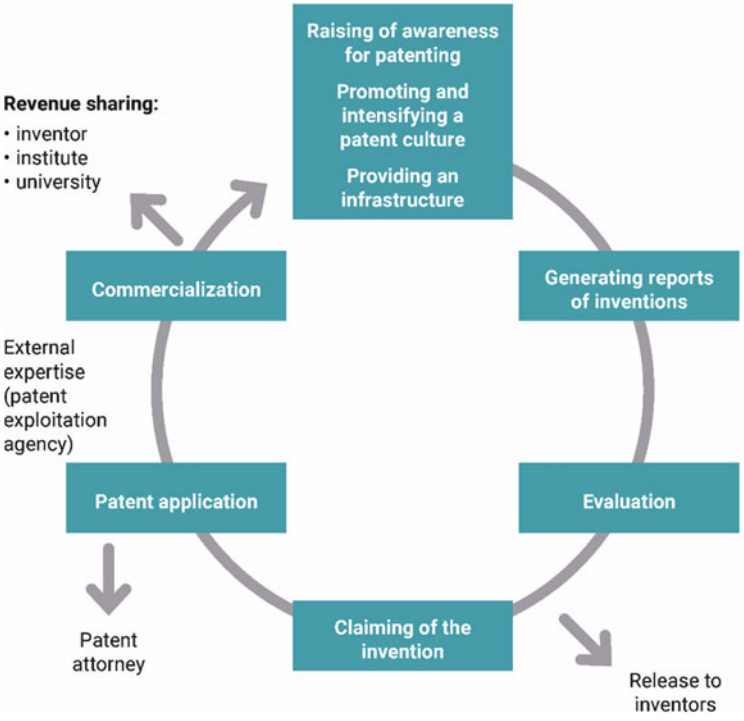

Fig. 3 The life cycle of a university invention (authors' own figure)

This has often, as a result, led to invention disclosures from university inventors lacking novelty and/or inventive step and/or commercial applicability.

In order to be able to conduct this path of university technology transfer, universities need to establish a culture/environment at the university that supports and encourages both invention disclosures and the participation of inventor(s) in the commercialization process. The formulation and adoption of a university patent policy, which includes information and training on IP issues, helps in the creation of a supporting IP culture. There are many ingredients for the establishment of a culture which allows technology transfer to thrive:

- The incorporation of technology transfer (TT) topics into the curricula;
- The publication of success stories on how TT can have a positive impact on personal careers, organizations, and society;
- The facilitation of access to technical information contained in patent documents to support research and development projects; and
- The provision of possibilities for students/researchers to learn both worlds by offering internships in patent offices and patent departments.

This process, led by the responsible infrastructure, namely the university's TTO, must include several sparring partners, such as:

- Administration (faculty and university level);
- Governmental authorities (ministries of education);
- National patent offices;
- Patent attorneys;
- Scientists researching on IPR topics;
- Technology transfer and commercialization agencies; and
- Business incubators and entrepreneurial centers.

Having established the needed infrastructure and culture within the university, invention disclosures, which are received by the TTO, must be evaluated. One central question that must be clarified at the very beginning of any IP and commercialization activity within a university is why a university is filing for a patent. For the great majority of universities worldwide, the reason is the desire to start commercialization activities in connection with a patent application or a patent. Therefore, when a TTO plans to patent a university invention and commences with the evaluation of the invention, it will be all about the economic potential of the invention and the question of whether the user of the patent will benefit from using it. It has always been difficult to explain to a university inventor that, when it comes to filing a patent and starting with commercialization activities, it does not count if the invention is excellent science or how much time and money the university inventor has already invested in the development of the invention. To figure out the economic value of an invention is probably the most difficult part in the valuation of inventions. Moreover, the most relevant reason for a TTO to reject and release an invention, next to the lack of novelty, is that the expected revenues

will not cover the patent management and commercialization costs. Given that university inventions are often technologically immature, this prognosis is challenging to conduct.

So, when it comes to the evaluation and valuation of a university's inventions for the purpose of patenting them, certain criteria should be carefully scrutinized, such as:

- Ownership status of the invention;
- Options for protection;
- Commitment of the inventors;
- Maturity of development of the invention;
- Size and features of the potential market;
- Economic benefit of both licensor and licensee; and
- Commercialization feasibility and potential financial returns.

If most of the above-mentioned criteria are met by the invention case, a preliminary prior art search, if not performed in parallel when the invention was made, is now critical. The search can be done by using patent databases, such as *Espacenet*, or scientific/technical databases, such as *PubMed*. A huge amount of information published in patent applications is not protected and can be used freely because it is not included in the claims of a patent in force in the relevant territory. In addition, information included in patents is a source of commercial information, leading to customers, suppliers, and new partners, as well as a warning about developments by rivals and changes in the market.

A person experienced in drafting patent applications, such as a patent attorney, should draft the patent application. The drafting should be done properly, also because it might be a priority document for later filings. In some cases of patents based on academic inventions, the filing must be performed by filing a provisional patent application due to time constraints concerning the publication of research results. In territories where there is no grace period, filing a provisional patent application without consulting persons familiar with the drafting of patent applications can have a negative influence on the quality of the patent application and, consequently, on the commercialization activities. Therefore, an important argument for raising IP awareness in academia is, on the one hand, to inform and teach about the possibilities of patent searches and, on the other hand, to educate about the importance of synchronizing the publication or patenting of an invention with the launch of commercialization activities.

The design of a patenting strategy is a further step toward a successful commercialization case. Patents need a certain market penetration in order to bring financial benefits. They should be filed in key markets for manufacture and sale but also where copies might be produced and sold. From the viewpoint of an academic institution, the commercialization activities should at least cover the invested costs in research and development, production of prototypes, patenting of the invention, and marketing of the technology. Also, part of a patent strategy is to continuously value patent portfolios. If there is already a licensee, it is useful and very often part of the

licensing agreement to jointly set up the patenting strategy. Part of the decision-making within patent strategies is also that patents should be abandoned if they produce more costs than revenues and that patents are not to be used as a tool to enrich academic publications lists.

One of the most ambitious but hit-or-miss ways to commercialize technologies from academia is to support the creation of spin-offs by, among other things, providing patents and other necessary IPRs to the spin-off. Even if universities wish to support their spin-offs by all available means, depending on their status, they often have to obey laws and regulations, such as competition and budgetary laws, and protect the interests of the inventors, who do not want to be involved in the spin-off. In addition, as mentioned earlier, it is very difficult for the TTO and the founders to agree on a fair and reasonable market price due to the rather premature condition of academic inventions.

What has been proven to be a good practice in the concept phase of a university spin-off is an early dialogue between the TTO (both the entrepreneurship supporting unit and the IP commercialization unit) and the inventor/founder (see Fig. 4). Both parties discuss the feasibility of the spin-off project. If the policy of the university toward spin-offs is "founder-friendly," then the IP in question would be escrowed for the spin-off team and not commercialized with other parties than the founders. There should be an understanding that the founder(s) show concrete interest in founding the company by delivering updates of the founding and business development progress to the TTO. To show the university that there is a substantial interest, the founder should undertake efforts to submit relevant documents, like a pitch deck or a business plan with concrete milestones and also a financing plan within a reasonable time period after declaring the intention to found the company. The university should grant IP access options to the spin-off through IP transfer and/or license and/or share models. In a subsequent step, the spin-off team and the IP commercialization team should jointly develop an IP strategy, where the spin-off team is including the costs for further IPRs in the financing strategy.

When the concrete implementation of the spin-off project begins, the spin-off team should commit to developing the project based on individual milestones. In return, the university extends the escrow for the IPR exclusivity for the relevant business field and subject to third-party rights. In case of non-compliance with the agreed milestones, the escrow may be withdrawn. However, since the fulfillment of milestones in the early phase of an entrepreneurial venture is subject to great uncertainty, this must be considered accordingly. If in this phase additional inventions are made, the filing of patents should be conducted in collaboration with the TTO. While the preparation of the company financing and the incubation process are commencing, the negotiations about the preferred model and conditions have to move substantially forward. At the time of the company's formation, the contract for the use of the IP by the spin-off has to be concluded according to the selected model. The spin-off team undertakes to represent the interests of the IP provider to the best of their ability when involving investors and business angels. If an option to acquire the IP is provided for in the contract, it should be a prerequisite from the point of view of the university that it continues to participate in the

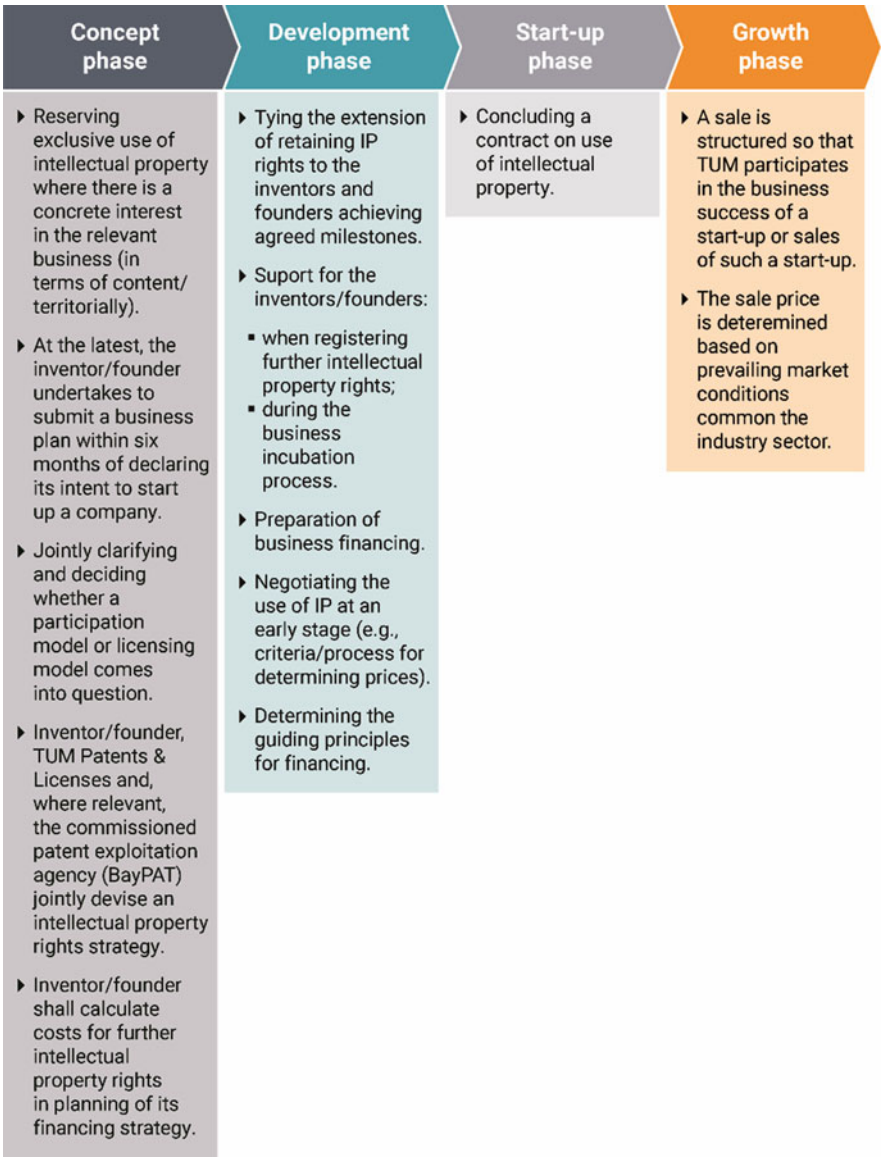

Fig. 4 *TUM's* IP road map as a structured approach for handling IP for university-based spin-offs (source: used with kind permission of TUM)

company's success or in a company sale. In later financing rounds or when the company is sold, ownership of the IP can be a decisive criterion. For this reason, the spin-off can exercise the option to acquire the IP rights if necessary. Here also, the

spin-off should ensure that the university continues to participate in the company's success or in the sale of the company when drafting the respective contracts.

3 Some Case Studies

The Researcher's/Founder's View[1]

Since the full significance and application potential of singular or several successive inventions can usually only be fully recognized or come to light after some time, IP management must fundamentally be understood as an integral part of academic research culture. This means that academic research must not – as is still widespread today – regard invention disclosures to the employer as an exception, justified only in individual cases by far above-average and obvious potential to the inventors, but as an integral milestone of every research project. Unquestionably, such a requirement is initially and in the first approximation contradictory to the established academic practice and, moreover, seems to be opposed to a delay of publications and thus to a speedy academic career for the person involved. Therefore, the acceptance of processes that aim at forcing the sustainable protection of university know-how stands and falls with the existence of university contact points that, in addition to their core task – the evaluation of inventions and the decision to claim the invention or release it to the inventors – also understand the speed of these decisions as an indispensable driver of the success of such a change in thinking. If such decision-making processes and their implementation are no longer compatible in terms of time with the fundamental academic necessity regarding the publication of research results, any rethinking in the sense of IP management integrated into research is doomed to failure. As well as an adequate spin-off time, well-rehearsed processes also require sufficient human resources; this service can only be implemented by very large universities in an independent form, while as a rule, superregional cooperation between university technology transfer offices appears to be advisable and has already proved its worth.

Once a functioning university contact point for inventors has been established, success depends essentially on whether the researchers are convinced of the necessity and, above all, of the advantages of IP management, and whether this conviction is communicated and practiced in the respective research groups. There can be strong resistance to the implementation of fully integrated IP management, both within the professoriate and within the research groups. Here, the opinion that university research must not serve any economic goal and purpose and that all research results must be publicly accessible and usable is the most frequently cited argument against IP protection or an invention disclosure to the employer. This is countered first by the obligation under labor law to report inventions to the employer,

[1] This case study was conducted with the valuable support of Prof. Dr. Hans-Jürgen Wester, Chair for Pharmaceutical Radiochemistry, Technical University of Munich, and founder of SCINTOMICS GmbH, a spinoff of the Technical University of Munich.

although surprisingly (and subjectively increasingly) the opposite sentiment, namely that research results are primarily the IP of the researcher and that the latter therefore also has the decision on their use, can be found especially among young researchers.

In practice, however, none of the above-mentioned arguments will be eliminated by lengthy discussions, especially since these are sometimes subordinated to the primary reasons for rejection (e.g., additional, time-consuming preparation and editing of patent applications; delay of a preferred rapid publication). This can be counteracted by informing researchers in detail and transparently about the potential benefits of IP management (inventor remuneration, creation of sustainable values, securing of business locations, etc.).

Resistance to the fixed/continuous implementation of an IP management and thus the continuous filing of invention disclosures could only be overcome after the sustainable added value of patent applications and the advantages of out-licensing had been proven by previous IP protection and commercialization cases and these examples could be displayed and comprehended by subsequent researchers.

From the perspective of professors, and thus the university, the continuity of a functioning IP management system is particularly important. Since, as previously mentioned, the full significance and application potential of inventions is not necessarily immediately apparent and university research projects usually extend over several years, the possibility of successive (dependent) inventions can and should be considered right from the start of a project. This requires that the responsible project leaders or chairholders exercise their responsibility regarding IP management continuously and attentively, and that possibly no longer correctable disclosures (in lectures, abstracts, etc.) are avoided. Especially in successive patent applications covering a complete thematic strand, the training of academic staff regarding patent law, formalities, and deadlines is particularly important (and is also received with much interest). Only in this way it can be ensured that the results of thematically interlinked research work (such as theses) can be successively and optimally protected. If necessary, this also includes delaying the publication of doctoral dissertations for up to two years to complete the next evolutionary stage to be protected or avoiding the participation of non-employees in particularly sensitive topics (since these are not subject to secrecy).

Certainly, a non-protected or non-protectable idea/technology can also provide the basis for a university spin-off. However, it is understandable that mainly successful spin-offs must quickly defend themselves against a constantly growing number of competitors with copycat products or similar products. It therefore seems very questionable whether (and, if so, for how long) a promising spin-off based on an idea/technology that is not protected or cannot be protected can hold its own in such a competitive environment.

Moreover, in the context of global trade, it seems obvious that, for example, European or U.S. companies and spin-offs in the purely manufacturing sector can hardly develop full competitiveness, and thus only the service sector and the broad area of cutting-edge technology allow promising spin-offs in the long term. In this context, companies in the “cutting-edge technology” sector are usually defined by spending more than 8.5% of sales on research and development (companies in the “higher-value technology” sector have a spending of 3.5 to 8.5% of sales). Thus, it is

obvious that no company spends such significant research and development costs without securing them with valid property rights and without having performed a positive "freedom-to-operate" analysis.

Thus, as mentioned above, it is still possible to found a spin-off without IP protection rights, but these spin-offs, if successful, will soon face a steadily growing competition. If unique selling propositions are very important for the growth of a spin-off, these in combination with valid IP rights are indispensable and obligatory for growth by means of strategic or financial investors.

Since the foundation of the majority of spin-offs is based on one or more thematically narrowly defined IP rights, the question of IP rights for further know-how and strategies for this quickly arises in the further course of the enterprise: Securing the company's goal through thematically narrowly limited, in-depth property rights (vertical coverage) or securing successively broadening company goals through horizontal coverage. While vertical coverage based on existing and established collaborations, networks, and contacts offers great transparency with regard to the selection, risk assessment, and evaluation of new IP, especially for spin-offs with a lack of research and development (R & D) infrastructure, extended horizontal coverage requires significantly broader expertise within the spin-off and is also associated with more entrepreneurial risk.

The special assistance provided by the contact persons of the university TTO in the context of licensing by the spin-off, especially at the beginning of the venture, was particularly helpful in the form of success-related license payments. In this context, it should be noted that the financial risks for founders coming from an academic environment as inventors frequently seem unclear, hardly calculable, and often unacceptably high. Success-based royalty payments are certainly one way to reduce such spin-off problems.

Oliver's Investor's/Practitioner's View

One of the most important challenges for founders is to decide how to distribute the shares in the team. If the team is present at the beginning and everyone has the impression that they will contribute equally in terms of know-how, work force, network, etc., then with a team of four, you quickly end up with the simplest division of 25% each. This can be right, but it can also be the source of hard arguments later. But at the inception stage, when the founders have few resources except the idea and the commitment to achieving a lot, then it hardly matters who holds how many shares because on paper the value of the spin-off is zero anyway.

If the team had already been working together as a project team for some time, then the discussion about the distribution of shares will certainly be different because the team will be weighing up the work done so far, individual contributions to results, prototypes, contacts, potential customers, leads, market knowledge, know-how, strengths, and weaknesses that have emerged. This can result in tough arguments, but they can be quite necessary for the resilience of the spin-off. Moreover, they usually lead to a more realistic distribution of shares than the 25% for four founders described above. Instead, the distribution could look like this: 35%, 25%, 20%, and 20%.

All non-monetary assets, as mentioned above, and this certainly includes IP at the beginning, are assets whose value the founders have to agree on. Depending on how high the founders estimate the value of their "assets to be contributed," the amount of their shares is decided. Everything is on paper. How much these non-monetary assets are worth is only known when the company exits. And since we are still far, far away from that, the founders have to agree among themselves who gets how many shares. If one of the founders can contribute more cash than his or her co-founder, he or she has the best argument to demand a higher share because monetary assets have a significantly higher value at the beginning than non-monetary assets. This also includes IP!

Why this long preface? In my experience of founding and supporting numerous spin-offs, too much time is spent on valuing non-monetary assets at the beginning. Especially if the gap between the founders is relatively large and they cannot really agree on the valuation of the non-monetary assets, but they still want to found the company together, then this postponed decision will almost certainly lead to critical, existence-threatening situations later on.

Case: A Start-up Example from Munich

The company was founded in 2008 by three scientists. All of them were operationally active in the company; let us call it *BioTech GmbH*. It was a knowledge-based spin-off from a university chair and in which IP naturally played an essential role. Even more astonishing was that the IP provider owned the IP privately. Needless to say, the IP was vital for the *BioTech*. Still more annoying was that the IP was not brought into the company. One can hardly believe it. However, it gets even worse for the company. Because, you guessed it, the question came up when the company was founded: How should the shares be distributed?

For understandable reasons, the founders wanted to keep the IP provider "happy." After all, the operational founders were grateful that the IP provider let them work with the patent and not someone else. Did it matter that the IP provider did not want to have an operational role in the company? "No" in the eyes of the operational founders because, after all, it "only" depended on their skill to steer the company into good waters. Sure, they needed the patent, but it was there anyway. How convenient. In short, the IP provider got 30%, the CEO 35%, the CRO 17%, the COO 12%, and 6% went to important new employees. Everyone agreed that the value of the company would increase, so the "cake" would get bigger for everyone. Therefore, "everyone was sitting at the same table." And yes, the IP provider negotiated that in the event of failure or non-success, the use of the patent would revert to him alone. Therefore, it was a kind of liquidation preference (a well-known term in venture capital term sheets). It was agreed that this was not a point of contention. Incidentally, it was unanimously argued that in the case of a foundation with a total of €50,000, the 30% share for the IP provider was not felt to be so large. Everyone was satisfied; they felt they had been treated fairly.

In fact, *BioTech* continued to develop. The company was popular, also with new employees. A master's student had a further idea, which was to be set down in a master's thesis, and turned out to be more and more an important know-how carrier, so the three shareholders offered the student a 2% share each.

A brief interim summary of what happened here: Two of the shareholders do not have operational responsibility but have a strategic importance for the company (IP owner and important know-how carrier). Although all five are shareholders, there is no alignment of interests.

BioTech flourishes and grows. The value of the company increases to €3 million. Due to this externally attributed value, the IP provider's share suddenly equals €900,000 without having been operationally value adding. Although this value still exists only on paper, the sense of injustice among the operationally active shareholders increases. They are annoyed. The value of the IP is suddenly perceived as "too expensive." The three have no legal recourse. ◀

What Is Problematic About This Case?

- The shares between the founders are unequally distributed. Oliver is more of an advocate of "equal inequality." However, it must be very well justified. The three who bear the main burden of making *BioTech* a success have a combined share of only 64%. That is not even enough to be able to strategically realign the company on their own (for that, they would need 75.1%).
- In a very early phase, 6% of the shares were given to an employee without agreeing on a vesting. In other words, the shares were given away without first assessing the results of the employee's work, such as through milestones, duration of employment, completion of the employee's master's thesis, etc. *Vesting* means that the option on the share becomes increasingly vested as the milestones are reached.
- The liquidation preference for the IP provider was not negotiated. For example, the three operating shareholders could have negotiated to accept this liquidation preference only if there was a *cap*. More precisely – a downsize protection (see Fig. 5).

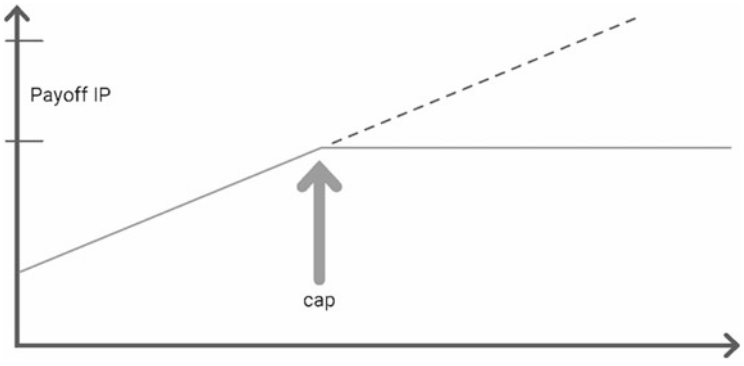

Fig. 5 Cap for downsize protection as liquidation preference (authors' own figure)

- All shareholders must be fully committed to the success of the venture. Not taking the crucial IP into the company but keeping it private is a no-go for a high-tech spin-off. Fueling growth via VC money would usually require having the IP in the company.

What Value Should Be Assigned to the IP When Founding a Company?
This is a matter of considerable debate:

- One can argue that without the IP, the value of the company cannot be generated. Therefore, it would be fair to assign a high value to the IP provider. Since the company has no or hardly any money yet, the company cannot buy the IP. Accordingly, one agrees with the IP provider on a high company share because it does not burden the other shareholders financially at first.
- One can just as well argue that it is only the operational, creative, self-sacrificing, persistent, and entrepreneurial performance of the three that leads to the IP's potential being raised. Only the entrepreneurs make it possible for the IP to be exploited, namely in the sale of products to customers.
- The expectation that the path from IP to customer is short is of course tempting, but also wrong. IP only means that something technically new has been invented. The invention says nothing about the desirability of the product. This is decided on the market. Demand is subject to dynamics that are difficult to understand. It is the resourceful entrepreneur who "can" make the "new" a success. You guessed it, to answer the question posed above, I would say that IP has exactly no value at all in spin-offs. It must prove the value first. That is why the IP belongs in the company – no ifs, ands, or buts. The IP must not be "infected," for example by third-party rights.

Case: Another Start-up Example from Munich

The IP was developed at a university. The IP was reported to the university, which after examination concluded not to apply for the patent itself but to release it to the inventors. The three inventors filed a private application. They initially remained at the university and then decided to take the step of founding a company.

The founders decided to divide the shares equally. One of the three founders did not become operational but had contributed significantly to the IP. He remained a professor at the university, while the other two founders left their postdoctoral contracts. The patent was brought into the company. There was no "infection" by third-party rights.

The company quickly developed positively so that external financiers (venture capital) offered fresh money for further growth. The due diligence did not reveal any problems. The venture capitalist (VC) offered €1 million for 25% of the shares. The pre-money valuation was therefore €3 million; the post-money valuation was €4 million.

After the VC round, the three initial founders still held 75% of the shares and a combined value of their shares of €3 million.

Certainly, in this case, one can argue that 25% or €1 million is a lot, especially since the VC did not contribute to the value generation. However, the VC valued the company (based on the assets, the value created, and the market potential), and on this basis contributed €1 million in cash to the company. ◄

The Difference Between the Two Cases

The big difference to the first case is that when the company was founded, it was ensured that the IP was freely available to the company. Moreover, in the first case, no VC would have given fresh money to grow the company.

Entrepreneurs must be able to freely dispose of the IP. This applies in particular to the initial IP, which could (but does not necessarily have to) become the basis for commercial success. Entrepreneurs must be free to adapt or completely change their business model without having to ask the IP provider, which is the case when one of the shareholders holds an IP privately and is not an asset of the company.

This is, of course, only one small piece of the puzzle in a world that becomes complex enough when several research institutions in different countries play a decisive role in helping a new technology achieve a breakthrough. Imagine if important IP of *mRNA technology* were in the hands of individuals rather than companies: It would be even more difficult to extract vaccines and drugs from it. *Öslem Türeci*, the co-founder of *BioNTech* said, "Innovation doesn't happen in one fell swoop" (Miller et al., 2022). BioNTech's *Lightspeed* project to develop the mRNA-based vaccine against COVID-19 was based on many publications and patents – but it was the entrepreneurs *Özlem Türeci* and *Uğur Şahin* who made the difference.

4 Learnings and Takeaways

The journey from academic research results to the foundation of start-ups and spin-offs and the development of products and services to market maturity needs intensive research and support and thus time and investments by the university, the founders, and the investors. Since the protection of research results is the first step and key for their later commercialization, an efficient IP management by the university's TTO plays an indisputably crucial role. The university's IP and commercialization policies need to consider the specialties of funding a company out of the university by students and researchers. The university IP and commercialization policies have to be transparent and allow fast-track decisions. TTOs have to adopt a "founder-friendly" policy in order to promote academic entrepreneurship, but also at the same time to guard the interests of the university and to take into consideration all the boundaries and constraints that occur in the academic world. Founders on the other hand must be aware of the university's IP policy and other relevant frameworks (like laws on employees' inventions, budgetary laws, etc.) but also consider topics like possible IP rights of third parties. Bringing patents into a new company should

be the normal case. In reality, the contribution of patents plays a huge role when it comes to the distribution of shares. Attracting venture capital and fresh money for scaling goes along with the necessity of freedom to operate. Having shareholders in the company who hold patents privately prevents growth capital to fuel the company.

Takeaways

- Integrate technology transfer (entrepreneurship and IP management) as part of the "third mission" into the established structures and processes of the university.
- Align different cultures: industry, VCs, and academia.
- Develop policies, rules, and regulations for the commercialization of IPRs and the foundation of spin-offs.
- Always involve (and as early as possible) the legal department and the TTO of your organization.
- Document the research project's progress (e.g., laboratory notebooks).
- Don't start working with third parties without a contract – prioritize contract negotiations.
- Define, document, and secure background and side ground IP rights.
- Consider IPRs that are privately owned by students or researchers and that may be needed for your research.
- Make sure that the IP is freely available in the company and not held privately by any shareholders.
- The success of a start-up depends on the future work. All work which has already been invested in previous contributions (like IP) might be relevant but should not be overrated for future success. Shares should be distributed accordingly. The availability of funding for early-stage start-ups in a university ecosystem is essential to initiate tech and IP-based ventures.

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Alexandros E. Papaderos was from 2008 until 2022 the Deputy Head of the Office for Research and Innovation and the Head of Innovation at the Technical University of Munich (TUM). He was responsible for the innovation and technology transfer activities at TUM. He has more than 21 years of experience in the fields of protection and commercial exploitation of research results, collaboration between academia and business, and university entrepreneurship. His track record includes numerous IP commercialization cases, negotiation, and conclusion of research collaboration contracts with academic and industrial partners, as well as broad experience in the creation of university start-ups and spin-offs. Among other appointments, Dr. Papaderos is a permanent guest of the Committee for Research, Technology, and Innovation of the Bavarian Industry Association (vbw), a member of the TTO Advisory Group of the European Patent Office (EPO), and Vice Chair of the Council for Technology Transfer & Intellectual Property of the Greek Government. He is furthermore a frequent speaker in workshops and seminars on technology transfer issues. Since July 2022, Dr. Papaderos is the Head of Sector Research at Tach2yone GmbH, a green energy transition investment company.

Oliver Bücken was one of the first employees at UnternehmerTUM, the leading center for innovation and business creation in Europe, and scaled project-based entrepreneurship and tech education at the Technical University of Munich (TUM) from almost zero to hundreds of entrepreneurial tech projects today. He headed UnternehmerTUM Academy for Innovators until 2021. He trains professionals, supports early-stage projects and start-ups, and lectures in various programs including "Manage and More," "VC-Lab," "Principled Entrepreneurial Decisions," and the Executive MBA in Innovation and Business Creation at TUM.

Start-ups and entrepreneurship have been salient features throughout his professional life, and after graduating in business administration, he worked in the banking and venture capital industries. He was also one of the co-founders of an early e-commerce company in 1996, which did an IPO in 1999 and was sold in 2001. He is committed to the funding and co-founding of 15+ start-ups as an early and founder-friendly investor with three exits completed to date.

Managing IP-Related Tensions Between Universities and Spin-Offs

Alexander A. Fink, Joshua Arbter, and Stephan M. Wagner

1 Introduction

Every vital start-up ecosystem greatly benefits from its surrounding universities. There are many well-known examples of founders commercializing knowledge that they initially created at their alma mater. In 1998, for instance, *Stanford University* filed patent *US 6,285,999 B1*, based on the invention of one of its PhD students, *Lawrence "Larry" Page*. Later that year, Stanford licensed this patent to *Larry Page* and *Sergey Brin*. With this invention, which serves as the key pillar for a pioneering search algorithm, the two Stanford alumni incorporated *Google*, revolutionized the *World Wide Web*, and became the executives of one of the world's most innovative and valuable companies.

New ventures that commercially exploit knowledge which was substantially created during academic activities are better known as university spin-offs (Pirnay et al., 2003). Since spin-offs are considered beneficial for society and critical for economic vitality, creating and promoting them has become increasingly popular in the past decades (Shane, 2004; Wright et al., 2007). The *Association of University Technology Managers (AUTM)* estimates that more than 14,000 spin-offs were founded in the United States between 1996 and 2017. While in 2004, U.-S. universities created 462 spin-offs, this number more than doubled to 1,040 in 2019 (Association of University Technology Managers, 2019; Wright et al., 2007).

Previous research shows that IP is a core asset for a spin-off's founding and development process (Pirnay et al., 2003; Rasmussen et al., 2014; Vohora et al.,

A. A. Fink (✉) · S. M. Wagner
Department of Management, Technology, and Economics, ETH Zurich, Zurich, Switzerland
e-mail: afink@ethz.ch; stwagner@ethz.ch

J. Arbter
McKinsey & Company, Stuttgart, Germany

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_17

2004). However, founding a spin-off based on scientific discoveries might confront scientists with a seemingly paradoxical situation: establishing the business without owning a core asset, the IP. Although the founding scientists might have invented the IP, the IP belongs to the university. Thus, spin-offs must find an agreement on how to access this critical asset. Surprisingly, knowledge about the interaction of how both find an agreement is scarce. By considering both perspectives, this study reveals relevant process steps and four significant tensions that both parties face in IP-related discussions.

2 IP and Its Protection from Spin-Off and TTO Perspectives

Since commercializing knowledge based on discoveries at universities has become increasingly popular, many countries have implemented policies to facilitate the transformation of scientific knowledge into businesses. While universities in the United States started doing this in the 1980s, European institutions adopted policies on academic entrepreneurship due to changing contextual conditions in the following decade. In particular, a debate on the societal impact of universities, decreasing public financing, and changing legislation led to the implementation of technology transfer offices (TTOs) (Wright et al., 2007). Among many technology transfer options, universities prominently established proactive policies to stimulate the founding of spin-offs (Clarysse et al., 2005; Shane, 2004; Wright et al., 2007).

The extant literature has mainly approached IP and its protection from either a spin-off's or a TTO's perspective. The authors find indications on IP and its protection in studies aiming to explain *types*, *performances*, or *capabilities*. Table 1 summarizes studies in top-ranked academic journals and their references to IP in this context.

2.1 TTO's Perspective

Types Since the implementation of TTOs can take on many different forms, handling IP might be contingent on the type of TTO. For instance, Clarysse et al. (2005) distinguish TTOs according to their primary objectives. The authors find *three distinct types*, which they label as *"low selective," "supportive,"* and *"incubator."* Depending on the type, activities to assess and protect IP differ considerably. For instance, while the first type (low selective) emphasizes patenting, the second type (supportive) supports patenting and licensing negotiations with industry players.

Performance Scholars use IP protection mechanisms as an indicator to measure a TTO's performance. In addition to the number of patents and licenses, extant literature considers the number of spin-offs as a performance measure of TTOs. For instance, Di Gregorio and Shane (2003) and O'Shea et al. (2005) study parameters that help explain why some universities are more successful in founding

new spin-offs than others. The first study finds that intellectual eminence and two policies – inventor share of royalties and equity investments – increase the number of newly founded spin-offs. In comparison, local venture capital and the commercial orientation of university research show no effect.

While Di Gregorio and Shane (2003) consider institutional and environmental factors, O'Shea et al. (2005) narrow their analysis to internal university characteristics, such as the university's tradition of spinning out new ventures or staffing. They conclude that policymakers should establish a comprehensive system to identify, protect, and commercialize universities' IP.

Capabilities/Development Moreover, literature investigates capabilities that universities need to leverage spin-off creation. Again, IP plays a vital role since it serves as the foundation for the spin-off's growth (Van Burg et al., 2008). Rasmussen and Borch (2010, p. 608) find that *"the issue of IPR [IP rights] ownership may be problematic if not explicitly dealt with."*

2.2 Spin-Off's Perspective

Types IP serves as a distinguishing factor in categorizing spin-offs. For instance, Mustar et al. (2006) develop a taxonomy for research-based spin-offs. They reveal the transferred IP (among other inputs) as a distinguishing factor in studies that focus on the link to the parent university.

Performance Moreover, literature evaluating spin-off performances often considers IP with respect to the technology involved. For instance, Bolzani et al. (2020) show that equity ties to the university are beneficial while technological ties are not. Clarysse et al. (2011) instead find that university spin-offs grow the most from a broad technological base, which is transferred to them by the university and allows for multiple applications. Furthermore, the authors emphasize the critical role of the TTO in supporting the spin-off: The novelty of technical knowledge has a negative effect on growth unless the spin-off receives support from an experienced TTO.

Capabilities/Development Scholars centering on spin-offs' capabilities and development consider IP as a key pillar for their growth phases. Vohora et al. (2004), for instance, depict the critical role of IP for a spin-off's creation and development process. Even in the first development phase, IP creation is omnipresent and serves as a core asset for the following phases. Similarly, Rasmussen et al. (2014) show that a spin-off's core competency – opportunity identification and development – draws upon the IP developed at the university.

In summary, all these studies imply that IP remains a central question for both TTOs and spin-offs. IP and its protection mechanisms are important performance measures for TTOs, and its management differs depending on the structure and goals

Table 1 References to IP and its protection in literature on university/technology transfer offices and/or spin-offs (authors' own table)

	Types		Performance		Capabilities/development	
University/ Technology transfer office (TTO)	Clarysse et al. (2005)	3 types of TTO: low selective, supportive, and incubator. Activities to assess and protect IP differ considerably between the types.	Di Gregorio and Shane (2003)	Intellectual eminence and two policies – inventor share of royalties and equity investments – increase no. of spin-offs to exploit universities' IP. Local venture capital and commercial orientation of university research does not affect the no. of newly created spin-offs.	Rasmussen and Borch (2010)	3 university capabilities supporting spin-off creation: creating new paths of action, balancing both academic and commercial interest (among others IP), integrating new resources.
	Markman et al. (2005)	3 structures of TTO: traditional university, non-profit research foundation, a for-profit private venture. 3 licensing strategies of patent-protected technologies.	Siegel et al. (2004)	Obstacles for TTO performance: cultural and informal barriers among key stakeholders, TTO staffing and compensation practices, inadequate rewards for faculty involvement. Evaluation and protection of IP are important steps in the knowledge transfer process.	Van Burg et al. (2008)	5 university capabilities to leverage spin-off creation: creating awareness, supporting teams in developing skills, supporting spin-offs in accessing resources, setting clear and supportive rules, shaping culture. IP as the basis for the spin-off's foundation.
			O'Shea et al. (2005)	History dependence (resources and capabilities), faculty quality, size and orientation of science and engineering funding, commercial capability are predictors for spin-off activity. "a comprehensive systems approach to the identification, protection and commercialization of university intellectual property needs to be undertaken" (p. 1006).		

Spin-offs	Mustar et al. (2006)	Taxonomy of research-based spin-offs: differentiation based on the institutional link, the business model, and type of resources. Emphasis on the importance of the IP transfer process for spin-offs' creation and development.	Clarysse et al. (2011)	Compares spin-offs from companies and universities. University spin-offs benefit from a broad technological base. The novelty of technology has a negative effect unless there is an experienced TTO involved.	Vohora et al. (2004)	Spin-off development process consisting of 5 phases and 4 "critical junctures". Spin-offs cannot progress in the next phase without overcoming each juncture. IP creation essential in the first phase. Research creates "intellectual property to underpin establish the venture" (p. 151).
	Pirnay et al. (2003)	Discussion on existing definitions. Distinguishing factors for typology: (1) student or researcher, (2) knowledge (codified or tacit).	Rasmussen et al. (2014)	Spin-offs that received support from the university departmental level perform better than non-supported due to the support in developing capabilities (see next column).	Rasmussen et al. (2014)	University department level impacts a spin-off's evolution of competencies. Opportunity identification and development draws upon IP developed at university.
			Bolzani et al. (2020)	Equity-based linkages to parent universities have a positive effect on spin-offs' performances; technological ties instead weaken the performance. IP management depends "significantly on academic inventors' choices and behavior" (p. 18).		

of the TTO. Furthermore, IP lays the foundation for spin-offs' development and survival. Thus, accessing IP is essentially vital for them.

3 Methodology

In this study, the authors adopt a multiple, comparative case study approach (Eisenhardt, 1989). They purposefully selected four university TTOs and 12 related spin-offs. The TTOs are comparable in their strategic orientation, structure, and the IP-related services they offer. The sampled institutions and spin-offs are based in Germany and Switzerland. Both countries have in common that inventions arising from federally funded research remain with the university. In total, the authors conducted 22 interviews and collected additional material. Table 2 explains the sample in more detail.

The authors prepared semi-standardized interview guidelines and conducted all interviews between November 2020 and February 2021. The interviews lasted on average 45 minutes. While they were still collecting data, the authors transcribed the interviews and analyzed them with the data analysis software *MAXQDA*. Consistent with the study design, Eisenhardt's (1989) recommendations of within-case and cross-case comparisons guided the data analysis.

4 IP-Related Tensions and Implications for How to Overcome Them

4.1 Overview of the IP-Related Interaction

The entire interaction between spin-offs and TTOs is complex and often dialectic. Drawing on the interviews, the authors illustrate the major IP-related steps, corresponding actors, and influencing factors in Fig. 1.

The sample reveals two pathways. First, 11 spin-offs reported a new invention to the TTO *(Option A)*. Subsequently, the TTO evaluates and decides whether or not to protect the reported IP. In case of an IP release, meaning that the TTO decides not to protect the IP, the spin-off might protect and exploit the IP independently of the TTO. On the contrary, if the TTO decides to protect the IP, it specifies the type (most prominently patents) and the scope of protection. In doing so, TTO informants acknowledge to have considered the spin-off's business plans. Then both parties initiate the negotiations, where tensions might emerge (see below).

Second, one spin-off contacted a TTO to find an agreement on an already protected technology *(Option B)*. In this case, both parties can directly proceed with finding an IP agreement. Negotiations usually occur between a TTO's spin-off support team, a TTO's licensing manager, and the spin-off's founders. Depending on the structure of the TTO and staffing, these roles might overlap.

Independent of the pathway, the interviews revealed four tensions that emerge when the parties negotiate the IP agreement. The implications draw upon

Table 2 Sample (authors' own table)

	Case 1 TTO Alpha	Case 2 TTO Beta	Case 3 TTO Gamma	Case 4 TTO Delta
TTO Age, staff	> 10 years operating < 30 employees	> 10 years operating 30–40 employees	< 10 years operating 30–40 employees	> 10 years operating ≥ 50 employees
Interviews TTO (Conducted interviews)	Licensing manager (1)	Head of spin-off support (1) Technology transfer manager (2)	Head of technology transfer (1) Licensing manager (1)	Technology transfer manager (1) Licensing manager (2)
Spin-offs (Sector; founding year; conducted interviews)	Spin-off A (Medical Engineering; 2021; 1) Spin-off B (Electrical Engineering; 2019; 1) Spin-off C (IT services; 2017; 1) Spin-off D (IT services & Optics; 2017; 1)	Spin-off E (Mechanical Engineering; 2019; 1) Spin-off F (IT services; 2019; 1) Spin-off G (Chemical Engineering; 2018; 1) Spin-off H (IT services; 2017; 1)	Spin-off I (Glass & Synthetics; 2020; 1) Spin-off J (Mobility/Mechanical Engineering; 2019; 2)	Spin-off K (Electrical Engineering; 2017; 1) Spin-off L (Mechanical Engineering; 2007; 1)
Additional data	Websites TTO and spin-off, pitch deck, internal notes, press releases	Websites TTO and spin-off, pitch deck, IP strategy coaching document of an external patent attorney, press releases	Websites TTO and spin-off, pitch deck, press releases	Websites TTO and spin-off, pitch deck, press releases

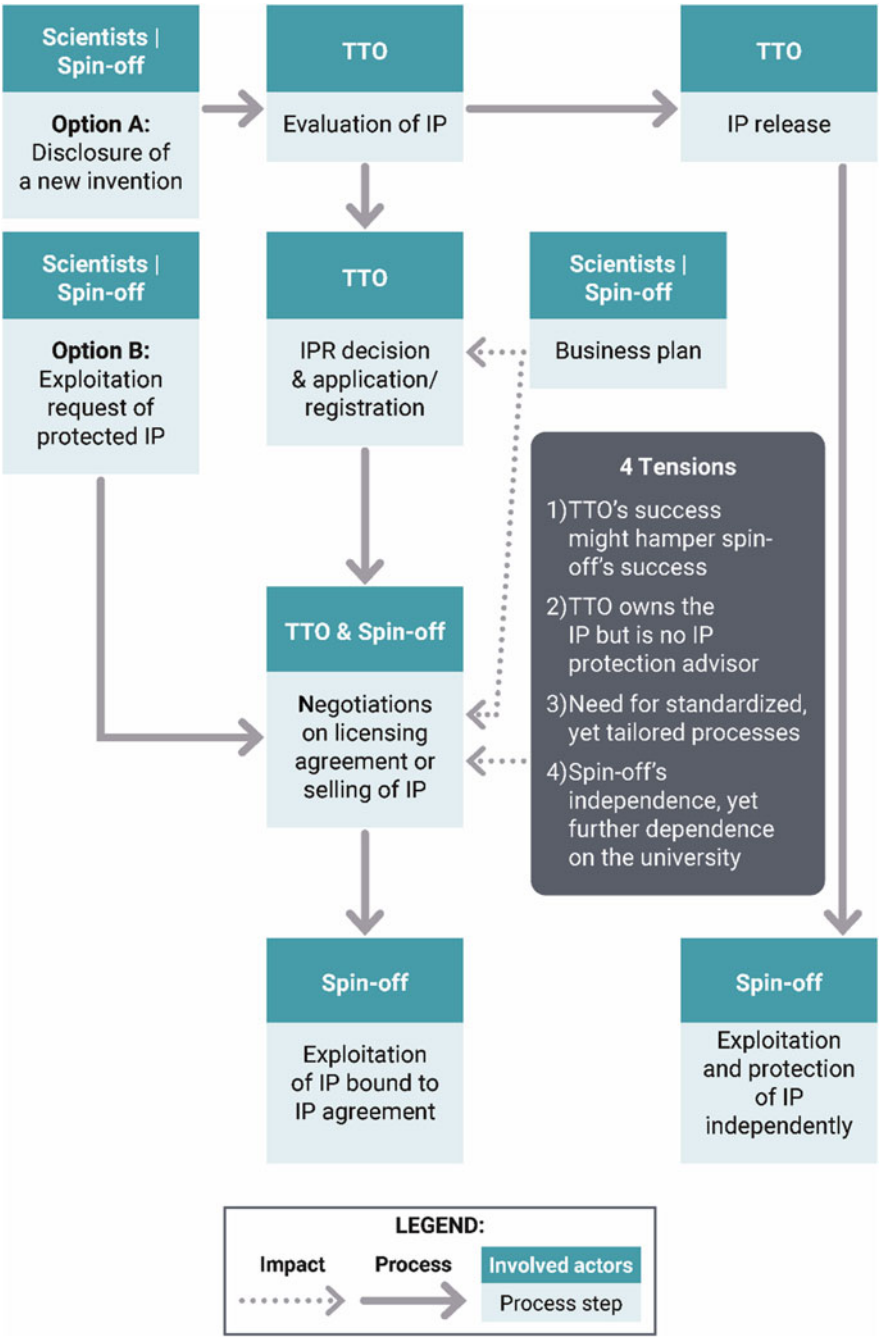

Fig. 1 IP-related interaction between TTO and spin-off (authors' own figure)

recommendations by the interviewed spin-offs and TTOs. Table 3 summarizes the tensions and implications.

4.2 Tension 1: TTO's Success Might Hamper Spin-Off's Success

The informants state a trade-off between the TTO's success and the load it puts on the spin-off's starting conditions. On the one hand, the TTO wants to negotiate the best deal for the university. Frequently used and easily measurable performance indicators – such as the number of patents or licenses – generate revenues for the parent university. On the other hand, the TTO wants to support the spin-off in its founding, an additional performance indicator. However, these measures might be conflicting in certain instances. By focusing on the university's revenue stream, the TTO might even strangle the spin-offs it wants to create. For instance, this study's data show that a decision focus on patenting might benefit the TTO but might not necessarily be the best choice for the spin-off since it requires paying substantial fees while resources are still limited.

Implications for Spin-Offs First, closely check the TTO's protection and licensing offers and align them with your long-term strategy. In this sample, the components of the licensing agreements were similar: fixed payments, royalties on the spin-off's revenue, sub-licensing fees, equity, or phantom stocks. The licenses were primarily exclusive. The interviewed spin-offs preferred a royalty agreement bound to milestones. TTO Alpha, Beta, and Delta were reluctant to sell IP due to the risk that IP might end up in a bankruptcy estate.

Second, after knowing the offers, evaluate the TTO's room for negotiation. Even if they tell you something different at first, TTOs can adjust the negotiating scope because every new IP is unique. In the sampled cases, not a single first licensing offer was congruent with the last offer. Sometimes, TTOs even encourage founders to show their negotiation skills. One of the TTO managers stated:

> I tend to have a better feeling when the founders really haggle. By doing that, they show their entrepreneurial spirit. [Technology transfer manager, TTO Beta]

Third, inform the TTO about your long-term goals, allowing them to consider your needs. While doing that, prepare best- and worst-case scenarios for the TTO:

> It makes a difference whether the time horizon is up to product maturity or up to the market entry and if it is five years or 15 years. That is always a case-by-case consideration. [Licensing manager, TTO Delta]

Implications for TTOs First and foremost, rethink and revise the current performance measures to mitigate this tension. In their current form, they might be conflicting and even hamper the spin-off's development. New measures should focus on a long-term perspective, favor the spin-off, and consider the societal

Table 3 Tensions and implications for spin-offs and TTOs (authors' own table)

Tension	Description	Implications for spin-offs	Implications for TTOs
1. TTO's success might hamper spin-off's success	• A trade-off between the TTO's success and the load it puts on the spin-off's starting conditions. • Current measures of TTO's performance (no. of patents, licenses, spin-offs) might create conflicting incentives and have a detrimental effect on the spin-off.	• Closely check the TTO's protection and licensing offer and align it with your long-term strategy. • TTOs can adopt the negotiating scope (although they might state it differently initially). • Inform TTOs about your long-term goals. Prepare best- and worst-case scenarios for the TTO.	• Revise and create new performance measures focusing on long-term societal impact: a new focus on the use of IP rather than its appropriation. • Include spin-offs' long-term goals in the decision on IP protection and the IP agreement. • Consider informal barriers as a complementing facet to formal IP rights, although they might not contribute instantly to your success measures.
2. TTO owns the IP but is no IP protection advisor	• Spin-offs regularly ask TTOs for advice on IP; however, IP consulting is critical for TTO due to legal restrictions. • Reason for seeking advice: founder's limited IP knowledge.	• Revise the view on TTOs: Consider them as an alliance partner rather than an advisor for IP protection. • Establish a good relationship with your primary contact at the TTO. • Enhance your understanding of IP (basic knowledge, customized advice, market benchmark, contact alumni).	• Be spin-offs' alliance partner rather than their advisor. • Refrain from building founder's IP skills. Instead, connect spin-offs with knowledgeable players in the ecosystem. • Enhance awareness at the university.
3. Need for standardized, yet tailored processes	• Requirement of tailored contracts leads to a perceived slow interaction. • Standardization allows faster execution but is difficult with IP-related topics.	• In the beginning, ask for process milestones and required steps. • Discuss the tailoring of templates with external advisors, even if this delays the process.	• Provide adequate staffing (no. of employees and their skillset, i.e., include entrepreneurial-oriented staff and not only lawyers and scientists). • Provide a clear road map and transparent processes.

4. Spin-off's independence, yet further dependence on the university	• Potential conflict concerning the IP ownership in transition from academic to a commercial environment. • Decoupling from university is challenging since spin-offs often depend on the university's infrastructure, which they cannot build up instantly internally.	• Distinguish clearly between the work for the spin-off and the work for the university to avoid IP ownership conflicts. • Either focus on the spin-off or pursue an academic career. This decision should be reflected in your employment contracts. • Aim for time-limited access to specialized resources, such as labs or experimental settings.	• Support spin-offs in finding arrangements that allow them time-limited access to specialized resources, e.g., through favorable, simplified contracts. • Increase founder's awareness about potential IP ownership conflicts.

impact. These findings resonate with Holgersson and Aaboen (2019): Instead of focusing on the appropriation of IP, success measures should focus on the utilization of IP.

Second, take spin-offs' long-term goals and current business plans more into account for decisions on IP protection. For instance, one manager of TTO Beta stated:

> I mean, we know something about IP, but we have a rudimentary knowledge of the company's business. [Technology transfer manager, TTO Beta]

This can be achieved through many actions. For instance, the data show that TTOs still focus strongly on formal IP protection, most prominently patenting. The authors acknowledge that formal IP protection might often be an appropriate choice, and TTOs should not refrain from using it. However, the sampled data suggest extending the scope and not limiting the negotiation on formal IP. The combination of formal protection and informal barriers – such as secrecy measures or lead-time advantage – as a compromise for the sake of the spin-off's chances to grow might be a viable option. Suppose spin-offs suggest delaying formal protection due to resource constraints and take informal barriers as a temporal substitution. In that case, TTOs should consider that possibility when deciding on the IP protection and agreement, even if the informal barriers might not contribute instantly to TTOs' success measures.

4.3 Tension 2: TTO Owns the IP but Is No IP Protection Advisor

When approaching the TTO, scientists are often confronted with protection-related issues for the first time. Hence, they regularly ask TTOs for advice on protecting IP. Furthermore, since the TTO belongs to the same parent institution, founding scientists feel comfortable discussing confidential issues. However, advising spin-offs is often complicated for TTOs because they are restricted by law in providing management advice (due to liability concerns). Thus, TTOs are not allowed to provide specific IP protection advice. If at all, informants acknowledged providing advice on a superficial level.

The underlying reason why spin-offs seek advice is their lacking knowledge about IP protection. While they are specialists in creating IP, protecting it is usually not their competency. The founder of spin-off H stated exemplarily:

> We were technical founders, so IP strategy is not something we are educated in. We did not know about what is important, the consequences of not having an IP strategy early on, and all these things. [Spin-off H, TTO Beta]

Half of the spin-offs in this sample had previously informed themselves broadly about possibilities in obtaining a patent. However, none of these spin-offs thought in

detail about scenarios, associated costs, long-term consequences, or alternatives. This resonates with the TTO informants' experiences.

Implications for Spin-Offs First and foremost, prepare yourself *("I think preparation is the most important thing." [Spin-off G, TTO Beta])* and enhance your basic IP protection knowledge. In this vein, get basic knowledge from IP institutions (e.g., *DPMA*[1] in Germany or *IGE*[2] in Switzerland), helpdesks (e.g., *European IP Helpdesk*[3]), or start-up support organizations (e.g., *Venturelab*[4]). All these institutions offer IP-related courses or workshops. You do not have to become an IP protection expert, but basic knowledge fuels further steps and enhances your position for the negotiations to come. Furthermore, get customized advice from someone other than the TTO (e.g., IP lawyer, IP-knowledgeable advisors). As one of the founders put it in a nutshell:

> Buy in expertise; check it out yourself. [Licensing manager, TTO Delta]

At the same time, be aware that an additional party might have a potential conflict of interest since:

> This [IP protection] is a huge money printing machine for patent attorneys. [Spin-off L, TTO Delta]

Further, founders and TTOs unanimously recommend evaluating the market or industry benchmark related to IP protection and ask alumni who have already founded a spin-off to share their experiences. TTO Beta emphasized exemplarily:

> Try to find out how other people have done it who have already founded a company. What were the success factors and the challenges? [Head of spin-off support, TTO Beta]

Based on the first implication, revise the predominant view on TTOs as advisors for IP protection to mitigate this tension. Consider the TTO instead as an alliance partner. This means that negotiations on accessing IP are necessary, but there is mutual interest in being successful. Thus, the TTO is neither a purely supportive IP protection advisor nor an enemy (as two interviewees critically claimed). To build this alliance, establish a good relationship with the primary contact person at the TTO. Meet with them in person and invite them to see your lab and present your technology or prototype.

Implications for TTOs First and inversely to the spin-offs' implication, consider yourself as an alliance partner rather than as an advisor for IP protection. Thus,

[1] www.dpma.de – German Patent and Trademark Office.

[2] www.ige.ch/en/ – Swiss Federal Institute of Intellectual Property.

[3] www.intellectual-property-helpdesk.ec.europa.eu – European IP Helpdesk.

[4] www.venturelab.swiss – Venturelab.

refrain from building the founder's skills on IP protection through providing general IP protection advice. Thereby, TTOs simultaneously avoid operating in a legal grey area. If founders approach you requesting specific advice, connect them to specialists in the ecosystem, even if these specialists might impede future discussions. This requires the TTO to become part of the start-up ecosystem. This study's informants recommend building a broad external network of investors, IP institutions, industry partners, or alumni. Similarly, the TTO should also aim for a broad internal network comprising, for example, student associations, student entrepreneur clubs, doctoral programs, and industry relations departments, to enhance awareness.

4.4 Tension 3: Need for Standardized, yet Tailored Processes

All the sampled spin-offs perceive the interaction with the TTO as too slow and bureaucratic. Founders stated exemplarily:

> In this case, young spin-offs, who are always used to working fast, meet TTO employees – the interaction is simply too slow. [Spin-off G, TTO Beta]

> The processes should be accelerated in any case. [Spin-off J, TTO Gamma]

The interviewed managers of the TTO were well aware of this and justified that:

> It is a challenge to have something as dynamic as a spin-off in an ecosystem that is maybe a little bit more fixed and traditional and not so dynamic. But I think we do our best to manage that balance. [Technology transfer manager, TTO Beta]

The underlying reason for these perceptions resides within a trade-off between standardization and customization of internal processes. In general, while standardization allows a faster execution, customization is necessary to meet the parties' needs. In this specific case, every newly developed IP is unique; therefore, its protection and potential use depend on many contingencies. TTOs and spin-offs have to decide on a case-by-case basis, meaning that tailoring agreements and IP protection are crucial. Complex negotiations with long-term impacts should be well thought through and thus might retard the execution.

At the same time, spin-off founders operate in a dynamic environment since limited resources often require them to improvise and act instantly. As a result, spin-offs expect these dynamics inversely from their counterparts. TTO managers are aware of this and thus establish standardized processes and templates to accelerate the IP protection and transfer process. By standardizing processes, they further implement hierarchical control mechanisms for drafting legally binding documents.

Implications for Spin-Offs Ask the TTOs about the process steps ahead at the beginning and study the materials they provide. Although this might delay the process, discuss (contract) templates with an external advisor to see where tailoring is necessary. Even though you are acting dynamically, consider that these

agreements have long-term impacts on your business. Thus, drafting them with care might prevent future troubles.

When you talk to alumni founders, try to determine if and how the TTO of your university deviates from defined standards. This may strengthen your negotiating position, as you can provide examples for prior deviations from the standard process and demand them as well.

Implications for TTOs First, universities should provide adequate staffing for TTOs. This is not limited to the number of employees but also refers to their skillset. The sampled informants recommend including staff with an entrepreneurial mindset or their own founding experience. The inclusion of such staff is beneficial in bridging cultural discrepancies such as a "lawyer mindset" versus "entrepreneurial thinking."

Second, provide clear road maps and transparent processes for the upcoming interaction at the beginning. Spin-offs appreciate receiving clear instructions, outlooks, and information on the necessary data to be prepared. As one founder aptly put it:

> Better tell us beforehand what are the things that you always do with other [spin-offs], so we can already plan a bit ahead and manage expectations. [Spin-off B, TTO Alpha]

4.5 Tension 4: Spin-Off's Independence, yet Further Dependence on the University

The spin-off's IP often builds on basic research and hence generally requires long development cycles. Compared to generic start-ups that face market pressure from day one, spin-offs transition from an academic, non-commercial context to a competitive business environment. This transition from the lab bench to the market poses significant challenges. In particular, ongoing academic and commercial work might induce tensions since separating both is often challenging (see also Rasmussen & Borch, 2010). The founder of spin-off C explained exemplarily:

> That is tricky, because how do you distinguish between, 'They developed this during university employment' or 'During their free time'? [Spin-off C, TTO Alpha]

However, such separation between working for the spin-off or the university is critical since the origin of inventions causes severe differences in IP ownership. Moreover, separating both work environments is even more challenging since spin-offs often continue using the university's infrastructure, such as labs or experimental setups. This might be necessary for the spin-off's development since setting up such infrastructure would require a tremendous investment from a financial and time perspective.

Implications for Spin-Offs First, you should contact the TTO before establishing the spin-off and communicate the intent of founding it. If the spin-off has already been incorporated, you should clearly separate between the work for the spin-off and the work for the university to avoid IP ownership conflicts. The founders recommend either focusing on the spin-off or pursuing the academic career and mirroring this in their employment contracts.

Second, you should decouple the spin-off as early as possible. Do not cut the ties to your parent university instantly but rather keep them a bit looser. Therefore, aim for time-limited access to specialized resources, such as labs or experimental settings. Furthermore, decoupling can be strengthened by joining incubation or acceleration programs or including industry experts and externals in the founding team:

> I think the best thing to do is to set up the team in such a way that you bring in [industry] expertise. You notice that immediately. [Licensing manager, TTO Delta]

Implications for TTOs First, support spin-offs in finding arrangements that allow them further and time-limited access to particular resources that spin-offs cannot build up instantly but need for their core IP (e.g., lab equipment). Therefore, establish favorable, simplified contracts for the further use of the university's infrastructure.

Second, point out potential IP-related difficulties if the founders do not separate ongoing academic and commercial work during the negotiations.

5 Learnings and Takeaways

This study depicts the IP-related interaction between spin-offs and TTOs and finds four tensions that both parties face while negotiating. The authors further explain implications to overcome these tensions based on the learnings of the informants and hope that these insights provide orientation in navigating through the volatile spin-off creation phase. Given the pioneering role of spin-offs and universities in shaping economies, research on their interaction and relationships is likely to continue flourishing in the future.

Takeaways

Transferring IP from the lab bench to a commercially viable product remains a major challenge for TTOs and particularly for spin-offs. Both parties face four tensions while negotiating:

1. TTO's success might hamper spin-offs' success;
2. TTO owns the IP but is no IP protection advisor;

(continued)

3. Need for standardized, yet tailored processes; and
4. Spin-off's independence, yet further dependence on the university.

The authors further draw implications from this study that help both parties to overcome these tensions (see Table 3).

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Alexander A. Fink is a research associate and PhD candidate at the Chair of Logistics Management, Swiss Federal Institute of Technology Zurich (ETH Zurich). He holds a bachelor's and master's degree in Industrial Engineering and Management from Karlsruhe Institute of Technology (KIT), Germany. His research interests lie at the interface between Entrepreneurship and Supply Chain Management. His work on the formation of start-ups' IP protection strategies has been recognized as one of the best entrepreneurship papers at the 2021 annual meeting of the Academy of Management.

Joshua Arbter studied Industrial Engineering and Management at the Karlsruhe Institute of Technology (KIT), Germany. He focused on production, logistics, and innovation management. During his master's studies, he spent a semester abroad at Aalto University in Espoo, Finland, and wrote his master's thesis at the Swiss Federal Institute of Technology Zurich (ETH Zurich). In 2021, he joined McKinsey & Company as a Consultant. He is training to become an operations expert through McKinsey's "Operations Excellence Program."

Stephan M. Wagner holds the position of Chair of Logistics Management and is Faculty Director of the HumOSCM Lab at the Swiss Federal Institute of Technology Zurich (ETH Zurich). From 2008 to 2019, Professor Wagner was Director of the Executive MBA in Supply Chain Management (MBA ETH SCM). Prior to that, he served on the faculty of WHU – Otto Beisheim School of Management, Germany, and worked for 10 years as head of supply chain management for a Swiss-based technology group and as senior manager for an international top-management consulting firm. His research interests lie in the areas of supply chain management and purchasing and supply management – with a particular emphasis on interfirm relationships, risk, innovation, entrepreneurship, digitalization, sustainability, and humanitarian operations.

He is the author and editor of 12 books and over 150 book chapters and articles. He has published empirical OM research in general management journals, such as *Academy of Management Journal and Journal of Management; OM journals, such as Journal of Operations Management and Journal of Supply Chain Management; and practice journals, such as California Management Review and Interfaces*. Furthermore, his work has appeared in leading methods journals, such as *Organizational Research Methods* and *Sociological Methods and Research*. Newspapers, including *Financial Times* and *Wall Street Journal*, have written about his work. He has obtained numerous research awards, as well as substantial funding and competitive grants for his research.

Part V

The Global IP Office's View

It is not at all untypical for IP assets to be the main, if not sole, reason for the existence of a start-up.
—Alexander T. Puutio
Intellectual Property Rights Advisor
United Nations

Tools of the Trade: A Trading Nation's View on the Value of IP Rights for Start-Ups

Michael Falk, Ben Mitra-Kahn, Charlotte Trinh, and Haiyang Zhang

1 Welcome

Start-ups face many challenges, not least finding the resources to commercialize ideas and scale. A lot of what makes your business distinctive and valuable is likely to be intangible – your business plan, confidential information, internet assets, software and data, brands, and designs – and that is why you should care about intellectual property (IP) rights early. IP rights such as patents, trademarks, designs, and plant variety protection are tools for protecting and building intangible value. Thinking now about how IP factors into your strategy can help you capitalize on that value as you seek resources and scale.

Consider the example of an Australian company, *Kambrook*, founded in 1964 by Australian inventor *Frank Bannigan* in his home garage. *Kambrook's* mission was to create practical electrical appliances that enhance everyday life. Frustrated that he lacked enough power points to test his products, *Bannigan* invented the 4-way power board in the 1970s. The product was hugely successful – it was the basis for *Kambrook's* growth into a leading manufacturer of electrical appliances. However, the power board was not patented and *Kambrook* ended up sharing the market with many other producers. According to *Bannigan*, "I've probably lost millions of

M. Falk (✉)
Office of the Chief Economist, IP Australia, Phillip, ACT, Australia

B. Mitra-Kahn
Australian Bureau of Statistics, Canberra, ACT, Australia

C. Trinh
Australian Embassy Beijing, Beijing, China

H. Zhang
Department of Science, Energy and Resources, Canberra, ACT, Australia

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_18

dollars in royalties alone. Whenever I go into a department store and see the wide range of power boards on offer, it always comes back to haunt me."

The entrepreneurial experience in Australia has changed significantly since *Bannigan* started inventing in his garage. In recent decades, entrepreneurship has shifted decisively away from manufacturing and toward services, including to the professional, scientific, and technical services sector associated with advanced technology (Bakhtiari, 2017). Entrepreneurs also face different challenges today than previously. In Australia, as in many advanced economies, the gap is continually widening between global leaders at the technology frontier and the average business (Andrews et al., 2022). Progress for businesses at the global frontier is strong because they can easily finance investment in intangible assets, such as advances in artificial intelligence, which are inherently scalable. Businesses unable to carry out intangible investment risk lagging behind, particularly in digital intensive sectors (Corrado et al., 2021).

In this chapter we present an Australian perspective on IP for start-ups, reflecting our experience working in IP economics, policy, and business support with Australia's national IP office, *IP Australia*. Entrepreneurship in an industry creates vital impetus for players in that industry to improve. IP rights are vital tools for innovation, technology transfer, and start-up growth. It can be challenging to work out the key intellectual assets that contribute to your competitive advantage as a start-up and how best to protect them. We'll discuss some of the ways we've learned that businesses can use IP rights to drive business value and navigate market conditions. Regardless of the strategies that you use, there are overarching things you should know, things to do, and support you can draw on to benefit from IP rights.

2 IP Is Simple and Complicated

The Simple Part

At its core, intellectual property is simple. You pay for the exclusive right (read: monopoly) for an invention, brand, design, plant, shape – an aspect of an idea – that you've created. Holding that right, no one is allowed to copy you without seeking your permission and potentially paying a license fee in the country where your IP right is registered.

Governments created IP rights to encourage you to invest in creating new products and services (in the case of patents and design rights), and to make it easier for consumers to know what they are buying (in the case of trademarks). When your ideas (e.g., inventions, designs) are made public in the marketplace, it can be difficult to exclude others from reproducing them. In producing technologies, products, or services based on your idea, imitators usually take on less risk than you, the original producer, and you may not financially benefit from the idea as much as you would otherwise if the idea was well-protected.

Trademark protection is important from the perspective of customers because when a brand is strongly protected, they have clarity on what they are buying. If you

buy a triangular chocolate bar, for example, you'll know it's *Toblerone*. You might not know that the *Toblerone* shape, like the *Coca-Cola* bottle shape, is protected by trademarks. You might not know that, unlike patents, trademark rights can be renewed in perpetuity since the need to prevent consumer confusion does not lessen over time. But you are a beneficiary of that system.

When customers are clear on what they're buying, they're more likely to pay a premium for quality that you – the producer – have invested into a product. Similarly, potential investors – who may otherwise find it difficult to observe the commercial value of your new enterprise – may treat your IP and the extent to which it is unique and protected as evidence of your managerial competence. When IP rights serve these roles, they can directly influence your success.

More Complicated Parts

When it comes to obtaining patents for start-ups, there are hurdles to consider. Patents can seem expensive for lean start-ups (although not as expensive as many people think) and can take longer to process than start-ups want to wait (but there are ways of speeding things up – and slowing them down, with the right approach).

On top of this, for you to obtain an enforceable patent right, your invention needs to meet several criteria. In Australia, we examine patent applications against three key criteria. In simple terms these are: (1) novelty – is the invention different to what has been done before, (2) inventive step – is it different *enough*, and (3) manner of manufacture – is it suitable for patent protection. Novelty, inventiveness, and industrial usefulness: Most countries have variations on these requirements. The requirements do differ a little across countries, and that can matter, especially in relation to cutting-edge technologies such as software inventions where rules differ. Should you get an IP attorney or other professional assistance? Yes, you should. (You have a lawyer and an accountant, right?) You should have IP advice.

In managing IP, complications can happen when the product or technology you are developing is made of many parts created by many different parties. Sometimes you may want to manufacture in one country and sell in another so you should think about what to protect where. Many of the products we rely on today are complex, produced through global value chains or collaborations between businesses or consortia. Developing and commercializing complex products often depends on different parties being willing to share or trade their ideas, for example, through cross-licensing arrangements. In these situations, IP arrangements can get complicated. You can be sure that *AstraZeneca* had to deal directly with *Oxford University* when it came to the COVID-19 vaccine technology. But when Samsung makes a mobile phone, they engage with an established technology license model, through a standard-setting body, so there is no need to get a license from everyone in the technology supply chain. How, then, can you make the most effective use of IP rights to position your product or service and seek investment and growth? That depends on the industry you are in, how it is structured, and your position in the value chain, as well as the geographic scale of your operations and ambitions.

3 Entrepreneurship and IP Activity in Australia

In Australia, young small businesses – that is start-ups that are 1 to 2 years old – created 2.5 million full-time equivalent (FTE) jobs between 2004 and 2015, amounting to 80% of FTE employment in Australia (Bakhtiari, 2017). As in other countries, high-growth startups contribute disproportionately to economic growth and are a key force that propels the economy forward.

Entrepreneurial activity in Australia, as measured by the number of firm entries, has increased in recent years, after declining during the 2008 Global Financial Crisis and for several years after (Bakhtiari, 2017), and despite a temporary slump during the onset of the COVID-19 pandemic.

The largest share of entrepreneurial activity in Australia is in construction – this industry accounted for nearly one out of every five firm entries over the period spanning 2002 to 2015. Professional, scientific, and technical services – where entrepreneurship is often associated with advanced technology – ranks second behind construction and increased its share of firm entries by 1.6 percentage points from 2009 to 2015 (Bakhtiari, 2017). As in many industrialized countries, entrepreneurship in Australia has shifted from manufacturing toward services – this includes knowledge-intensive services, healthcare and social services, accommodation, food, and real estate services (Bakhtiari, 2017).

Only a small share of Australian small and medium enterprises (SMEs) own IP rights – around 4% – but that share doubled from 2002 to 2017. IP activity by SMEs is concentrated in manufacturing and wholesale trade. These patterns are consistent with evidence from the United States that manufacturing industries such as biotech, medical instruments, pharmaceuticals, machinery, and computers attract the highest patent premium (Arora et al., 2008).

A key driver of growth in IP activity within Australia has been an upsurge in trademark registrations. International studies show that trademark registrations at the country level are positively related to entrepreneurial activity (Lyalkov, 2020). In Australia, the increase in trademark use has been concentrated in service industries, where entrepreneurial activity has grown, and in industries subject to deregulation intended to increase competition, such as electricity, gas, and water, as well as education (Jensen & Webster, 2004; Zhang, 2021).

4 IP Rights Are Tools for Survival, Adaptation, and Growth

Live Long and Prosper

Looking at data from different parts of the world, a common finding is that companies that hold IP rights tend to live longer. Patents and trademarks are consistently correlated with a company surviving for longer than similar companies without IP rights. Figure 1 shows data from Australia on the rate at which companies deregistered over time. By their second year, 12% of all firms have become inactive in Australia, but only half of that – 6% – of patent holders have suffered a similar fate. That gulf between the survival rate of patent holders and non-holders grows

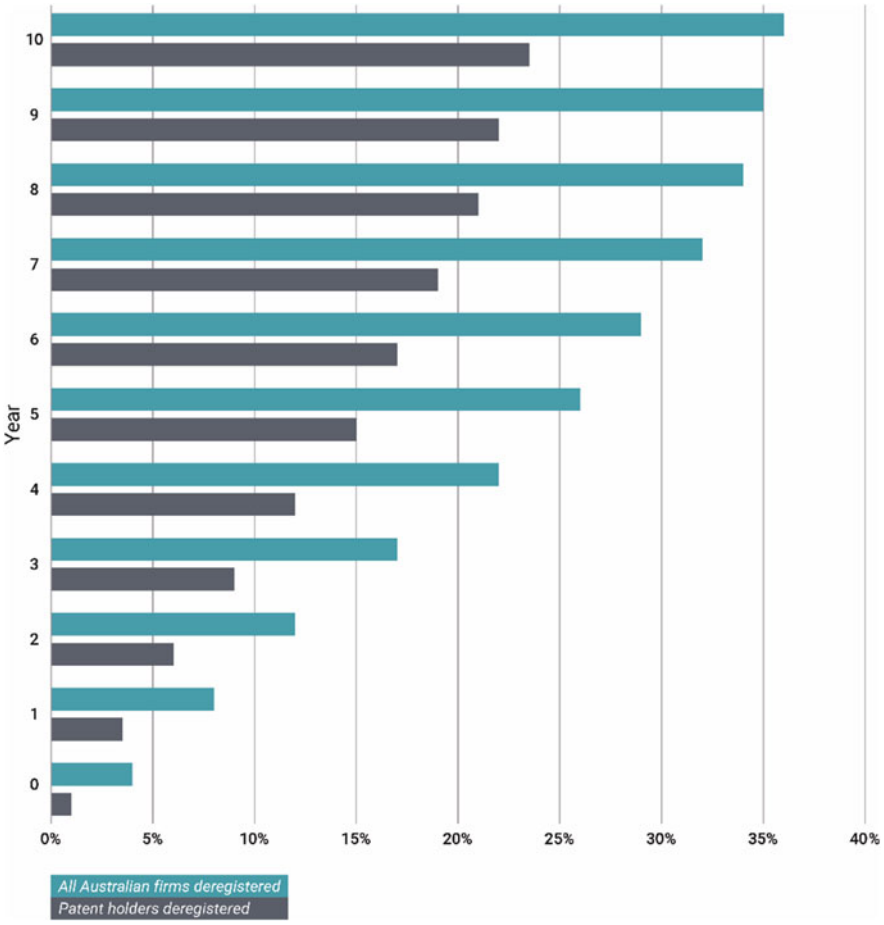

Fig. 1 Patent holders deregister at a slower rate than other firms (Zhang, 2021)

with the number of years since birth, and it is the same if you plot holders of each of the registered IP rights – trademarks, design rights, or plant variety protection – against companies that have no rights (see also Zhang, 2021).

Grow Faster

Companies that own IP rights are significantly different from companies that own no IP rights in their likelihood of achieving high growth. Based on one U.S. study, patent-owning companies are on average 10 times larger than patent non-owning companies for employment, and around 15 times larger for output and value added. Patent owners are more skill-intensive and more capital-intensive than non-owners. Based on available evidence, a significant portion of the difference derives from ownership of the IP right itself, rather than wholly reflecting self-selection into patenting by companies with high growth potential. A company's first patent

application tends to coincide with significant increases in size, skill, and capital intensity, and increases in the number of products it brings to market. The evidence suggests that patenting is associated with firm growth through the introduction of new products (Balasubramanian & Sivadasan, 2008).

Further evidence of the effects of patents is found by looking at how a company's worker compensation changes after it files an allowable patent application (U.-S. terminology for granting a patent). A recent U.S. study compared companies whose patent applications were initially allowed or rejected. The study found that the initial allowance of a high-value patent generates a substantial increase in firm productivity and worker compensation: On average, workers capture around 30 cents of every dollar of surplus generated by the patent. The earnings increase is concentrated among senior workers, who are also more likely to stay with the company following the patent allowance (Kline et al., 2019).

Trademarks are often used as complements to patents by companies, to appropriate returns from innovation through compelling branding or distribution. They are also a means to protect non-technological innovations such as new services or business methods. Based on research which looked at 600,000 Australian small and medium enterprises (with fewer than 200 employees) over the period 2002–2017, a company is 20% more likely to experience high growth – that is, annual growth in employment of 20% or more over three consecutive years – after filing a trademark compared to peers that have filed for no IP rights. Newly established companies that file for at least one IP right during their first year (whether a patent, trademark, or design) are approximately twice as likely as those who file for no IP rights in their first year to experience high growth in employment and turnover.

Using data on Australian companies, Fig. 2 plots average outcomes before and after a company's first trademark filing, for "treated" companies that file the mark and a group of "control" companies that do not use trademarks but are matched to the treated companies for age, size, and industry. Figure 2 reveals that employment growth is flat in the years before trademark filing both for the trademark filers and non-filers. After filing, there is continuous growth in employment for the trademark filers but much less growth for the control group.

Invest in Advance of Profits

In the early stages of a new venture, what sets you apart may be mostly intangible – a great business plan, an early-stage idea or invention. At this point, you may lack a roster of satisfied customers or track record of successful product launches to point to as evidence of your quality or potential. Patents signal to investors that your company is well-managed and that you're in a good position to capture returns from investment – *their* investment. Obtaining patents can increase your likelihood of obtaining venture capital, especially during early investment rounds. Patents can likewise affect investors' estimates of a start-up's value (Hsu & Ziedonis, 2013).

Registering trademarks can also constitute a valuable signal to venture capitalists and other investors. Developing and protecting trademarks signal your professionalism and seriousness to build a strong customer base and carve out a market niche (Castaldi et al., 2019). Evidence suggests that for start-ups in the very early stage of

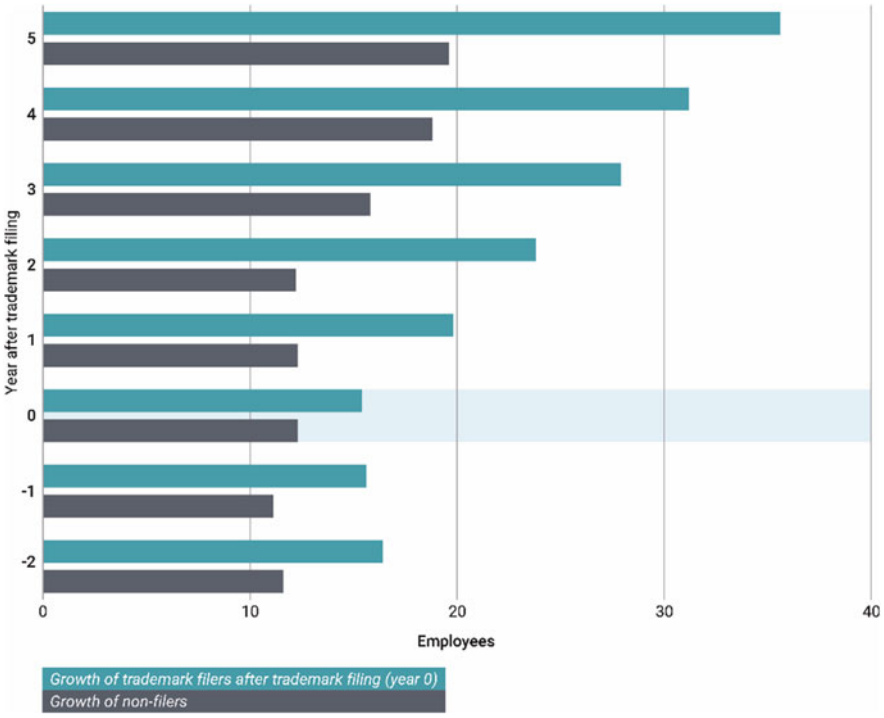

Fig. 2 Trademark filers grow larger than their peers after filing their first trademark (Australian Bureau of Statistics 2019, Business Longitudinal Analysis Data Environment)

development, a greater number and breadth of trademark applications predict higher venture capital valuations. As your company progresses into a more advanced stage of development, the positive effect of trademarks on valuations can diminish (Block et al., 2014).

In seeking outside resources, pitching can be one of the most important activities for a business looking to scale. Whether you're looking for investment partners, potential collaborators, or setting up a crowdfunding campaign to generate hype and customer traction, it's likely that you're also going to reveal details about your business plans and ideas. If you decide to go down this path, it is important to think about the implications that disclosure can have on your ability to translate IP into a competitive advantage. Inventions that are disclosed publicly cannot be patented.

In Australia, when making your first public disclosure (or use) of your invention, a 12-month grace period applies: Within 12 months, you can still file a patent application without the disclosure standing in the way of your application. Be aware though that while many countries have 12-month grace periods, such as the United States, others have only a few months, which is widespread in Europe, or no grace period provisions at all. If you disclose something in Australia and rely on the

grace period here, that same patent application won't be accepted in European countries that do not have a grace period.

Be sure to carefully consider your IP strategy up-front: What are the aspects of your business that require protection? Are there options where being open about your IP outweighs obtaining formal protection? Can you avoid revealing details of the invention, for example, by framing your pitch according to the problem that you are solving rather than the solution you have conceived? Will you manufacture in one place, sell in another, and thus want different types of protection in different markets? Being clear about your options for protecting and sharing your IP should inform your choices about how to resource and commercialize your concept.

Navigate Export Markets

Once you're ready to offer a new product for sale, you should be aware that this counts as a "public disclosure" of inventions related to that product. It is critical that you've submitted the inventions to the IP office before commercializing the product – and this includes IP offices in any foreign markets you intend to enter. File a patent application before exporting. There are ways of getting into multiple countries and having options on where to progress by filing with the *World Intellectual Property Organization (WIPO)*, and again, we'd recommend an IP attorney support you in this decision-making.

There is strong evidence that, for companies exporting technology-intensive goods, protecting IP in a destination market translates into a premium in export value. Patenting in an export country provides legal security that you'll be able to exclude others in that market from making, using, or selling your patented invention. According to one study, which used data for all French exporters over 2002–2011, patenting results in an increase in the value of exports by around 6%. The effect is attributed to exporters increasing the volume they export to a market because the market becomes more attractive with patent protection (de Rassenfosse et al., 2020).

Successfully protecting your IP in export markets depends on a proactive approach to detecting and resolving IP breaches. *IP Australia* conducted a study of Australian exporters to *China* and *Southeast Asia* and found that a proactive approach to IP is often founded in local relationships and knowledge. The study involved a survey of 118 exporters (mostly micro and small companies) and 16 interview-based case studies. Several businesses reported that they rely on local business partners to monitor for infringements. In one case, after detecting an infringement, an exporter engaged a local wholesaler to negotiate with the infringing party. In a second case, an exporter engaged a new distributor with market power over local retailers to force the alleged infringer from the market (Export Council of Australia & IP Australia, 2020).

When you enter a foreign market, you often do so with a weaker understanding of the costs of operating in that market than local firms. For both start-ups and established companies, the costs are compounded by a lack of legitimacy among local buyers, potential distribution partners, and financial institutions. A major obstacle is the difficulty associated with establishing brand recognition in the foreign market (Giarratana & Torrisi, 2010). Trademarks are an important "entry ticket":

Developing trademarks identify you with a visible name in the marketplace and can help you differentiate your goods and services.

Protecting a trademark insulates your brand from copying and may help to deter competitor entry (Barroso et al., 2019). A recent study by *IP Australia* of around 9,000 Australian manufacturers found that after filing trademarks in an export market, they are nearly three times more likely to enter that market and on average will earn 30% more export revenue if they are long-term exporters to the market. For the average company in the sample, this amounted to AU$ 416,000 a year after filing (Falk, 2021).

For exporters, IP rights are more than a defense against infringement. They are a tool that exporters can use in navigating and taking advantage of changes in market conditions. A shift in the real exchange rate – a rise in your currency relative to the currency of an export market – will usually lead you – the exporter – to reduce your exports to that market. Your products have become more expensive overseas and so foreign buyers can now select cheaper local goods over imported varieties. But a rise in the real exchange rate also increases your purchasing power in the export market. Trademark holders are in a strong position to take advantage of that change by increasing their investment in marketing and developing their foreign customer base. The same study of Australian manufacturers found that after filing trademarks in an export market, exporters are likely to expand their exports there when the exchange rate rises, unlike the average exporter which will reduce its exports (Falk, 2021).

Of course, IP rights are not a cure-all, and it is vital to know how (and whether) IP fits within your broader commercialization strategy. Your approach to IP should support the long-term interests and aims of your commercial venture. To that end, it is critical to identify the intangible assets that underpin your competitive advantage, the risks in relying on those assets, and your best route to market.

5 Play Defense and Find Your Cutting Edge

Protect Yourself

There are too many horror stories of IP strategy done poorly (or often not at all) to choose from. In a best-case scenario this leads to added cost and erodes your competitive advantage. In worst-case scenarios it can render your business model entirely unworkable, and your market entry fails.

Take some comfort in knowing that even the big end of town gets it wrong. *Nike*, *Apple*, and *Lego* have all been engaged in long-running IP disputes in *China* with third parties because their IP strategies left openings that could be exploited. The process of clawing back assets takes substantial time and investment, even with the resources of a sophisticated multinational. Imagine investing heavily in protecting the technology that goes into a piece of hardware (e.g., a home espresso machine) without being able to adequately protect consumables used in conjunction with the hardware (e.g., single-serve coffee capsules).

Successful ventures usually enjoy the protection of a business moat. Business moats create distance between you and your competition that is hard to bridge. IP is

often a key component of business moats, but you will likely find other intangible assets in the mix, including network effects, data, pricing models, or distribution and marketing capability. Moats often shrink over time, particularly if your business fails to innovate at a suitable pace. The key issue for any business is understanding the nature of their moat and which of their intangible assets contribute to that competitive advantage.

Anatomy of a Moat

At a high level, your moat comprises all your intellectual capital. That is, all the human and organizational resources that contribute value to your business. At this level, your assets may appear to be extremely intangible, but they are valuable assets, nonetheless. Think of your corporate memory and know-how, your organizational culture, customer satisfaction and loyalty, your partner networks, and relationships.

We can boil this down to something more concrete, your specific intellectual assets: These are organized, or codified, ideas and knowledge often captured in documentation, procedures, and processes. They are often not recognized as a special class of asset or protectable in some special way, but they are capable of detailed description and relatively consistent transmission between individuals and entities. Think of your customer lists, recruitment and retention processes and policies, recipes, search engine optimization (SEO) practices, and pitch strategies.

We can boil this down further to your intellectual property rights: These are assets specially recognized and protected under legal and administrative systems and includes copyright, trademarks, patents, designs, and plant variety protections. IP rights are the most concrete expression of your intangible value.

Your IP should be a foundation to directly support your intellectual assets, which in turn form the building blocks of your intellectual capital. For instance, a well-crafted trademark forms the basis for executing on a brand strategy and projecting a defined brand identity. This in turn promotes consumer identification with your products and services and brand loyalty. Ultimately, this contributes to a competitive advantage in terms of higher margins and market share.

It's critical that businesses routinely reassess their moat and maintain good IP hygiene. Ask yourself how wide is your moat, how are you managing the moat, and is it aligned to your business strategy?

Alternative Pathways

So, you've looked inward, assessed your moat, and identified its intangible components. You have probably found that not all your intangible capital and assets can be readily captured in the form of IP rights. You will probably also find that it's not always necessary or ideal to reduce intangibles into some form of IP right.

Registering IP rights is not the only way to protect your intellectual property. There are other approaches you should consider, depending on your industry and strategy/objectives. The important thing is to educate yourself about available protections and make an informed choice about the best option for your business.

You should adopt a toolbox approach. Here are some of the other tools you could be reaching for:

- Develop practical, technical, or structural options for limiting access to your key intangible assets. For example, can manufacturing, maintenance, or processing be designed in a way to compartmentalize knowledge and access? Can information be kept secret among a defined and trusted group of individuals? A classic example is the *Golden Syrup* product made by the United Kingdom's *Tate & Lyle*, where only six people (apparently) know the full method of inverting the sugar to produce this particular product which ships more than a million cans a month.
- Do some basic research or due diligence on your partners. You should confirm critical information for yourself rather than relying on warranties and assurances. It's better to avoid the cost and disruption up-front rather than (maybe) being compensated afterward.
- Have appropriate contracts and confidentiality agreements in place. Most importantly, these documents should be fit for your specific circumstances and the jurisdiction in which they will need to be enforced.
- Invest in understanding the commercial and regulatory landscape. Without this understanding you will not be able to position yourself or structure your business and relationships in an optimal way.
- Manage your relationships with partners closely so that you are aligned on objectives. Rather than being an IP risk, partners can sometimes also serve as your eyes and ears on the ground, and feed into your understanding of the landscape.

Ultimately, your ability to protect your IP should inform your go-to-market strategy. This includes the decision whether to compete or collaborate with current market leaders (Gans & Stern, 2003; Teece, 1986). Do you possess the in-house capabilities to produce and market your product or service? If not, your best bet could be to license or sell your IP to another company. Without effective protections – without being able to safely disclose details of your valuable IP – you may be limited in your ability to negotiate with potential partners, so you may need to compete with market leaders directly (Gans & Stern, 2003). We shape our tools and our tools shape us, so they say.

6 Where to from Here

If you agree that understanding IP is important – then where to now? Consulting an IP attorney is an important first step and often begins with a pro bono introduction. Some companies prefer to first undertake an internal audit of their IP and there are intangible asset specialists who can help.

In recent years, many IP offices around the world have adopted a proactive approach to ensuring that small businesses have the information they need to make informed decisions about IP protection. At *IP Australia*, when filing patents, SMEs are eligible to fast-track their applications and can also access a case

management service where a subject-matter expert shares information about the application and examination process.

By increasing information resources available for businesses, and by raising public awareness and understanding of the IP system, *IP Australia* is working to embed consideration of IP early in a company's life.

A key focus for *IP Australia* is supporting exporters to navigate the international IP system. Based in the Australian Embassy in Beijing, Australia's IP Counsellor to China, *Charlotte Trinh* (an author of this chapter), helps Australian companies understand the Chinese IP and legal systems. Many countries have IP councilors in China and around the world. *IP Australia* partners with export assistance organizations, as well as universities, accelerators, and peak industry bodies to educate businesses about IP. For example, through its Landing Pads program, the Australian government trade organization *AusTrade* has established hubs in important global markets that support Australian businesses, before and after they arrive in an export market. Charlotte has run one-on-one IP clinics with Australian businesses involved with the Shanghai Landing Pad, educating them about IP, filing strategies, non-disclosure agreements, and the importance of local partners for expert advice. Overall, the cohort that received this training was found to be better prepared than previous cohorts.

7 Learnings and Takeaways

For start-ups, effective use of IP rights can generate a variety of benefits:

- Attract critical resources, for example, by increasing investors' estimates of a start-up's value;
- Contribute to increasing a start-up's likelihood of surviving and realizing high potential for growth; and
- Enable a business to navigate and take advantage of changes in market conditions, for example, as a business moves into exporting.

Effective use of IP rights depends on start-ups seeking the right types of information and support:

- Auditing the intellectual assets that you own, how these contribute to your competitive advantage, and how these are best protected – expert assistance is available from intangible asset specialists, IP offices, and IP attorneys;
- Understanding how your IP strategy should be informed by the nature of the products or services you are bringing to market, the structure of your industry, and your position in the industry value chain – more complex products often require more complex IP arrangements; and
- Drawing on the support of local partners (e.g., commercial partners in export markets) to detect and resolve IP breaches.

IP offices, including *IP Australia*, are increasingly proactive in engaging businesses through a variety of channels, to embed consideration of IP early in a company's life, and in providing information and support to help new businesses benefit from IP. Fact sheets, case studies, online education programs, tools, and checklists – all are available at www.ipaustralia.gov.au.

Takeaways

There are many tools by which to protect your IP, and IP rights have many beneficial uses – not only defending against infringement but also attracting investment, realizing growth potential, and taking advantage of changes in market conditions. An effective IP strategy begins by identifying your sources of intangible value, and how to support and build them using IP tools and drawing on expert advice.

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Michael Falk is Chief Economist at IP Australia, and leads its program of economic research, advice, and publications. He joined IP Australia in 2019 as an opportunity to shape policy thinking through evidence and help the government address challenges at the nexus of innovation, competition, and trade. He has over a decade's experience in research, strategy, and communications roles across government, academia, and industry. He holds a PhD in the Management of Technological Innovation from Melbourne Business School and a Master's in Publishing and Communications from the University of Melbourne. He has regularly consulted for public and private sector organisations, applying research to high-pressure policy evaluation and planning cycles. For example, as digital technology upended traditional publishing and media models, he worked with the executive teams of first-mover digital media start-ups to devise entrepreneurial strategies.

Benjamin Mitra-Kahn is an economist who has served as the Economic Advisor to the UK Intellectual Property Office (2009–2012), Chief Economist at IP Australia (2012–2021), and is currently the Program Manager of the Household Expenditure and Income Data Branch at the Australian Bureau of Statistics. He has published research on the economics of copyright and patents and was responsible for policy and legislation at IP Australia (2018–2021).

Charlotte Trinh is Australia's Counsellor for Intellectual Property to China. She joined IP Australia in 2020 and commenced her post at the Australian Embassy in Beijing in March 2021. She works to guide and connect Australians to the China innovation system to help them make the most of their IP in China. She also works to deepen Australia-China engagement and collaboration on IP issues. Prior to this role, she worked as a technology and brands lawyer in mainland China, Australia, Vietnam, and Hong Kong. She has extensive experience helping companies capture, manage, and commercialize their intangible assets.

Haiyang Zhang is an economist in the Australian Government Department of Industry, Science and Resources, Canberra, and has a PhD from GRIPS (in Tokyo, Japan) in Development Economics and International Development.

Market Success for Inventions: Patent Commercialization Scoreboard and Innovation Support

Thomas Bereuter, Adéla Dvořáková, and Ilja Rudyk

1 Role of Intellectual Property Rights for Technology Start-Ups and SMEs

Small and medium-sized enterprises (SMEs) are regarded as the backbone of the European economy. However, a large portion of their contribution to economic growth and job creation is in fact generated by a small percentage of them. These businesses, which are able to achieve periods of extremely high growth, include start-ups, but also established SMEs, and their success frequently stems from investment in innovation and intellectual assets. Intellectual property (IP) rights, such as patents, trademarks, and industrial designs, help keep control over intellectual assets and may be instrumental in enabling these innovative businesses to

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T. Bereuter
European Patent Academy, European Patent Office, Munich, Germany
e-mail: tbereuter@epo.org

A. Dvořáková (✉)
LESI High-Growth Technology Business Task Force, Munich, Germany

I. Rudyk
European Patent Office, Munich, Germany
e-mail: irudyk@epo.org

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_19

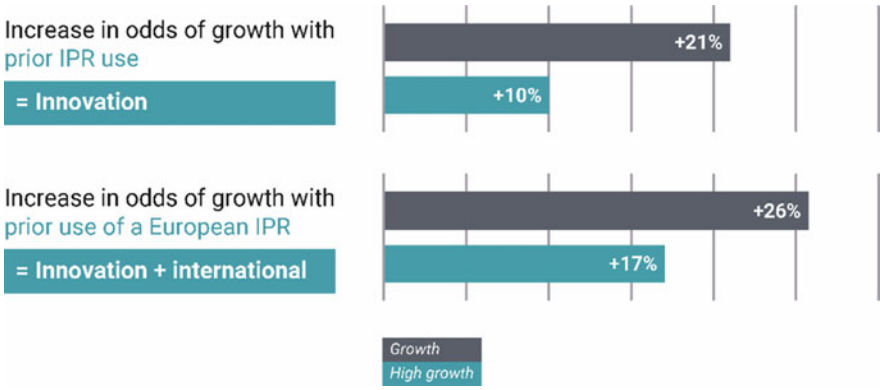

Fig. 1 Increase in odds of growth with IP (authors' own figure, based on EPO/EUIPO, 2019)

leverage the value of their ideas and secure a return on their investments (EPO/EUIPO, 2019).[1]

Intellectual property rights (IPRs) are thus an essential part of a technology company's intellectual asset portfolio and should be part of the focus of business creators' attention from the beginning. However, especially early-stage companies often overlook their importance while they concentrate on bringing products and services to the market, and even established SMEs face significant challenges in maximizing the value of their IP portfolios.

1.1 Intellectual Property Rights and High Growth

A joint study of the *European Patent Office (EPO)* and the *European Union Intellectual Property Office (EUIPO)*, (hereafter "the High-growth Study,") (EPO/EUIPO, 2019)[2] investigated the relationship between IP and company growth. The study reveals, for instance, that SMEs that have filed at least one IP right are 21% more likely to experience subsequent growth and 10% more likely to become a high-growth firm (see Fig. 1).[3] When using IP bundles (combinations of patents, trademarks, and design rights), often associated with good IP management practices, the odds of high growth jump to 33%.

The likelihood of experiencing growth and high growth also increases if SMEs are prepared to scale up their business and expand internationally. Companies that

[1] https://www.epo.org/high-growth (accessed on March 17, 2022). SMEs that own IP rights also have more employees, pay higher wages, and generate on average 68% higher revenue per employee than SMEs without IP rights (EPO/EUIPO, 2021). Available at: https://www.epo.org/ipr-performance (accessed on March 17, 2022).

[2] *Idem*.

[3] High-growth firms are those that achieved a minimum of 20% growth in turnover in three consecutive years, according to the OECD and Eurostat definition.

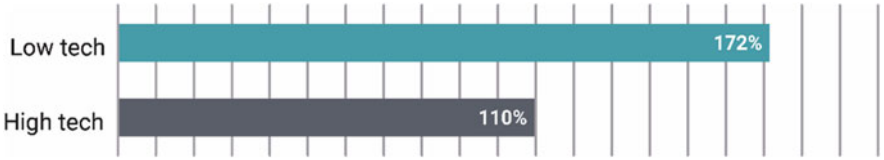

Fig. 2 Increase in odds of high growth with prior use of a European patent (authors' own figure, based on EPO/EUIPO, 2019)

have filed at least one European IP right, providing protection in several European countries, raise the odds of growth and high growth by 26% and 17% respectively.

A strong IP portfolio is particularly vital for deep tech companies[4] that need to invest significantly in R & D before being able to reap the returns on their investment. IP rights make it easier for such companies to capture the value of their inventions. They play a pivotal role in helping secure a return on risky investments by excluding copycats. This is exceptionally important in the growth phase when earnings increase dynamically, making copying advantageous. Companies without IP protection for their attractive products and services would struggle to secure financing and establish collaborations (Yap, 2022).

The High-growth Study therefore elaborated on the correlation between growth and the use of IP rights in the case of technology companies seeking patent protection at the European level. These results are even more striking. For instance, as depicted in Fig. 2, for technology SMEs that have filed a European patent, the likelihood of achieving high growth leaps by 110% if they operate in high-tech industries (such as pharmaceuticals, electronics, or spacecraft) and by 172% if they are active in low-tech industries (e.g., food products or textiles).

However, it is important to understand that the ownership of patents as such does not suffice as the unique success factor, *per se*: They merely serve as an instrument for realizing the value of the protected technology through successful commercial exploitation. To fulfill its function, the IP portfolio must dovetail with the overall business strategy and be combined with smart IP management.

1.2 Benefits of Patenting for Technology Start-Ups

Despite the undisputed role of patents in facilitating growth, deep tech start-ups often fail to place enough emphasis on the creation of a strong patent portfolio. Due to their small size, limited capacity, and budget, the founders tend to focus on many different aspects of the business that enable them to get through the coming months, such as satisfying the short-term needs of their paying customers or investors.

[4]Deep tech enterprises actively develop advanced technology, as opposed to the larger population of small businesses that merely implement and deploy such technology. They typically have disruptive potential and therefore face higher development costs, as well as greater market and technology risks.

Building a competitive patent portfolio is a mid- to long-distance run that does not necessarily secure revenue and survival in the short term. Thus, it is not always sufficiently high on the priority list (Bulthuis, 2020). Lack of IP knowledge and focus, however, often leads to failure. Only one in two companies usually manages to make it through the first five years and leverage their technology to achieve the desired growth.[5] An interesting example of a successful start-up that benefitted from having filed a patent early on is the company *DyeMansion*.[6] The founders secured their patent protection and used it to gain funding and support for their business model. A member of the founder's family, an IP professional, provided the required insight. Not all start-ups have the option of obtaining expert advice when required, however. Therefore, greater emphasis needs to be placed on enhancing the IP knowledge and skills of business decision-makers, along with their understanding of the importance of a strong patent portfolio in the different growth phases of a company.

The findings of the High-growth Study presented in the previous section show a clear link between investing in patents and high growth. But how can patents be exploited to speed up a tech company's growth rate? Developing an IP strategy and building a strong IP portfolio at an early stage combining, say, patents with trademarks, trade secrets, design rights, and so on, offer a number of concrete benefits. They are broadly summarized in "4 Reasons to Patent."[7] The following table presents an overview of the reasons to patent and links them to real-life examples from the *EPO Innovation case studies*:

1. Market access;
2. Negotiating;
3. Funding;
4. Strategic value.

1. Market Access

Patents are instrumental in securing freedom to operate (FTO), a prerequisite for building a strong and sustainable position in the market. Although freedom-to-operate analyses may be challenging when there is a patent thicket, they should be an integral part of a diligent patent analysis. A proactive patent search strategy analyzing the freedom to operate can reduce the risk of infringing the rights of

[5] See, for example, Survival of private sector establishments by opening year in U.S. Bureau of Labor Statistics Latest Numbers, available at: https://www.bls.gov/bdm/us_age_naics_00_table7.txt (accessed on March 28, 2022) or five-year survival rates of enterprises in the EU, available at https://ec.europa.eu/eurostat/statistics-ex-plained/index.php?title=Business_demography_statistics#Enterprise_survival_rate (accessed on April 6, 2022).

[6] https://www.epo.org/business-forum#dyemansion (accessed on March 17, 2022).

[7] https://www.4ipcouncil.com/4smes/4-reasons-patent (accessed on March 17, 2022). Similar material summarizing the essentials of trade secrets is available at https://www.4ipcouncil.com/4smes/4-essentials-of-trade-secrets (accessed on March 17, 2022).

third parties. The case study *Micrel* (Hofmann, 2017a) is one such example. At an early stage, the company had to withdraw from the UK market due to lack of secured FTO. Learning from this experience, they improved patent protection on their products and employed a tailored IP strategy, including FTO analysis, to re-enter the market better prepared.

In addition, patenting enhances companies' reputations in respect to their customers and partners, paving the way into new markets and enabling the company to charge a premium for its products (Gasnier & Svensson, 2017; Granieri, 2017). Moreover, competitors hold professionally managed portfolios in high regard, making them respect the IP position of the owners and thus reducing the risk of infringement. These aspects are particularly crucial for start-ups as an indicator of their professionalism and competitiveness (Hackl, 2022).

Especially for inventions that can easily be reverse-engineered or where there is a risk of information leakage destroying trade secrets, patent protection is a powerful tool in safeguarding the invention from copycats, which may potentially secure the whole business. Companies with strong patent portfolios have greater control over their rights, also contributing to their stronger position in terms of negotiating licensing deals or any other IP-based cooperation.[8]

Examples of EPO Innovation Case Studies:

- *Cosmed* (Granieri, 2017)
- *fos4X* (Hackl, 2022)
- *Fractus* (Simon, 2017)
- *Micrel Medical Devices* (Hofmann, 2017a)
- *Picote* (Gasnier and Svensson, 2017) ◀

2. Negotiating

Patents enable their owners to monetize their technology through commercialization, not only by supporting product or service sales, but also by facilitating technology sales, licensing, or cross-licensing deals. This allows companies to secure additional revenue, gain access to new technology and freedom to operate, or leverage their technology in new markets/applications that would otherwise be difficult to reach.

A well-defined IP strategy for the technology under development can also smooth the way for collaborations or joint development. Start-ups and smaller companies often struggle with limited resources, making them more interested in cooperation with external partners. Protecting the technology with a patent may help attract potential partners and strengthen the company's position in

[8] One example is the SME case study *Fractus* (Simon, 2017), where successful litigation served as a precedent for continuing and future licensing agreements. For more details on IP enforcement strategies for SMEs, see Vandermeulen (2020).

negotiation by keeping control of its own IP and reducing the imbalance of power in respect to larger partners. In some cases, patents may even increase the chances of the technology being discovered by another party, as in the case of the Turkish university spin-off *Dermis Pharma* (Vardar Sukan & Çakir, 2021).

Protecting research results with patents is often a prerequisite for commercializing the technology via spin-off creation, which is particularly vital for university research technology transfer models (Hofmann, 2017b; Karg, 2022).

Examples of EPO Innovation Case Studies:

- *Cubicure* (Karg, 2022)
- *Dermis Pharma* (Vardar Sukan and Çakir, 2021)
- *Lithoz* (Hofmann, 2017b)
- *Voltea* (Gasnier, 2017)
- *Webdyn* (Ollivier, 2017) ◄

3. Funding

The phase between the initial investment and actual generation of revenue may be rather long, especially for start-ups operating in deep tech industries such as life sciences or advanced digital technology. Health-care start-ups, such as *Marinomed* (Hackl, 2017a) or *Perceive3D* (Aguilar, 2022), rely on external funding in the early stages. More than one round of financing is often necessary before the company starts generating sufficient income.

The above is crucial when it comes to attracting investors. The freedom to operate, preventing imitation, a stronger negotiation position, or increasing the value of the company as such are just some examples of the relevance that patents represent in realizing the company's growth potential. Patents, and IP portfolios in general, send a positive signal to potential investors and attract further investments. In most cases, a solid IP base is also a prerequisite for a successful initial public offering since it is carefully assessed during the due diligence process. The assessment builds investors' trust in the company's potential to sustainably generate value by protecting its competitive advantage.[9]

Examples of EPO Innovation Case Studies:

- *Atlantic Therapeutics* (O'Beirne, 2021)
- *Marinomed* (Hackl, 2017a)

[9] See, for instance, the case history of *Marinomed* (Bereuter & Hackl, 2021), a biopharmaceutical company that had a successful IPO by leveraging the value of its IP portfolio.

- *Oxeon* (Heiden and Pamp, 2021)
- *Perceive3D* (Aguilar, 2022)
- *Skeleton* (Svensson, 2017) ◀

4. Strategic Value

Last but not least, patents increase the strategic value of the company. They protect the company's competitive advantage along the whole value chain and enable it to reap the value of R & D investments, which can then be re-invested in R & D for further value creation. This is particularly relevant for entrepreneurs adopting the build-to-sell strategy, such as the company *fos4X* (Hackl, 2022), and whose main objective is maximizing the market value of the company. A strong and diligently managed patent portfolio that is well aligned with the business strategy, along with other IP rights (such as trademarks, which are essential for building a brand) are crucial assets that enable entrepreneurs to achieve an optimum exit value.[10]

Another less obvious aspect is that patents, together with appropriate staff training and the introduction of recognition and reward mechanisms, contribute to an innovation mindset that is inviting for creative thinkers and may help the company attract talented personnel. IP rights as such are not the only key to value creation. The team's expertise contributes a significant portion of the competitive advantage facilitated by technology and IP, enabling value maximization. Companies thus need to pay attention to forward-looking staff management[11] and provide the right incentives, motivation, tools, and so on throughout the IP value chain, from creation of the technology to monetization, as demonstrated by the successful start-up *Blubrake* (Granieri, 2022).

Examples of EPO Innovation Case Studies:

- *Aerogen* (McManus, 2017)
- *Blubrake* (Granieri, 2022)
- *Ekspla* (Hackl, 2017c)
- *fos4X* (Hackl, 2022)
- *Orcan Energy* (Hackl, 2017b) ◀

[10] For further information on the role of intellectual assets in strategic transactions, see Graner, 2020.

[11] For more practical advice on the management of people in the IP value chain, see Bereuter et al., 2020.

2 Patent Commercialization Practices of European SMEs

Small and medium-sized enterprises (SMEs), together with universities and public research organizations (PROs), regularly account for almost one in every four patent applications filed at the European Patent Office (EPO) and originating in the EPO member states.[12] These entities form an important part of the European economy, and it is therefore crucial to ensure that they are enabled to maximize the value of their technology by leveraging their IP portfolio. Two surveys, one on European SMEs and one on European universities and PROs, help to better understand their practices and identify successes and challenges that they face in commercializing their European patents:

The *SME scoreboard* was conducted among 1,500 innovative established SMEs and start-ups from Europe that have recently filed a European patent (EPO, 2019),[13] while the *UNI/PRO scoreboard* examined about 700 recent European patent applications from almost 250 European universities or public research organizations (EPO, 2020).[14]

2.1 SMEs' Commercialization Practices

The *SME scoreboard* shows that established SMEs and start-ups typically rely on European patents for many reasons, such as preventing competitors from imitating their inventions, building a reputation, and securing freedom to operate. However, about half of the respondents also regarded transactional purposes as important, like setting up licensing agreements and commercial contracts, enabling them to move into new markets (see Fig. 3). These results confirm that strong patent protection and broad geographical coverage are particularly important for technology start-ups and small companies. Due to their small size, these businesses are even more dependent on licensing agreements and cooperation partnerships with foreign entities to commercialize their inventions internationally and scale up their business.

When it comes to the specific commercialization practices of the SMEs surveyed, the study reveals that almost 70% of all patented inventions are actually commercially exploited. Of these, about half are commercialized in collaboration with external partners, mostly via licensing and cooperation agreements, with the main objectives of increasing revenues and gaining market access. Nearly one-third of them are exploited by means of spin-off creation. Cross-licensing, often considered a collaboration form typical of large enterprises, accounts for about 20% of all jointly exploited patents (see Fig. 4). According to the study, the ranking of different forms of collaborative exploitation is the same for various industry sectors, although there

[12] See the EPO's Patent Index 2020: https://www.epo.org/about-us/annual-reports-statistics/statistics/2020.html (accessed on March 28, 2022).

[13] https://www.epo.org/scoreboard-smes (accessed on March 17, 2022).

[14] https://www.epo.org/scoreboard-research (accessed on March 17, 2022).

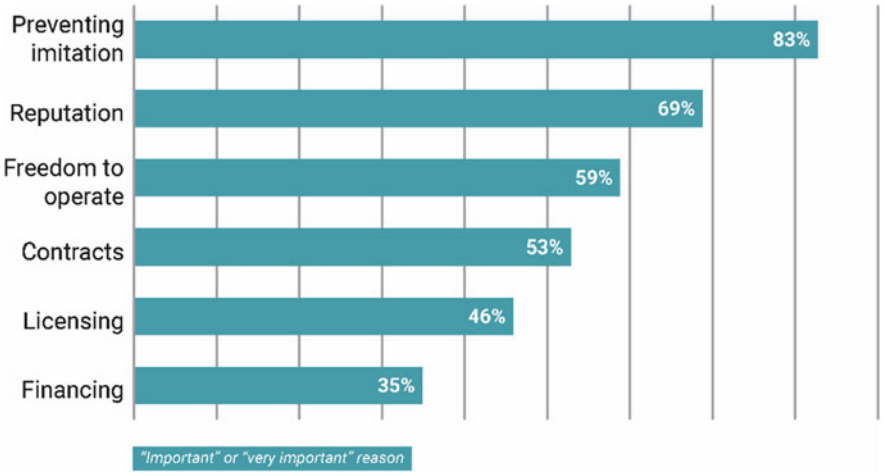

Fig. 3 Reasons for patenting – SME scoreboard (authors' own figure, based on EPO, 2019)

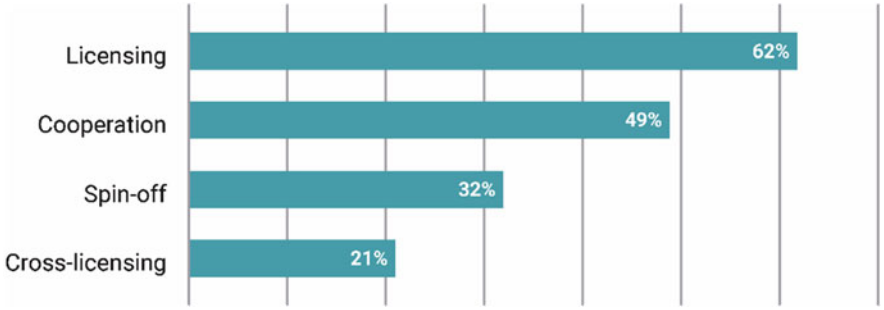

Fig. 4 Forms of collaborative exploitation – SME scoreboard (authors' own figure, based on EPO, 2019)

is some variation in the frequency. Licensing is clearly the dominant type of joint exploitation in mechanical engineering, for example. Chemistry is the field in which patented inventions are most frequently exploited by spin-off creation.

2.2 Commercialization Practices of Universities/PROs

For universities and PROs, about 36% of the patented inventions were already being exploited, while exploitation was still planned for 42%. The UNI/PRO scoreboard looked into motivation to exploit their patented inventions. Commercial exploitation, revenue generation, and practical use were the three reasons cited by almost all respondents.

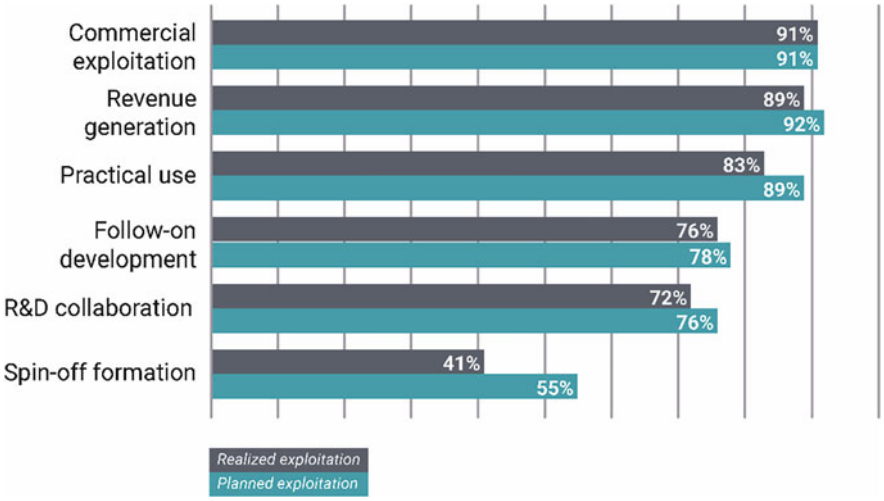

Fig. 5 Reasons for exploitation – UNI/PRO scoreboard (authors' own figure, based on EPO, 2020)

One interesting finding is that spin-off formation was only mentioned in about half of the cases. As Fig. 5 reveals, it was reported in 55% of cases of planned exploitation, but for only 41% of cases of realized exploitation. The gap between planning and reality may be due to universities' and PROs' lack of resources and expertise in dealing with the legal and operational complexity of founding a spin-off start-up and negotiating fair conditions.

2.3 Challenges in Patent Commercialization

In general, the results described above indicate the good overall position of European SMEs that use the European patent system for patent commercialization, thereby confirming the findings of the High-growth Study. However, especially smaller and younger companies face a number of challenges when commercializing their technology.

Challenges of Commercialization in General

For patents that are not commercially exploited, the most frequently cited reasons are that the technology is too early stage or that commercial opportunities are still being explored, both features of deep tech companies. Lack of resources and lack of skills or contacts, which were cited in third and fourth place with 32% and 19%, respectively (see Fig. 6), merit more attention since these challenges relate directly to shortcomings faced by SMEs due to their size and market position, and support can be provided in tackling these issues.

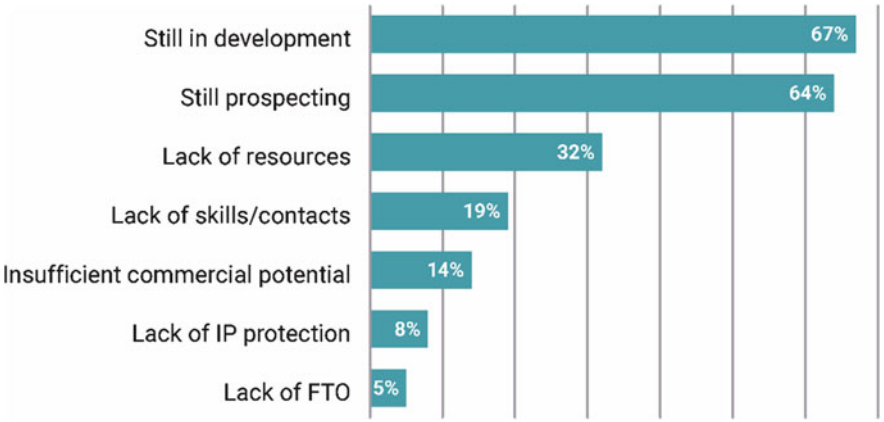

Fig. 6 Reasons for non-exploitation – SME scoreboard (authors' own figure, based on EPO, 2019)

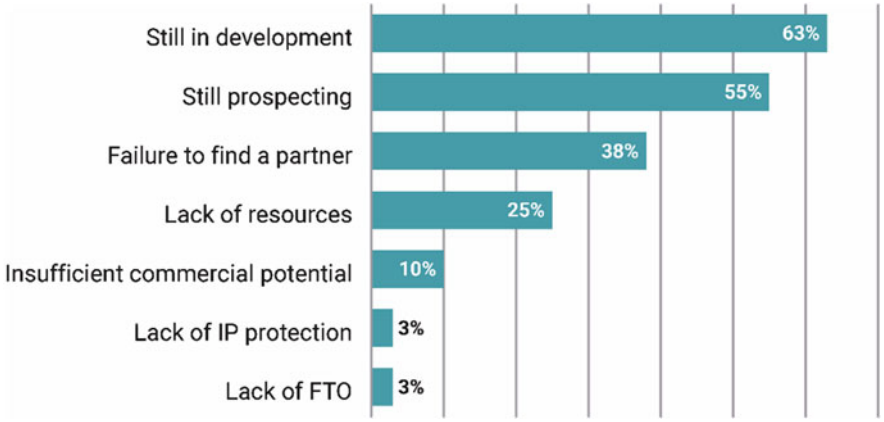

Fig. 7 Reasons for non-exploitation – UNI/PRO scoreboard (authors' own figure, based on EPO, 2020)

One positive finding is that a lack of freedom to operate is not among the greatest challenges for the SMEs surveyed. It is low on the list, with just 5% of companies citing it as a reason for the non-exploitation of their patents. The situation may be different for SMEs that do not use the European patent system, however.

The UNI/PRO scoreboard confirms these main challenges with similar results (see Fig. 7). Failure to find a partner and lack of resources are indicated even more frequently than among SMEs as two of the most frequent barriers to exploiting patents (considered challenges in 38% and 25% of cases respectively). In addition, the cost and complexity of negotiations was identified as the major challenge of realized exploitation.

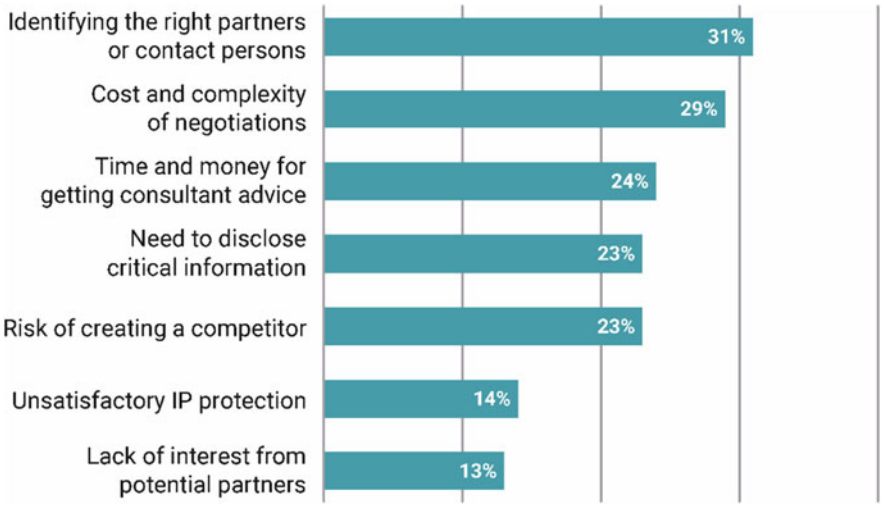

Fig. 8 Challenges in collaborative exploitation – SME scoreboard (significant challenge with score "4" and "5," authors' own figure, based on EPO, 2019)

Challenges of Collaborative Exploitation

When it comes to the collaborative exploitation of patented technology, the SME scoreboard confirms that identifying the right partners or contacts is the main challenge for joint commercialization. Up to 60% of partnerships involving SME patents or patent applications are in fact initiated by their partners. This implies that a majority of the current partnerships are actually not due to the SMEs' own efforts to find business partners. In those cases where they manage to set up collaborations across Europe by their own efforts, the contacts come from their own networks, prior business collaborations, or their partners' networks. Intermediary channels such as internet trading platforms, brokers, and consultants or patent information tools are largely underused for the purposes of achieving successful collaborations.

Further challenges, often due to the small company size and thus lack of resources and/or experience, are shown in Fig. 8 and include the cost and complexity of negotiations, and the lack of time and money to obtain the right advice.

Some differences can be observed between the various technology sectors. Identifying the right partners or contacts is a key issue in instruments, chemistry, and other fields but is perceived as less critical in electrical engineering. The cost and complexity of negotiations is a serious challenge in almost all sectors.

These results are also supported by the UNI/PRO scoreboard. It shows that SMEs are considered by the universities and public research organizations as potential partners in 50% of cases of planned patent exploitation, in contrast to 30% of cases where large companies are considered. Once exploitation is realized, however, the share of SMEs and large companies is 40% for both groups. This suggests that universities and smaller companies, start-ups in particular, struggle to partner with larger companies, likely because larger companies have a strong tendency to be risk adverse and slow in decision-making. Universities and smaller companies often need to rely on the existing network of SMEs for joint commercial exploitation.

3 Innovation Support for Start-Ups and SMEs

Both EPO scoreboards identified several obstacles to successful commercialization, which can be summarized in principle as lacking contacts or a network, skills, and resources. For this reason, together with its stakeholders, for example the *Licensing Executives Society International (LESI)*, the EPO has developed several products and training courses to help technology start-ups and established smaller companies overcome these hurdles and achieve the desired high growth by commercializing their technical solutions.[15]

To support technology businesses, the EPO has established the *High-growth Technology Business (HTB)* initiative in cooperation with the LESI. The initiative focuses on two main job profiles that have the greatest influence on IP-related matters at companies: business decision-makers and IP professionals, the latter including in-house IP managers cooperating with external advisors. On the one hand, it is designed to encourage business decision-makers to engage strategically to create value and, on the other hand, to train IP professionals in business-focused IP management practices. Together with the LESI, the EPO has created a series of events in the initiative:

- *The HTB conference* offers a dual track from which participants can choose their focus on business or IP, dealing with multiple topics related to IP strategy and IP management.
- *The online HTB forums* feature success stories of companies that created value by leveraging their technology with IP, presented in a lively presentation-and-discussion format by the CEO/founder and an international expert panel.[16]

Publications and other training materials supporting SMEs are another key outcome of the EPO-LESI cooperation. Content relevant for decision-makers, IP professionals and other stakeholders in their innovation ecosystem, such as research organizations, IP advisors, market facilitators, and investors, is available on the EPO website[17] and in *les Nouvelles*, the journal of the LESI.[18] These publications provide practical insight into relevant topics for new and established SMEs, including IP

[15] Other EPO stakeholders or multipliers active in this field include the *Center for Intellectual Property (CIP)*, the *Center for Intellectual Property Studies (CEIPI)*, the *European IP Helpdesk*, *Enterprise Ireland*, national patent offices, *PATLIB centers*, and chambers of commerce.

[16] The recordings of the case studies from the HTB forums ("High-growth technology case studies"), together with the main takeaway messages, can be viewed at https://www.epo.org/business-forum (accessed on March 17, 2022).

[17] https://www.epo.org/high-technology-businesses (accessed on March 17, 2022).

Most publications are also available in a book format published by Novaro Publishing, see for example (Various Authors, 2021).

[18] See for example: https://www.lesi.org/docs/default-source/ln/lnjune2020/les-nouvelles%2D%2D-june-2020%2D%2Dfull-issue.pdf?sfvrsn=314226dd_3 (accessed on March 17, 2022).

commercialization, transactions, negotiation, open innovation (Heiden & Peters, 2020), enforcement, and people management.

To help businesses overcome one of the most important challenges, namely the lack of contacts and difficulties in finding the right partner for joint commercialization, one of the key topics of the EPO-LESI initiative is how to work with market facilitators. The aim is to raise understanding among start-ups and SMEs of the possibilities open to them beyond their established personal and business contacts, give practical advice on the types of facilitators to consider, and how to work with them (July & Rudyk, 2020). In addition, the High-growth Technology Business community on *LinkedIn* serves as a joint platform for supporters and members of the community to exchange content, experience, and contacts. For example, as a starting point, it gives members a list of market facilitators and IP brokers.[19]

To help the technology businesses learn from each other, the EPO provides free access to the innovation case studies, consisting of three different case study series[20]:

- *Technology transfer case studies* illustrate how patents facilitate technology transfer from R & D-conducting organizations and describe the journey from an idea in the lab to the introduction of products and services to the market.
- *SME case studies* present companies that use IP strategically to their advantage and elaborate on their IP management practices.
- *High-growth technology case studies* are based on the success stories presented at the HTB forums.

Entrepreneurial inventors are the target group of the *Inventors' Handbook*, aiming to overcome the obstacles of commercializing their inventions. The handbook serves as a practical guide to the main steps that inventors typically go through, again assisting researchers and start-ups in dealing with the lack of skills and IP knowledge. It gives insight into essential topics such as prior art search, IP protection, business planning, funding or negotiation, and tips to avoid the most common pitfalls.[21]

Since small businesses and universities/PROs all struggle with the lack of resources, several tools can help them become more efficient in accessing patent information and carry on an IP assessment on their own:

The free database *Espacenet*[22] contains over 130 million patent documents from around the world, updated on a daily basis. Together with the *European Patent Register*, it serves as a powerful tool to search patent applications and granted patents as well as their legal status, helping test the novelty of technology and assisting with

[19] See https://linkedin.com/company/htbcommunity (accessed on March 17, 2022). The platform also provides regular updates on events and shares IP-related material dedicated to business decision-makers and IP professionals.

[20] https://www.epo.org/case-studies (accessed on March 17, 2022).

[21] https://www.epo.org/inventors-handbook (accessed on March 17, 2022).

[22] https://www.epo.org/espacenet (accessed on March 17, 2022).

assessing the freedom to operate. It is also extremely useful for several other business-relevant questions, such as searching for potential partners, keeping track of the R & D efforts of competitors, or tracking the progress of technology in the field.[23]

The annual training conference *Search Matters* showcases patent search strategies and techniques as well as the various publicly accessible databases and search programs. The main objective is improving participants' search capabilities by gaining an in-depth understanding of how EPO examiners perform their searches on patent applications.[24]

Besides offering highly efficient patent knowledge tools directly to the users of the patent system, the EPO is known for supporting and coordinating the network of *patent information (PATLIB) centers* since 1990. These centers are the main local contact for inventors, start-ups, and SMEs, and act as enablers of technology transfer and IP commercialization in all fields of technology. The current 327 patent information (PATLIB) centers in 37 countries, offer a wide portfolio of services, ranging from simple IP information, patent analysis, business analysis, to technology transfer services and commercialization support.

The increasingly empowered PATLIB network, in its many activities and out-reach capacity, represents real business opportunities for both start-ups and SMEs, positioning the EPO as a leading contributor for innovation in Europe. Through its PATLIB 2.0 project, the EPO is supporting a harmonized certification of technology transfer professionals and work is in progress to strengthen technology transfer capacity in Africa by promoting the cooperation of the network with a group of African universities.

Patent information is also crucial when using the systematic approach of the free *IPscore* tool designed to support businesses and research organizations in assessing their technologies. It offers qualitative and comparative evaluation with 40 questions in five areas: (i) market, (ii) technology, (iii) legal, (iv) strategy, and (v) finances. Additionally, *IPscore* produces output in the form of graphical overviews and a report to facilitate communication of the results to ensure informed decision-making.[25]

Finally, the *e-learning* environment of the *EPO's Patent Academy*[26] and the *IP teaching kit* (EPO/EUIPO, 2018)[27] complement the above programs with a number of online training courses aimed at strengthening the IP competence of a broader range of target groups.

[23] The *Inventors' Handbook* includes a short practical guide for simple searches in *Espacenet*. Training courses can be found on https://e-courses.epo.org/ (accessed on March 17, 2022).

[24] For further information, see the best of *Search Matters 2021* at https://www.epo.org/learning/materials/best-of-search-matters.html (accessed on March 17, 2022).

[25] https://www.epo.org/ipscore (accessed on March 17, 2022). For more information on IP assessment see Hackl and Guillermin, 2020.

[26] https://e-courses.epo.org (accessed on March 17, 2022).

[27] https://www.epo.org/teaching-kit (accessed on March 17, 2022).

4 Learnings and Takeaways

Patent commercialization will certainly remain a field of lifelong learning. Start-ups benefit from the wide selection of tools and training activities provided by the *EPO's Patent Academy*, national IP offices and their *PATLIB centers*, *LESI*, the *Center for Intellectual Property (CIP)*, *CEIPI*, and others. Launched in 2020, The Blueprint for the *European Patent Academy* introduces an open, structured framework to design and deliver education based on four pillars: cooperation (broadening the range and outreach), certification (supporting standardization and career advancement), digitalization (ease of access), and modularity (targeted offer for different needs).

Furthermore, the unitary patent, providing protection in up to 25 EU member states by submitting a single request to the EPO, will be instrumental in reducing the complexity and cost of patenting, which is of particular relevance for start-ups.[28] Litigation will become less fragmented thanks to the Unified Patent Court; as its jurisdiction covers all contracting member states, its decisions will be directly applicable in all of them. The new legal framework will enable companies to benefit from more accessible and affordable options for patent protection and enforcement.

Takeaways

Technology start-ups should focus on IP, and patents in particular, from day one. The main reasons for seeking patent protection include gaining market access, strengthening the negotiation position, raising funding, and increasing strategic value for the company.

However, businesses often struggle to commercialize their patented inventions, mainly due to their lack of business contacts, skills, and resources. Start-up founders should therefore aim to improve their IP knowledge and skills, and seek support to overcome the challenges, starting with low entry barrier offers and networks already provided by the EPO's Patent Academy, the LESI, and other organizations.

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Thomas Bereuter manages the business support of the Technology Transfer and Dissemination program area in the European Patent Office's Patent Academy. He is a Certified Licensing Professional (CLP) with more than 20 years of experience in international commercialization of early-stage technology. He started his technology commercialization activities as an inventor founding a venture capital-financed start-up. Leading the wave of business incubation and technology transfer in Austria, he established an internationally recognized academic incubator as well as a technology exploitation office.

Adéla Dvořáková has gained IP expertise by working for several international bodies, in particular the EPO and the EUIPO. Adéla is also a member of the EPO-LESI High-growth Technology Business Conference Steering Committee, has co-authored several articles and contributed to various projects on IP and its importance for SMEs.

Ilja Rudyk is a core member of the Chief Economist Unit of the European Patent Office. He has co-authored several studies on the role of patents and technology for the European economy. He provides expert economic insight into issues related to innovation and technology commercialization.

Raising IP Awareness of Start-Ups: A French Perspective

Philippe Borne

1 Why Start-Ups Matter in France

Start-ups have been at the forefront of the political scene in France since the mid-2010s. Prior to that, the keyword was "innovation"; now, it tends to be "start-up," which has become quite trendy. That takes us back to 2015, when the minister in charge of the economy in France, a young gentleman named *Emmanuel Macron*, would often travel to the *CES* in Las Vegas. In the political narrative, France became the (other) "start-up nation." This actually evidences the realization by our policymakers that the ability to nurture and sustain a start-up ecosystem, especially in the digital sector, is key to staying in the economic race in the context of a tough world competition. This awareness is now even stronger, not only because Emmanuel Macron was sworn in as president of the French Republic some years after his early trip to Las Vegas, but also because it is now very clear that the new axis of the world is the rivalry between the United States and China. The power of both of these countries is heavily based on their leading position in the technologies that rule the world (e.g., *5G*, *quantum*, *AI*, among others). Incidentally, Emmanuel Macron's visit to Nevada's iconic city had a concrete consequence for the intellectual property (IP) system in France: There, our political leader, through discussions with French start-ups, discovered the provisional patent application, which was, after

Disclaimer: The views and opinions expressed in this chapter are those of the author and do not necessarily reflect the position of his current or past employers, or of any group or association he may belong to.

P. Borne (✉)
Délégué INPI Grand Est, INPI Alsace – Région Grand Est, Strasbourg, France
e-mail: pborne@inpi.fr

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_20

another journey along the meandering parliamentary trails, transposed into French patent law. At least that is how the story goes.[1]

2 The French Start-Up Ecosystem, As It Stands

As of July 15, 2021, and according to the *Dealroom*® database, France had 20,921 start-ups, 24 of which were unicorns – very close to the goal established by the French government in 2017 of having 25 unicorns by 2025, which goal was actually met as of January 2022, 3 years ahead of the fixed schedule[2]. Over the past 10 years, the number of start-ups in France has doubled, growing from 10,900 in 2012 to 22,800 in 2021 (data updated in March 2022). In 2020, this sector amounted to 370,000 employees, 240 incubators, and 50 accelerators.[3] In 2021, France ranked second in Europe, behind the United Kingdom (44,600 start-ups) but ahead of Germany (20,500 start-ups). Spain and the Netherlands ranked fourth with about 12,000 start-ups each. The growing rate has tended to slow down since 2018, but this characteristic is shared by all the European countries. In terms of unicorns, the United Kingdom leads the race with 117 unicorns in 2021, followed by Germany (57), France, then Sweden and the Netherlands. As of 2021, the estimated value of the French start-up ecosystem was €204 billion (Germany: €472 billion; the United Kingdom: €924 billion); it was €74.1 billion in 2017 and €30.3 billion in 2014.[4] Overall, the French start-up community is on an ascending trend, which has not been disturbed by the pandemic. After a plateau in mid-2020, the investments resumed their growth by the end of that year: French start-ups raised €678 million in October 2020, which translates as 54% more than during the same month in 2019.[5] Despite the second lockdown, they managed to raise €351 million in November 2020, 24%

[1] I have never identified a "certified" written source confirming that filiation other than some lines on some websites, like the following: http://www.nuss-ip.fr/un-nouveau-brevet-provisoire-pour-la-france/ or https://www.innovcean.com/article-numero-3/, accessed on December 15, 2021.

[2] 25e licorne: comment la French Tech a pulvérisé l'objectif fixé par Emmanuel Macron, available at https://www.lesechos.fr/start-up/ecosysteme/25e-licorne-comment-la-french-tech-a-pulverise-lobjectif-fixe-par-emmanuel-macron-1379574, accessed on March 29, 2022.

[3] The French start-up ecosystem at a glance, available at https://www.startup-energy-transition.com/the-french-start-up-ecosystem-at-a-glance/, accessed on December 23, 2021.

[4] All these figures were obtained in March 2022 on the *Dealroom*® website (https://app.dealroom.co/charts/unicorns_yearly/f/location/anyof_~united_kingdom~_germany_france_israel_sweden_switzerland_netherlands_spain). The number of unicorns can be different from one author to another. The definition of a unicorn used by the Dealroom® website is: "For Dealroom's Unicorn Club we include tech companies founded since 1990 that are currently valued at over $1 billion. We exclude companies that passed $1 billion as a subsidiary, but we include companies that may now be worth less than $1 billion, but exited at $1 billion+."

More information is available at https://dealroom.co/blog/what-is-a-unicorn?_ga.

[5] JDN, 12 02 2020 Les start-up françaises ont levé 678 millions d'euros en octobre 2020, available at https://www.journaldunet.com/web-tech/start-up/1496023-levees-de-fonds-octobre-2020/, accessed on December 15, 2021.

more than in November 2019.[6] According to a study by *E & Y*,[7] the French start-up ecosystem raised €5.4 billion in 2020, which represents a 7% increase as compared to 2019. With 140 operations corresponding to €1.42 billion, the digital sector is the one having the most fundraising. In October 2020, *Ynsect* spectacularly raised €190 million. The top recipients in 2020 were *Voodoo*, a start-up active in the internet services, with €400 million in funds raised, then *Mirakl*, in the IT sector (€256 million). Such performances permitted France to rank second in Europe, behind the United Kingdom (€12.71 billion raised) but slightly ahead of Germany (€5.24 billion raised). This trend was confirmed in 2021,[8] with striking new records: €5.14 billion raised for 416 operations in the first 6 months of 2021; France moved back however to the third place, behind the United Kingdom (€16.44 billion raised for 861 operations) and Germany (€7.83 billion raised for 313 operations).

In 2019, *Capterra*, a subsidiary of the *Gartner Group*, produced a report[9] based on the data coming from 1,200 start-ups combined with a survey of 140 entrepreneurs. Geographically, 51% of the start-ups were based in the Paris area, 11% in the Auvergne-Rhône-Alpes region, and 7% in Occitanie (south of France, around Montpellier and Toulouse). As is usual in France, Paris dominates the landscape.

The strength of France's start-up ecosystem is echoed by the presence of 13 French start-ups on the *SET100* list, which is an annual compilation of the top 100 start-ups of the *Start-up Energy Transition Award*.[10]

3 The Reasons Behind an Accelerating Expansion: A Strong Support from the Public Authorities

The above-described expansion is no mere coincidence. French start-ups, and the French industry in general, benefit from substantial support from the French public authorities. The higher level of the state seized the topic, namely the French president himself, *Emmanuel Macron*. This support has a name – *La French Tech*® – whose objective is to establish France as one of the world leaders in innovation.

La French Tech® is a trademark, a flag, aimed at promoting French start-ups, their excellence, and at attracting investors.

[6] JDN, 01 05 2021 Les start-up françaises ont levé 351 millions d'euros en novembre 2020 available at https://www.journaldunet.com/web-tech/start-up/1496591-levees-de-fonds-novembre-2020/, accessed on December 15, 2021.

[7] Baromètre EY du capital risque en France Bilan annuel 2020.

[8] Baromètre EY du capital risque en France 1er semestre 2021.

[9] Available at https://www.capterra.fr/blog/470/situation-economique-et-sociale-des-startups-francaises-en-2019, accessed on December 23, 2021.

[10] https://www.startup-energy-transition.com/.

It has its iconic places, for example, *Station F* in Paris's rapidly expanding tech scene, inaugurated in 2017, presented as the world's largest start-up campus, hosting over 1,000 start-ups in a recently renovated 34,000-square-meter building, the *Halle Freyssinet*, which was built as a rail depot in the 1920s.[11] The site was recreated by *Xavier Niel*, the iconic founder of *Free*, a telecom company. The high-tech design and vast indoor areas of the building, dotted with contemporary artworks, football tables, and colorful sofas, are traversed by buzzing groups of young entrepreneurs and geeks taking advantage of the 3,000 desk spaces, private meeting rooms, a 370-seat auditorium, and catering areas, including *La Felicità*, presented as the largest restaurant in Europe.[12] This type of site has been duplicated in the major French cities, which are part of the network of *La French Tech*® capital cities. *Station F* is not only a dramatic example but also an isolated one. Incubators, accelerators, and fab-labs are multiplying everywhere in France,[13] with a simultaneous rise in the number of businesses. In 2019, 815,300 new businesses were created, which represents a 18% jump in comparison to 2018.[14]

The French start-up ecosystem also has its events: The *VivaTech* exhibition in June, the meetings organized at the Elysée Palace bringing together entrepreneurs, business angels, and venture capitalists. The French President goes to great lengths to back our start-ups: In 2019, he managed to convince the insurance businesses to invest €5 billion in scale-ups.[15] On May 15, 2021, when launching the *VivaTech* exhibition, he defined tech as one of the top priorities of the French presidency of the European Union in 2022.[16] At the Elysée Palace, before an audience of 100 French and European investors and entrepreneurs in the digital economy, he presented the measures of the *"Scale-up Europe"* program aimed at creating a *European Tech*.[17] And in October 2021, our president launched a new €30 billion investment plan in tech.[18]

[11] Among the numerous websites dedicated to Station F, I would recommend the following one by the designer who has been in charge of the renovation of the building http://www.wilmotte.com/en/project/411/station-f-halle-freyssinet-worlds-biggest-startup-campus, accessed on December 15, 2021.

[12] https://bonjourparis.com/food-and-drink/la-felicita-europes-biggest-restaurant-opens-at-station-f/, accessed on December 15, 2021.

[13] https://lafrenchtech.com/fr/a-propos/#communautes, accessed on December 15, 2021.

[14] Business creation in 2019, INSEE (French National Institute of Statistics), https://www.insee.fr/fr/statistiques/4289603, accessed on December 23, 2021.

[15] France to boost its start-up nation status, available at https://world.businessfrance.fr/nordic/2019/09/19/france-to-boost-its-start-up-nation-status/, accessed on December 23, 2021.

[16] L'ambition folle de Macron: dix géants européens de la tech d'ici à 2030, available at https://www.latribune.fr/technos-medias/innovation-et-start-up/l-ambition-folle-de-macron-dix-geants-europeens-de-la-tech-d-ici-a-2030-886929.html, accessed on December 23, 2021.

[17] Objectif 10 géants tech européens d'ici 2030, available at https://www.elysee.fr/emmanuel-macron/2021/06/15/objectif-10-geants-tech-europeens-dici-2030-scale-up-europe, accessed on December 23, 2021.

[18] France 2030: Emmanuel Macron dégage 30 milliards d'euros pour son plan d'investissement, available at https://www.lemonde.fr/politique/article/2021/10/12/france-2030-macron-degage-30-

It also has its schools. For example, *42*, also founded by *Xavier Niel* in 2013, is a computer programming school based on the concept *"Zero tuition, zero teachers, zero classes, 100% coding,"* in which education involves a peer-to-peer learning environment and project-based learning. The candidates must be 18 or older; no previous diploma is required. Out of 70,000 candidates 3,000 are selected.[19]

It also has some key players, one of which is *BPI France*, the French public investment bank. Created in 2012, *BPI France* has a clear-cut goal: to support businesses and to help them grow, especially by backing the development of an ecosystem fostering innovation and entrepreneurship. With 50 regional branches throughout France, *BPI France* injected €45 billion into the French economy in 2020.[20] In 2019, *BPI France* launched the *DeepTech* plan with a budget of €2.5 billion over 5 years, aimed at making France the European innovation driver. As of 2021, this plan managed to create 200 start-ups.[21] Each year in October, *BPI France* organizes its big show in Paris, *BIG*, which stands for *"BPI France Inno Generation,"* gathering over 50,000 participants around 400 conferences and workshops, stands, and top leaders from France and all over the world.[22] Among them in the 2021 edition, on *BANG*, a large stage welcoming a series of leaders for 10-minute inspirational speeches, were the ministers of industry, the economy, and *President Macron* himself, who closed the meeting.[23]

La French Tech® has its elite: the *French Tech 120* and the *NEXT40*,[24] which focus on cutting-edge topics, such as AI, quantum, cybersecurity, or cleantech. Beyond being a label, *La French Tech*® is a support program dedicated to future world-class leaders, namely the *Next40*, which gathers a yearly selection of the top-performing French start-ups, including the unicorns and non-listed deep-tech companies valued at over $1 billion, and 80 high-potential fast-growing companies selected according to the evolution of their turnover or having raised funds exceeding €20 million. Both benefit from a 1-year support by a network of 60 *French Tech* representatives from the major French public administrations.[25]

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milliards-d-euros-pour-son-plan-d-investissement_6098019_823448.html, accessed on December 23, 2021.

[19] https://www.welcometothejungle.com/fr/articles/fiche-ecole-42-xavier-niel-code, and https://www.42.us.org/, accessed on April 8, 2022.

[20] BPI France, annual operating report 2020, available at https://www.bpifrance.fr/nos-actualites/bilan-dactivite-bpifrance-injecte-45-mdeu-dans-leconomie-en-2020, accessed on December 23, 2021.

[21] https://bigmedia.bpifrance.fr/news/plan-deeptech-3-chiffres-2-ans-un-seul, accessed on December 15, 2021.

[22] https://www.bpifrance.fr/nos-actualites/tous-a-bpifrance-inno-generation#:~:text=52%20000%2C%20c'est%20le,grand%20rassemblement%20business%20d'Europe. accessed on April 8, 2022.

[23] https://www.elysee.fr/emmanuel-macron/2021/10/07/cloture-de-levenement-bpifrance-inno-generation-big-par-le-president-emmanuel-macron, accessed on December 15, 2021.

[24] Both acronyms are a play on words with the CAC 40 and SBF 120 stock indexes.

[25] https://lafrenchtech.com/fr/la-france-aide-les-startups/french-tech-120-2/, accessed on February 22, 2022.

But it is not enough to spur the creation of new start-ups in France: The French public authorities also put in place mechanisms to attract entrepreneurs from outside France, one of which is the *French Tech Visa*.[26] By implementing a fast-track scheme which is valid for 4 years, the system allows non-EU start-up employees, founders, and investors to obtain a residence permit for France. Eligible companies do not have to have their headquarters in France.

This massive communication campaign is at least indirectly good for IP: *La French Tech*®, *Welcome To France*®, and *Choose France*® are among the trademarks filed to support the move.

But let's have a look at the IP stemming directly from French start-ups.

4 The IP Support Mechanisms in France

The French IP support system is on the one side based on a main player: the *INPI*, the French Patent and Trademark Office, and on the other side on two categories of actors: the IP professionals first (*France Brevets*, and even though its role is a bit different, the *CNCPI*,[27] the French Patent Attorney Association); and secondly, organizations active in the education area, where four players should be mentioned: the *CEIPI*,[28] *IEEPI*,[29] *IRPI*,[30] and the *Paul Roubier Center*, based in Strasbourg, Paris, and Lyon, respectively. The French TTO *SATT*[31] also plays an important role as they are especially in charge of raising IP awareness for the researchers working in the public research institutions.

INPI has long been an essential and very active player in raising awareness of businesses about IP-related challenges. *INPI*[32] has the specificity of having a network of 14 regional branches,[33] which was founded in the 1970s (see Fig. 1). Its original role was to make the IP documentation available to non-Paris-based companies, and to allow them to file their applications at a time when this required physically traveling to an office to hand over an occasionally huge stack of paper forms and associated documents. Of course, this changed in the 1990s because of the advent of the internet. Documentation, especially patent documentation, can now be accessed online, via patent databases like *Espacenet*®. In the same way, applications

[26] The French Tech Revolution, How France's startups made it to centre stage published by The Sift, available at https://frenchtechlondon.com/sifted-report, accessed on December 23, 2021.

[27] Compagnie Nationale des Conseils en Propriété Industrielle.

[28] Center for International Intellectual Property Studies.

[29] Institut Européen Entreprise et Propriété Intellectuelle, focused on training on IP strategy.

[30] Institut de Recherche en Propriété Intellectuelle.

[31] Sociétés d'Accélération du Transfert de Technologies.

[32] This section about INPI is a first-hand testimony from the author of the chapter who has been involved in the INPI life for over 35 years. All the information provided in this section have been made publically available, especially via the INPI website or various other forms of documentation.

[33] https://www.inpi.fr/fr/nos-implantations, accessed on December 15, 2021.

Fig. 1 The map of the *INPI* regional branches as of 2021. Each French region has an *INPI* branch in charge of disseminating good IP practices in the network of the local innovators. *INPI* also has 9 attachés in the French embassies (in Beijing, Abidjan, Abu Dhabi, Singapore, Delhi, Washington, Tokyo, Rabat, and Rio de Janeiro) in charge of backing French businesses in their overseas development. A total staff of about 150 employees work in the network (author's own figure)

are filed electronically. This has not caused the closure of the *INPI* regional offices, however, as in the 1990s some, especially parliamentary, reports raised a tricky issue for the French economy: French companies in this period had a poor level of IP awareness. The *INPI* regional offices have therefore been asked to transition to another type of activity: raising IP awareness among French businesses, which mission is taken up in article L411-1 of the French Intellectual Property Code. The switch was completed in 2014, when the *INPI* regional offices, until then open to the general public, closed their doors and started receiving the public on appointment only. Since 2014, the *INPI* local branches are no longer receiving offices for IP title applications. Moreover, the *INPI* staff in those offices were requested not only to wait for the clients to show up before providing assistance, but from 2014 on, they have had to identify innovative companies and contact them to propose one of a range of services branded under the name *Coaching INPI*®. *INPI* staff in the *INPI* local offices somewhat became "IP sales officers," with the aim not to sell patents, trademarks, or designs and models, but rather to have a discussion with the client, to identify the client's projects and environment, and to get them to adopt an IP policy in line with this framework. The purpose is to deliver a set of recommendations and

to direct the businesses to experts like lawyers or patent attorneys to implement the recommendations provided by *INPI*. The role of the *INPI* staff is therefore to bring up questions on a broad range of IP-related topics, and once the diagnosis is done, to turn to specialized IP professionals to continue the process. Fifteen years ago, the focus was on true IP beginners, namely the small enterprises without any IP policy. This has changed as well, and now the target client can be any type of company, including intermediary-sized companies, or even subsidiaries of big corporations, also those with a patent portfolio, in need of enhancing their IP practices, and deserving assistance because they can be at the origin of value creation in a territory. Moreover, the emphasis is strongly put on innovative, fast-growing, and exporting firms – in other words on those players whose development is likely to be the most beneficial for French prosperity.

The *Coaching INPI*® range of services is primarily based on the company visit, which is a contact organized on the company premises with the CEO, the research and development (R & D) manager, or the chief IP officer. This meeting represents an opportunity to hold an informal exchange on the IP policy, the activity, and the project of the company, with the underlying question being: Is IP at stake? These visits are also an occasion to get feedback from the businesses about their relations with the IP players, to present *INPI* and the *INPI* offer, or to answer IP-related questions. The visits are free of charge and carried out by a local *INPI* staff representative. An important point should be stressed here: The focus is on the business side of IP. The discussion is not about how to get a patent granted but rather to examine in what way IP could be put at the service of the business strategy of the client. The company visit became a key metric in the assessment of the activity of the *INPI* regional branches, which have a yearly objective of supporting 5,000 businesses in France.

The second brick in the *INPI* offer is the *IP Prediagnosis*, a service launched in 2004, which is fairly known in Europe, as it has attracted the interest of some European countries which have decided to implement it. The *IP Prediagnosis* is a more elaborate visit with the aim of also identifying the current IP practices of the company and how a better use of IP could help it develop. It results in a written action plan and is in most cases outsourced to external service providers, especially patent attorneys. The costs and expenses are fully covered by *INPI*.

The third component is the *IP PASS*, a service specifically dedicated to small and medium enterprises (SMEs). The *IP PASS* is a subsidy; it helps the enterprise implement the recommendations stemming from the *IP Prediagnosis* or from a visit. As a matter of fact, if *INPI* manages to convince a company to set up a contract, for instance because the company plans to work with a partner, the cost can put the breaks on turning the intention into the reality. In this case, and if the company decides to embark for the first time in a process – for example by implementing a contract, or filing a trademark abroad, or outsourcing a patent watch, etc. – *INPI* takes 50% of the cost of the service, with a contribution rate of up to €3,000 per service. A maximum of three services can be funded, with a limit of €5,000 as a total contribution.

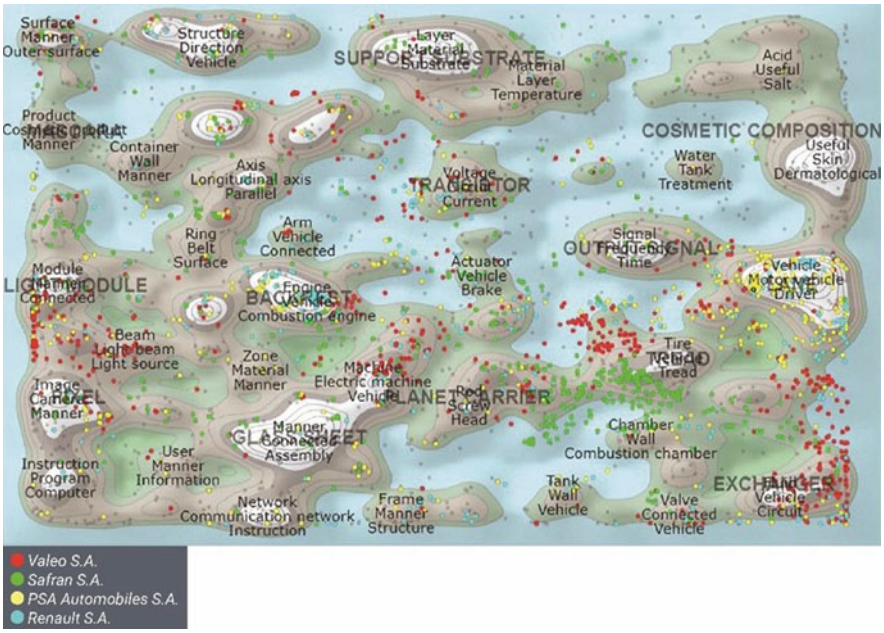

Fig. 2 Going to battle without an ordinance survey map can be deadly. Many patent mapping services are available on the market which are helpful for getting a quick overview about the players in one's environment. Potential allies, predators, acquisition opportunities, risks, and infringers, among others, can be identified. It might also be wise to know before spending time and money whether you are in a mine field or in a white space (used with kind permission by *Clarivate – Themescape Map* based on *Derwent Innovation* – all rights reserved)

IP MASTER CLASS is the *INPI* "jewel" in terms of service. It is dedicated to businesses having put a first foot on the IP scene and consists of a six-day training on IP strategy over the course of 6 months, including four half days of in-house coaching on topics chosen by the client. Each session has its mentor, usually the chief IP officer of a large corporation. The *CNCPI* is also involved. This course also provides experience and best practice sharing among the participants, which is a much-appreciated aspect. The cost for the client is €3,000 – the real cost is €10,000, 70% of which is absorbed by the *INPI* – but in some French regions – e.g., the Grand Est Region – this amount can be halved because of support brought by the Regional Council.

More recently, the *INPI* also launched a patent landscaping service dedicated to SMEs (see Fig. 2). A specific program has also been designed for start-ups, including a series of meetings and an evaluation of the IP practices; for companies working with public research institutions and involved in technology transfers, another

specific service has been elaborated.[34] In 2021 INPI developed a series of MOOCs (Massive Online Open Courses) dedicated to IP especially aimed at raising IP awareness of students.

Beyond these activities, the *INPI* regional branches are also in charge of animating the network of local innovators or partners by organizing workshops, conferences, setting-up corporate IP professional associations, or even organizing festive events.

France Brevets[35] plays on a specific ground: highly promising French companies, usually SMEs, having very strong potential, evolving in an aggressive environment, and at risk due to a too-weak IP policy. The 16 *France Brevets* employees are top IP strategists – they are practically the only French representatives on the *IAM Top 300* website.[36] They used to live out of their suitcases during the first part of their career, working for *Google*, *Apple*, *HP*, *Eaton*, or other leading global companies. This explains why their stance is sometimes a bit iconoclastic in a general context accustomed to a traditional view of IP. They can state that "fighting counterfeiting is rarely the primary issue for SMEs," proposing more assertive and business-orientated strategies. One of their key services is the *Patent Factory Program* aimed at helping a company build a patent portfolio in line with its business strategy to raise funding or succeed in an exit or an IPO.

Patent agents and specialized IP lawyers working in private practice seek to be profitable, and their role and stance are necessarily different from the ones of *INPI* and *France Brevets*; they are, however, key partners for *INPI* and *France Brevets*, and for those two public bodies to successfully fulfill their missions.

BPI France and the regional councils also have funding programs which can be mobilized for IP. France additionally has a rather interesting research tax credit system (the so-called *CIR*, which stands for *Crédit Impot Recherche*), allowing innovative companies to get 30% of their R & D expenses as a refund of up to 30% of €100 million.[37] IP expenditures can be incorporated in the refundable expenses. Patents are actually often used by companies as evidence that their activities can be considered as R & D activities entitled to the system.

In Europe as a whole, we can observe multiple emerging initiatives from the *European Commission (EC)*, *European Union Intellectual Property Office (EUIPO)*, *European Patent Office (EPO)*, and the *World Intellectual Property Organization (WIPO)*, especially aimed at SMEs.

[34] The complete offer as of December 2021 is available at https://www.inpi.fr/fr/services-et-prestations-domaine/aides-accompagnement, accessed on December 15, 2021.

[35] The France Brevets' offer is available at https://www.francebrevets.com/en/, accessed on February 22, 2022

[36] This site, maintained by the IAM (Intellectual Asset Management) journal, lists a directory of 300 top IP strategists in the world.

[37] https://entreprendre.service-public.fr/vosdroits/F23533?lang=en, accessed on April 1, 2022.

As an example, *EUIPO* recently launched a program dedicated to raising the IP awareness of SMEs in Europe. This program has a component aimed at financially supporting trademark or design and model filings (the SME fund).[38]

Hundreds of products or services have been developed by the national patent offices in Europe having the same goal.

5 Start-Ups and IP: The Current Status

Patents are key drivers for enhancing the value of a start-up and securing its capacity to raise funds at every stage of its development. Start-ups having at least one patent are three times more likely to be successful than those having no patents. Their ability to raise funds is also 50% higher.[39] This can be at least partly explained by the fact that venture capitalists investing in French start-ups are mainly based outside France, notably in the United States. These investors base their valuation of a start-up on its IP assets.[40]

In this game, one needs both a certain number of patents and those that are of high quality. Some studies have spotlighted the fact that the most successful companies are those which are on the offense and able to leverage the two aspects: quality and volume of patents. It has been demonstrated that to secure one's privileged position on the market, between 30 and 50 patents are necessary.[41] Studies carried out in France and in Germany have also shown that the optimal number of patents for a start-up is in the range of three to five in its creation or seed phase.[42]

Do French companies leverage IP at a level matching the ranking of France as an economic power?

Figures published by the *WIPO* are well-known (see Fig. 3)[43]: *France* regularly ranks sixth in the ranking accounting the total number of patent applications filed worldwide but ranks only 12th when tying this number to the population. France

[38] https://euipo.europa.eu/ohimportal/en/online-services/sme-fund, accessed on April 1, 2022.

[39] Pourquoi Les Start-Up Négligent-Elles Le Brevet? Vincent Lorphelin, Frédéric Hege et Marine Travaillot – *Forbes France*, March 2018.

[40] C'est à vous, edited by the MEDEF (the French Employers' Association), Hors Série special propriété intellectuelle, interview with Didier Patry and Guillaume Ménage from France Brevets, May 2021 accessible at https://www.nxtbook.fr/newpress/MEDEF-Paris/C_EST_A_VOUS-2105_HS_Special_Propriete_Intellectuelle/index.php#/p/Couverture, accessed on April 9, 2022.

[41] Hearing of France Brevets before the French Assemblée Nationale within the framework of a fact finding mission on the topic "Building and sustaining the digital sovereignty in France and in Europe," December 2020, available at http://videos.assemblee-nationale.fr/video.10089890_5fdb16f463d39.batir-et-promouvoir-une-souverainete-numerique-nationale-et-europeenne%2D%2Dauditions-diverses-17-decembre-2020, accessible in January 2021.

[42] Témoignage: France Brevets et les start-ups par Didier Patry, Directeur général de France Brevets, in RÉALITÉS INDUSTRIELLES – Novembre 2020 – Annales des Mines.

[43] WIPO (2021). World Intellectual Property Indicators 2021. Geneva: World Intellectual Property Organization, available at https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2021.pdf, accessed on March 17, 2022.

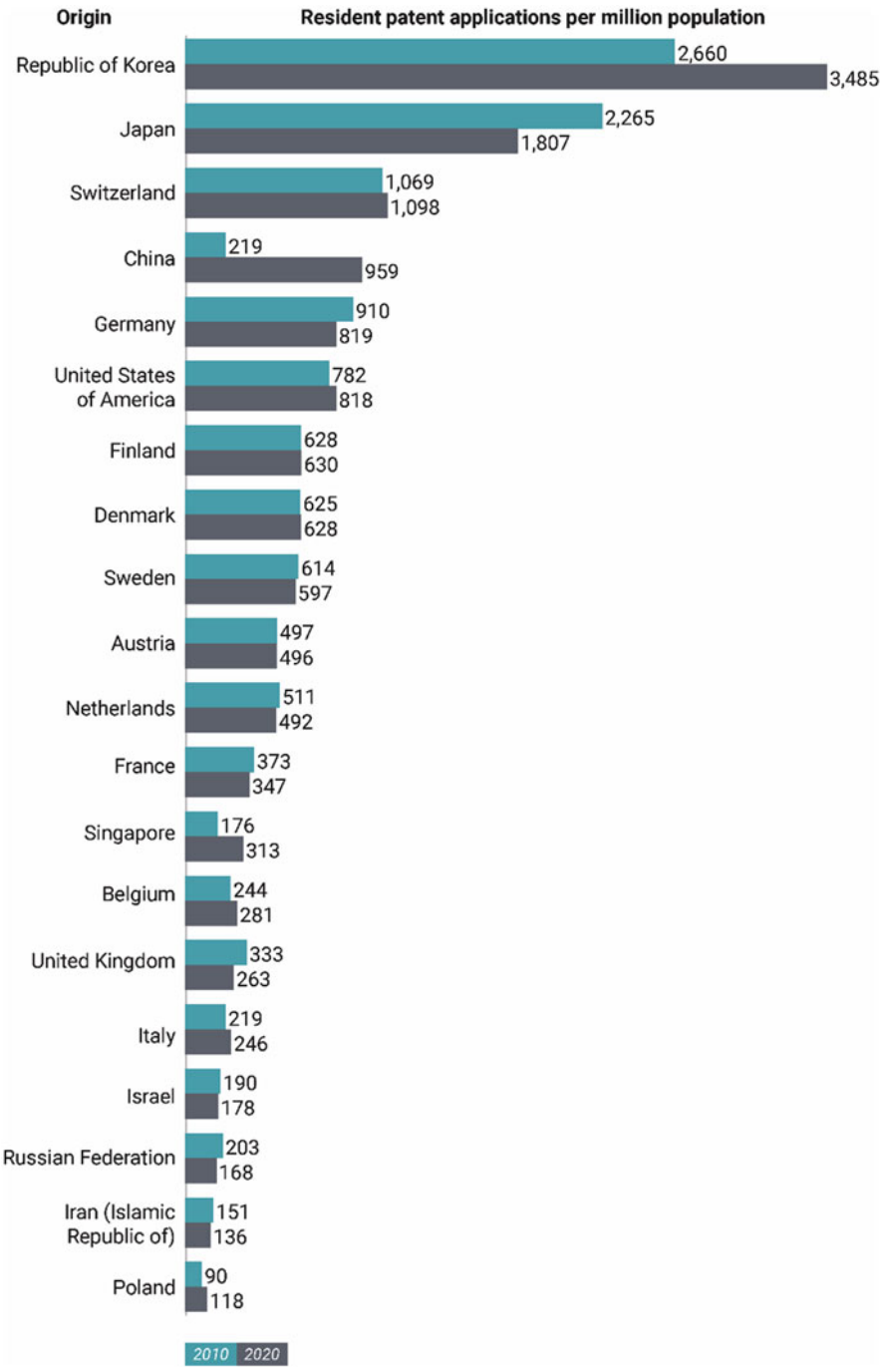

Fig. 3 Resident patent applications per million in the population for the top 20 origins (based on WIPO Geneva, World Intellectual Property Indicators 2021)

produced 347 patent applications per million in the population in 2020, whereas *China* produced 959, *Germany* 819, the *United States* 818, and *Switzerland* 1,098 – not to mention *Japan* and *Korea*, producing 1,807 and 3,485 patent applications, respectively, per million in the population. *China* multiplied its performance by more than four between 2010 and 2020. The high level of public funding dedicated to IP provided by the Chinese public authorities at least partly explains that result. *France's* ranking is about the same when relating the number of patent applications produced to GDP: In the 2021 *WIPO* report, *France* ranked 13th with 825 patent applications per US$100 billion in GDP (*Korea*: 8,249; *Japan*: 4,696; *China*: 5,845; *Germany*: 1,609). It could, however, be argued that this difference can be explained by a difference in the R & D expenditure: *France* would file fewer patent applications than Germany, for example, simply because the R & D expenditure of France is lower. This is partly true: Over the 2015–2019 period, *German* R & D expenditure was about twice as high as France's, and the gap tends to grow larger; in 2000 the ratio was 1.65, and it jumped to 2.07 in 2019.[44] But that does not totally explain the ratio between the number of applications filed by the residents of both countries, which was 2.61 (Germany/France) in 2020.[45]

In a report published in December 2020 about *Patents and the Fourth Industrial Revolution*,[46] *EPO* shows that when focusing on the number of patent applications filed per million residents, France ranks eighth in Europe. Overall, Germany files from two to four times as many patent applications as France. In some areas, France is absent. The imbalance between some French companies and their U.S. equivalent is dramatically high. As an example, the ratio *Qwant/Google* is 1 to 1,000.[47] In the digital sector, U.S. companies own from three to 110 as many patents as their best-endowed French counterparts.[48]

The situation with respect to start-ups is substantially in line with this general overview.

In July 2021, a much-publicized case dominated the headlines: that of *Pegasus* spyware, one of the alleged victims being the French president himself. Only three companies in the world had developed a software able to detect *Pegasus* on a mobile

[44] OECD data available at https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm, accessed on December 23, 2021.

[45] WIPO (2021). World Intellectual Property Indicators 2021. Geneva: World Intellectual Property Organization, available at https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2021.pdf, accessed on March 17, 2022.

[46] http://documents.epo.org/projects/babylon/eponet.nsf/0/06E4D8F7A2D6C2 E1C12 5863900517B88/$File/patents_and_the_fourth_industrial_revolution_study_2020_en.pdf, accessed on December 23, 2021.

[47] Témoignage: France Brevets et les start-ups par Didier Patry, Directeur général de France Brevets, in RÉALITÉS INDUSTRIELLES – Novembre 2020 – Annales des Mines.

[48] C'est à vous, edited by the MEDEF (the French Employers' Association), Hors Série special propriété intellectuelle, interview with Didier Patry and Guillaume Ménage from France Brevets, May 2021 accessible at https://www.nxtbook.fr/newpress/MEDEF-Paris/C_EST_A_VOUS-2105_HS_Special_Propriete_Intellectuelle/index.php#/p/Couverture, accessed on April 9, 2022.

phone: One was a promising French start-up; another was a U.S. company, *Crowdstrike*. As of October 2021, *Crowdstrike* appeared to have 69 patent families on *Espacenet*®. The French start-up had yet to have any published patent applications.

According to *France Brevets*, German SMEs file twice as many patent application as French SMEs. Only 15% of French start-ups own at least one patent, which is below the international average of 20%. This figure places French start-ups behind U.S. start-ups (22%) and German start-ups (23%).[49] The main reason of this general lack of interest of French start-ups in patents can be summed up in two points: the cost and a lack of strategic vision.[50]

From what can be observed, many start-ups consider setting up an IP strategy but too often give up. They start filing a trademark first, and only in a second and late step envisage filing a patent application. The patent is frequently viewed as a tedious legal and administrative step. The cost linked to the IP is not sufficiently anticipated in their business plan. The fundraising stage often triggers a reflection on the filing of a patent application. At such a point, they understand that their value is essentially based on intangible assets, and they realize that they need to protect the results of their R & D. However, they tend to view the patent essentially as a barrier to entry, adopting a defensive approach where patents result from the internal R & D, whereas in other countries, patent portfolios are often built using a mixed practice involving patent acquisition, sometimes embracing a more offensive stance.

From data kindly provided by the *Dealroom*® team in July 2021 and a search on the *EPO Espacenet*® *database*, we have studied the patent policy of the 54 most valued French start-ups in the AI domain. Overall, the 54 start-ups produced 465 patent families (on average: 8.6 families per start-up). It was determined that 24 start-ups have no patents, and 18 have more than five patent families. If one focuses on those 30 start-ups filing patent applications, on average they produced 1.6 patent families per year. The portfolios of the ones with more than five families usually cover Europe, the United States, and Asia. *Withings*, *SoftBank Robotics Europe*, and *SIGFOX* – founded in 2008, 2005, and 2010 respectively – have a large portfolio. On average the first application is filed within 2.4 years from the launch of the start-up. It should be added that we could not account for the in-licensed patents. The majority of the top applicants are included in the subset of the most valued companies. Generally speaking, the patent policy of the companies we studied seemed active. However, this goes against the standard behavior of French start-

[49] Startup et brevets quel besoin? Didier Patry, Forbes July 6 2017.
[50] *Op. Cit.*

Fig. 4 Logo of *Visible Patient* (used with kind permission of Visible Patient – all rights reserved)

ups. The patent applicants in the French Tech Next40/120 usually file three times as many applications as the average SME, according to a report published by *La French Tech*®.[51] This pace is even more active than the one of the intermediary-sized companies (the so-called ETI – Entreprise de taille intermédiaire[52]).

We also studied the patent policy of French start-ups in the quantum technologies which, along with AI, is a domain where the patent landscape is dominated by the United States and China. As of July 2021, the number of applications filed by the French players in this domain seemed fairly low.

Some clues also show that, even if we have made progress on this, in some circles, the patent remains somewhat viewed as a sin in a world which would be freed from any barrier or legal consideration and where the results stemming from scientific research would be free to anybody. Unfortunately, not all the stakeholders in the world think like this.

The next section is dedicated to one example illustrating how IP can serve the business strategy of a start-up.

Case: Visible Patient

The Company History[53]

Visible Patient is a spin-off of *Research Institute against Digestive Cancer (IRCAD)*, founded in Strasbourg in 1994, which is a leading research and training center in minimally invasive surgery, training over 6,000 surgeons each year. In 1999, *IRCAD* launched a research team dedicated to IT processing, led by *Professor Luc Soler*. That team developed computer-assisted surgery, which gave rise to *Visible Patient* in 2013. Luc Soler became CEO of the company.

[51] Baromètre d'impact des entreprises du French Tech Next40/120, Promotion 2021, publication La French Tech / Roland Berger, available at https://www.rolandberger.com/fr/Insights/Publications/Barom%C3%A8tre-d%27impact-des-entreprises-du-French-Tech-Next40-120.html, accessed on March 1, 2022.

[52] An ETI is a company having 250–4,999 employees and either a turnover not exceeding €1.5 billion or a balance sheet total of not more than €2 billion. A company having fewer than 250 employees, a turnover higher than €50 million, and a total balance sheet higher than €43 million is also considered an ETI (Source: INSEE, French National Institute of Statistics and Economic Studies).

[53] I wish to express my gratitude to Luc Soler, CEO of *Visible Patient*, for his careful proofreading of this text. The logo is reproduced with the kind permission of *Visible Patient* (see Fig. 4). This logo has been filed in a colored version as a French trademark (n°4627819) and an international trademark (n°1563673).

The Product

Visible Patient designed a solution producing from a patient's CT scan or MRI a digital 3D model of their organs and pathologies. The digital copy can be used and displayed on a PC, Mac, or iPhone, thanks to the *Visible Patient* planning software developed by the company. This medical device allows the surgeon to gain a very detailed understanding of the patient's anatomy, especially of the organ on which surgery will be performed. This helps avoid interpretation errors and the related consequences on the patient's health, or even life. But one of the main benefits of this solution is to allow simulation of devascularized volumes resulting from clamping a vein or artery and to evaluate the potential benefit, for example, in the surgical treatment of cancers. By providing a very precise 3D representation of an organ – one can move or rotate it, focus on a specific spot, and use a set of colors to highlight specific sections – the system enables one to anticipate the result of surgery or to limit the extent of the treatment: Instead of removing the whole organ, with the associated serious implications for the patient, it is often sufficient to remove only a part of it, thus improving the quality of life. Luc Soler often mentions the story of a 5-year-old child suffering from kidney cancer. The standard imaging techniques led to the conclusion that both kidneys had to be entirely removed, undergoing several months of dialysis before a future kidney transplant. The *Visible Patient* solution yielded the conclusion that only some parts of the kidneys had to be removed, leaving enough filtering capacity to avoid dialysis and transplantation. The child is now 8, has both kidneys, and can enjoy a normal life.

The Business Model

Visible Patient is ISO 13485 and MDSAP (United States, Canada, Australia) certified, and its software suite is CE marked and FDA cleared for the entire human body. *Visible Patient* decided not to sell its *Visible Patient* software suite, namely the software for 3D modelling and surgical planning, but instead to sell a service. *Visible Patient* is in fact a medical analysis laboratory (French NAF code 8690B) not receiving blood samples but receiving MRI- or CT-scan images instead. In return, *Visible Patient* provides the surgeon with a virtual 3D copy of organs and pathologies. It means that *Visible Patient* is not dependent on any imaging device manufacturer for developing its business. It also means that surgeons do not have to learn and spend time to use the *Visible Patient* image analysis interface: *Visible Patient* does the job for them, delivering directly usable results. Another advantage: There is no dissemination of the software outside *Visible Patient*, which limits the risk of technological piracy.

As for another competitive edge, *Visible Patient* managed to find an agreement with most French insurance companies to cover the *Visible Patient* analysis cost directly paid by insurances to the company. As a result, hospitals are not charged at all. No other competitive solution of 3D modelling is thus covered, illustrating the specific and unique added value of *Visible Patient* on that market.

IP at the Heart of the Development of the Company

The first important point is that the *Visible Patient* product is an interesting example of a software-based invention where the software is the heart of the competitive advantage. It therefore needs to be protected, and it has been patented with the help of a local patent attorney specialized in software-implemented inventions. That is a good reminder for all of us that software-implemented inventions are patentable.

Visible Patient always started with a U.S. provisional patent application, which is a fast protocol allowing rapid communication (e.g., via a scientific publication).[54]

Visible Patient provides a preliminary draft of the application to the patent attorney, who can then adapt the text of the specification.

The U.S. provisional patent application serves as the basis for a PCT (Patent Cooperation Treaty) extension. The targeted jurisdiction always starts with France and Europe, before adding many other countries, such as the United States, Canada, Korea, Japan, China, India, Russia, and Brazil (see Tables 1 and 2).

Another valuable lesson from Luc Soler's experience: Do not be devastated if the first patent reviewer report you get does not initially validate your invention! Software-based or AI-related inventions are complex matters, and it is often necessary to talk with the examiner to get them to understand where the inventiveness is. Negotiation is frequently mandatory.

The third key lesson from the experience of *Visible Patient*: In 2018, the company wanted to launch a fundraising campaign. The reply from potential investors was clear-cut: "You don't have enough IP."

As the potential market was large, the risk of copying was large too. Without good IP, the investors were not ready to provide money.

This explains why *Visible Patient* urgently filed the above-mentioned provisional patent applications. Simultaneous to the filing of the patent application, the software has been filed at the *APP* (a French agency specialized in software protection). This double filing permits the protection of both the functionality of the software (through the patent application) and the code itself.

This was a tremendous incentive for an €11 million fundraising in 2019. The successful outcome of the first negotiation round with health insurance companies has also been a positive sign for investors.

Visible Patient can therefore take advantage of four barriers to entry:

- Software: Designing a similar software would be rather time-consuming;
- Patents;
- Relations with insurance companies; and
- Various certifications (ISO 13485, MDSAP, CE mark, FDA 510k, etc.).

[54] The provisional patent application is now available in the French patent system as well.

It explains why *Johnson & Johnson* decided to realize this exclusive partnership for sales and marketing and why investors decided to invest more than €12 million.

Visible Patient also implemented an active trademark protection policy with – as of October 2021–24 filed or registered trademarks: three at *INPI Brazil*, five before the *Canadian Intellectual Property Office (CIPO)*, one at the *EUIPO*, eight at *INPI France*, one at the *Intellectual Property Office of the United Kingdom (UKIPO)*, one before the *United States Patent and Trademark Office (USPTO)*, and five international filings before the *WIPO* (search run on *TMView*® in October 2021).

Visible Patient Today: A Success Story

Visible Patient employed 20 staff as of June 1, 2019; now it has 55 employees.

In 2020, *Visible Patient* signed an agreement with a leading U.S. distributor. The company also continues to innovate preparing new patent filing applications.

Realizing in early 2020, when the pandemic was on the rise, that all the patients suffering from COVID-19 got a lung scan, *Visible Patient* developed and patented a software targeted at the analysis of lung images.

This made it possible to predict seven days in advance the severity of the illness for patients having no clinical signs, thereby avoiding useless intubation. This technique can be applied to other lung diseases.

The successes of *Visible Patient* are therefore far from being over.

Visible Patient: The Patent Portfolio

Tables 1 and 2 show the two key patents of *Visible Patient*. ◄

Table 1 Visible patient patent US 2018/62615529 P

Title: Automatic segmentation process of a 3D medical image by several neural networks through structured convolution according to the geometry of the 3D medical image		
First application	Applicants	Family
US 2018/62615529 P 2018-01-10	IRCAD; Visible Patient; Conservatoire National des Arts et Metiers (C.N.A.M.)	BR 112020014144 A2 / CA 3087740 A1 CN 111868781 A / EP 3738099 A1 JP 2021511577 A / KR 20200119250 A US 2020/334826 A1 / WO 2019 137997 A1

Table 2 Visible patient patent US 2018/62615525 P

Title: Automatic segmentation process of a 3D medical image by one or several neural networks through structured convolution according to the anatomic geometry of the 3D medical image		
First application	Applicants	Family
US 2018/62615525 P 2018-01-10	IRCAD; Visible Patient; Conservatoire National des Arts et Metiers (C.N.A.M.)	BR 112020014201 A2 / CA 3087691 A1 CN 111819599 A / EP 3738100 A1 JP 2021511575 A / KR 20200118050 A US 2020/334827 A1 / WO 2019 138001 A1

6 What the Current Landscape Teaches Us

This presentation of the situation of French start-ups vis-à-vis IP seems a good opportunity from which to draw some lessons and to reflect on the place of IP in the French, European, and international landscapes.

As far as IP is concerned, and as was shown in the previous section, French start-ups are somewhat lagging behind the leaders, and this should be a top concern issue for our policymakers, especially in a context where the control of technologies obviously became a prominent issue in the current and growing geostrategic competition. This competition is dominated by an increasingly tense rivalry between the *United States* and *China*, China having openly claimed its objective to take over the position of world leader from the United States by 2049, the anniversary date of the foundation of the People's Republic of China.[55]

The areas of top prosperity on the earth usually match the areas of intense technological development. Both China and the United States perfectly understood that the domination of the technologies is an unavoidable prerequisite for the domination of the world. It is therefore no mere coincidence if both have leading positions in many technology areas, especially in the ones which will be the base of a possible break in the strategic balance in the decade to come: AI, blockchain, quantum, autonomous vehicles, and space technologies, among others.[56] But the United States and China also understood the role of IP and standards in the race: Those countries that dominate the technologies will dominate the world, but to dominate the technologies, one needs to dominate the IP and the standards behind the said technologies.

Europe is now clearly aware of the role of technologies in the global competition.[57] This is, for instance, evidenced by the highly voluntary approach of *Thierry Breton*, European Commissioner for Internal Market, or of the French President: Significant measures have been taken to have Europe or the individual European countries catch up or even identify new areas of technological development and as a result behave as an innovation leader in a greater number of disruptive areas. By way

[55] About the U.S./China rivalry and the role played by the competition in the technologies in this rivalry, I strongly recommend the *CSIS* or *IFRI* websites (*Center for Strategic and International Studies* and *Institut Français des Relations Internationales*), two prominent think tanks, among other think tanks dedicated to international relations. The IFRI recently launched a new research axis dedicated to the geopolitics of technology which deserves to be visited (https://www.ifri.org/en/recherche/thematiques-transversales/geopolitique-technologies, accessed on December 23, 2021).

[56] Various reports identified those technologies which can be at the origin of a strategic break in the 20 years to come. One can mention: "Chocs Futurs," a report published in 2017 by the French *SGDSN (Secrétariat Général de la Défense et de la Sécurité Nationale)*; a report by *NATO (North Atlantic Treaty Organization)* published in 2020 "Science & Technology Trends 2020–2040"; the website of the *French Secrétariat Général aux Investissements d'Avenir* also lists the technologies considered by the French public authorities as breakthrough technologies.

[57] "Mastery of technology is central to the 'new geopolitical order,'" said Thierry Breton, available at https://www.euractiv.com/section/digital/news/mastery-of-technology-is-central-to-the-new-geopolitical-order-breton-says/, accessed on December 15, 2021.

of illustration, in France, *Emmanuel Macron* launched in 2021[58] the *Quantum Plan*, which will benefit from a €1.8 billion investment. A few years earlier, on March 29, 2018, he announced a €1.5 billion investment to support research in the area of AI.[59] France also recently launched the *Defense Innovation Agency*, the equivalent of the *U.S. Defense Advanced Research Projects Agency (DARPA)*.[60]

But apparently a majority of European countries do not seem to express a clear awareness of the second part of the rule of the game – the IP and standards part. Again, this is not the case for the United States and China: Their top ranking in the technology race is mirrored by their top ranking in the patent race,[61] not to mention their active role in the domain of standards. Europe, and especially France, has possibly not yet reached that level.

From my experience, and from what I observed, I could define four levels of IP usage within companies (e.g., start-ups) or at the country level (see Fig. 5).

The *level 0* corresponds to no IP at all, or to a "useless usage" of IP: Some patent applications are filed; patents may be granted and sometimes maintained by the effect of inertia, but those patents are not valorized, counterfeiters are not identified, and the IPRs are not even used as a means to enhance the image of the company. It should be reminded at that stage that having a patent does not always mean having an IP strategy.

The *level 1* corresponds to the traditional view of IP, where the top word is "protection." A patent is considered to "protect an invention," a little bit the barbed wire set around a technology domain to prevent the rest of the world from stepping inside it and to preserve an exclusivity. Another keyword is "counterfeiting": A patent is considered to fight counterfeiting. This reflects a defensive approach. IP also often remains a topic for the legal and/or R & D department, and the company's top management is not always involved. A majority of businesses use IP at this level. And it should also be fair to add that a majority of "IP educators" have long presented IP in this way, using the motto "protect your invention." This way of using IP is suitable in domains where the competition is not too harsh or moderately aggressive. I would be very happy if all the SMEs or start-ups could, for starters, adopt such an IP policy. In many circumstances, this defensive stance definitely

[58] Emmanuel Macron veut mettre la France dans le trio de tête mondial des technologies quantiques, available at https://www.lemonde.fr/politique/article/2021/01/21/emmanuel-macron-presente-un-plan-quantique-de-1-8-milliard-d-euros-sur-cinq-ans_6067037_823448.html, accessed on December 15, 2021.

[59] Speech of the president of the French Republic on AI, available at https://www.elysee.fr/emmanuel-macron/2018/03/29/discours-du-president-de-la-republique-sur-lintelligence-artificielle, accessed on December 23, 2021.

[60] Création d'une Agence de l'innovation de défense, available at https://www.publicsenat.fr/article/politique/creation-d-une-agence-de-l-innovation-de-defense-83766, accessed on December 15, 2021.

[61] This is reflected by numerous reports, especially the WIPO World Intellectual Property Indicators, or the already cited EPO study. Some reports are focused on specific technologies (e.g., Quantum technologies patents, publications & investments, by Michel Kurek, September 2020).

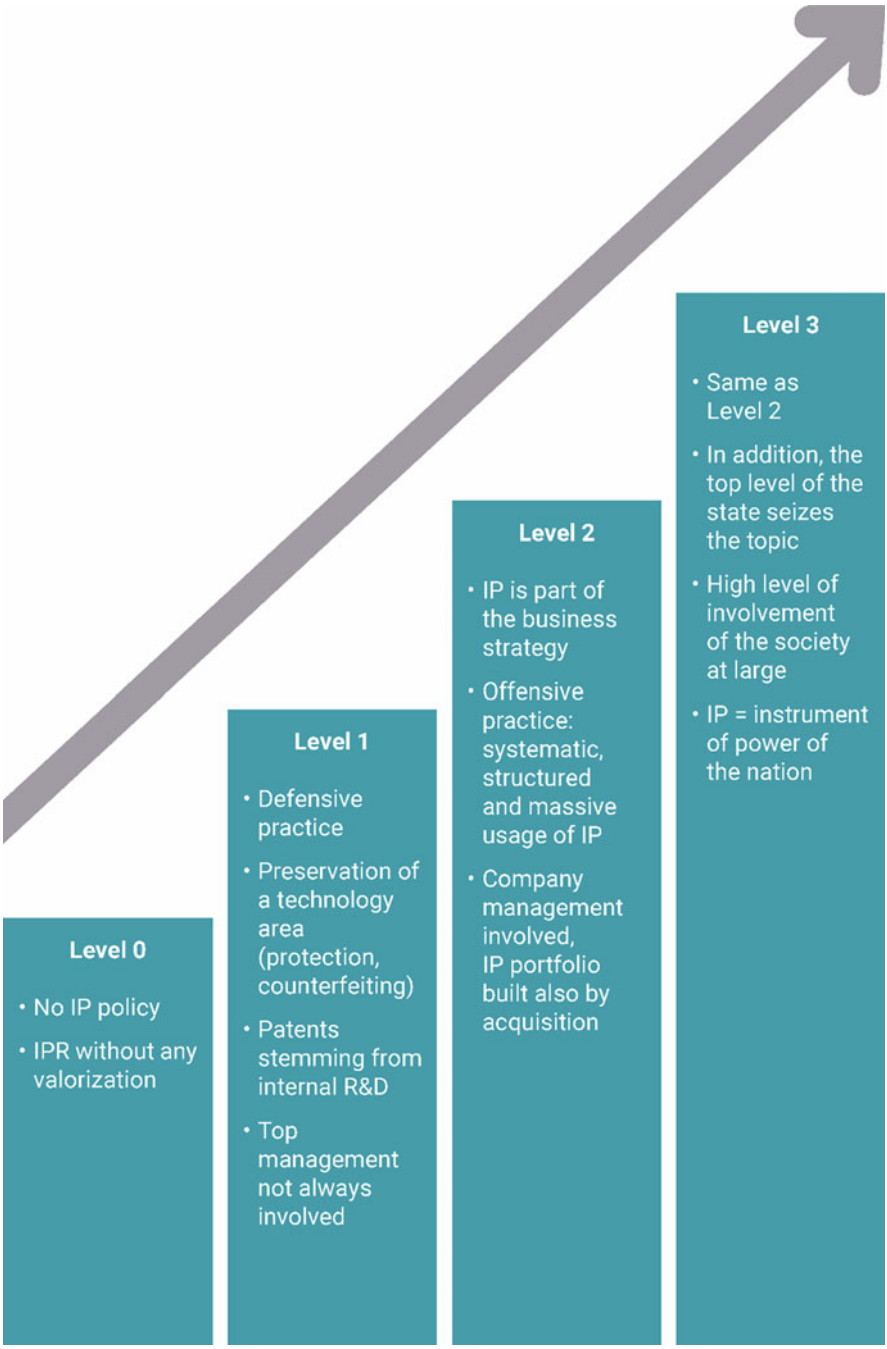

Fig. 5 Four levels of an IP strategy (author's own figure)

makes sense, simply because fighting counterfeiting is often an imperative need, as counterfeiting may be at the origin of a huge loss of revenue, among other undesirable outcomes.

In some more aggressive areas, however, especially for those companies active in disruptive high-value technologies, where the challenges originate from high-tech competitors, it is key to realize the need to extend the IP practices to the next level.

The *level 2* represents a significant change of perspective: The question is no longer only "how can I protect my invention" but rather "how can IP serve my business strategy." In other words, IP becomes a tool, among other tools, used by the top management to develop the competitive advantage of the company: "My company has this objective. How could IP help attain this objective?" Beyond its traditional role to protect, a patent is also a means to create problems for competitors. That leads sometimes to disconnect the IP strategy from pure IP concerns. The question is no longer to have an IP strategy, but rather to have a business strategy leveraging IP. Businesses moving to that level activate what *France Brevets* calls the other "IP pillars" (counterattack, revenues, economic driver, valorization and image, ecosystem).[62]

It also leads us to a difficult question: *"What is an IP strategy?"* I have heard many different definitions of what an IP strategy could be, reflecting a fairly wide diversity. One day, I came across a presentation where an IP strategy was defined as "a way to select the countries of extension over time in order to reduce the costs stemming from the various patent fees." That may relate to the optimization of the supply chain, but does it totally reflect the term strategy?

A definition of the term "strategy" that I find especially relevant in this context is: "the art of the dialectic of two opposing wills using force to resolve their dispute."[63] In the IP area, this definition critically reminds us that a patent is not only a question of the relation between an inventor and an invention, it is also, and may be primarily, a question of a relation between "two opposing wills," meaning two companies which have a dispute, are in competition on the economic battleground, and decided to use force to resolve this dispute. A patent is one of the means to establish a force relationship at the disposal of companies willing to resolve their dispute, and an IP strategy probably consists in identifying the various ways a patent can be "artfully" used in the dialectic – the interactions – which two companies decided to follow for one of them to impose its will on the other.

Case: A French Med-Tech Example

A good example of an implementation of such an approach is provided by the story of what recently happened to a French start-up in the medical technology

[62] An interesting webinar organized in May 2021 by the CEIPI together with France Brevets about IP strategy: https://www.youtube.com/watch?v=yP-Hn47MUe4, accessed on February 21, 2022.

[63] Introduction à la stratégie, Général André Beauffre – Armand Colin 1963; English translation: An Introduction to Strategy, ed. and trans. Major General R.H. Barry (New York: Praeger, 1965).

area. Let's call it *Company A*.[64] *Company A* had a very valuable technology, and like many companies of this sort, *Company A* had a market not only in France but also in all the developed countries, especially in the United States. To make its business profitable, *Company A* decided at one stage to expand its activity abroad. The breakthrough technology of *Company A* was identified by a U.S. competitor, the "war objective" of which became acquiring *Company A* in order to acquire its technology. The U.S. company had several possibilities at its disposal to pursue its goal: IP was one option, and finally IP was the option selected. It should be noted that the goal was not related to a pure IP issue; it was related to a business issue falling into a strategy of destabilization and predation based on IP assets used as a means of aggression. When *Company A* entered the U.S. market, the U.S. competitor took *Company A* to court for infringement. For infringement of what? Of patents stemming from the U.S. competitor's R & D? Maybe, but not necessarily. When such a strategy is embraced, the IP strategist, knowing that they need patents – weapons – to create a problem for the other party, can simply manage to get the appropriate patents likely to create major damages for the other party. As it is difficult to anticipate some years before the dispute which will be the "prey," and which patent will be suitable to capture the "prey," the IP strategist can acquire the patents they need by picking up in the broad technology market. At that stage, a patent landscaping comparing the technology of the prey to acquire with the patents available for acquisition can be very useful (see Fig. 2). This is a key point to have in mind: Patents are not only useful to protect the outcome of one's internal R & D, and useful patents are not only derived from one's internal R & D, but depending on the objective pursued, a patent portfolio sometimes needs to be built by the acquisition of patents belonging to others. In such a circumstance, a good way to respond to the lawsuit could be for the "prey" to acquire some other patents to create problems for the "hunter" and thereby correct the balance of power and bring back the stakeholders to the negotiating table. Unfortunately, this type of maneuver is not always in the scope of what the prey can imagine, and it is probably also beyond what it can afford, which raises another well-known point in the military domain: alliances. Alliances need to be prepared, however. Such alliances, where a pool of companies – having common interests, or sharing the awareness that they belong to a single community – decide to put their patents in common to be in a position to collectively respond to an attack, have been elaborated in the United States.[65] A collective vision of its IP would lead Europe to implement a similar, and highly sensible, initiative.

Company A engaged in a traditional process which consists in trying to demonstrate to the court that you are not an infringer. Before a U.S. court, it can cost a substantial amount of money; the average annual cost for a single

[64] I adapted the story to make it more relevant for the purposes of this chapter.

[65] A good example: https://www.rpxcorp.com/, accessed on December 23, 2021.

litigation case in the United States being in the range of $4–6 million.[66] The expenses totally depleted the cash flow of *Company A*, which as a result lost a significant part of its capitalization. Huge technological value but depleted valorization: It became easy for the U.S. company to acquire its prey at a lower rate. The exhausted *Company A* had no other solution than to accept the deal. Eventually, *Company A* and its technology moved to the other side of the Atlantic. Needless to say, *Company A* had probably benefited from French public funding in its early stages of development. ◀

"A business strategy without an IP strategy is no strategy." Level 1 took us from the "IP emptiness" to an approach where IP is especially seen as a legal issue. With *level 2*, we moved to the business side of IP, well evoked by the statement from *Ruud Peters*,[67] former chief IP officer at *Philips*.

Level 3 gets us to another, broader dimension where IP becomes a geostrategic subject. At this level, the higher level of the states themselves, realizing the implications of an IP policy for the power of their country, seizes the topic, and starts defining a national IP strategy. IP is no longer only an issue for businesses. As the prosperity of businesses is at the source of the prosperity of the nations, IP becomes a subject for the enlightened state itself.

In these countries, the strong commitment of the public authorities results in various measures to be taken.

One of them consists in implementing a very early introduction to IP, from elementary school. The idea is to disseminate in all the components of the society, at a very early stage, a strong IP awareness. The future CEO, head of R & D departments, innovators, but also and simply the future citizens must be aware of the effects of good IP practices for the prosperity of the country. The 特許庁のキッズページ (*JPO Kids Page*[68]) of the *Japan Patent Office (JPO)* website or the similar page on the *USPTO*[69] website illustrates this commitment. *Korea*, too, has the same type of policy.[70]

What also characterizes those countries is often the high level of public funding dedicated to IP. This especially explains the skyrocketing number of patent applications filed by Chinese applicants in the recent years. To foster the usage of patents by its residents, especially businesses and research institutes, *China* has set up a broad variety of incentives both at the national and local levels. In an insightful

[66] C'est à vous, edited by the MEDEF (the French Employers' Association), Hors Série special propriété intellectuelle, interview with Didier Patry and Guillaume Ménage from France Brevets, May 2021 accessible at https://www.nxtbook.fr/newpress/MEDEF-Paris/C_EST_A_VOUS-2105_HS_Special_Propriete_Intellectuelle/index.php#/p/Couverture, accessed on April 9, 2022.

[67] See https://ipkitten.blogspot.com/2013/05/best-practices-in-ip-2013-conference.html, accessed on December 15, 2021.

[68] https://www.jpo.go.jp/news/kids_page/index.html, accessed on December 23, 2021.

[69] https://www.uspto.gov/kids/, accessed on December 23, 2021.

[70] See https://www.kipo.go.kr/en/HtmlApp?c=910131&catmenu=ek02_03_03_04, accessed on December 15, 2021.

paper titled "How patent subsidies boost R & D," published in 2016, *Mengmeng Yu* and *Xia Zheng* explain that system.[71] It includes the provision of financial support to help businesses file their applications, maintain their patents in force, or cope with prosecution costs. As an example, the two authors report that the *Shanghai Patent Subsidy Measures*, put in place in 2012, permits to subsidize 80% of the application fee and 100% of the substantive examination fee. The agent fees can also be partly covered. Beijing implemented similar measures, particularly focused on emerging technologies or patents stemming from the collaboration between companies, research institutions, and universities. So-called "IP development zones" have been defined as allowing businesses having their premises in these areas to take advantage of pretty high subsidies to back their IP-related activities. These measures concern domestic filing, and overseas filing as well.

In the same way, *India* has conceived a plan specifically targeted at start-ups, *Start-up India*,[72] which has a section dedicated to IP. The program includes a scheme for facilitating *Start-ups Intellectual Property Protection (SIPP)*. It was launched in 2016 and has been extended until 2023.[73] A fixed fee is specified for a broad variety of services offered by a list of IP facilitators. Their charges are reimbursed by the *Office of the Patents, Designs and Trade Marks (CGPDTM)*, a subordinate office under the Department of Industrial Policy and Promotion. These services include the drafting of the patent application, either for a domestic or an overseas filing, the provision of general information about various IPRs or about the protection of IPRs abroad, the preparation and filing of responses to examination reports and other notifications sent by the IP offices, and the representation of start-ups at various hearings.[74]

One of the major interests of a patent for a start-up is its role as a driver for fundraising. A patent facilitates access to venture capital. One step in this process is the patent valuation, which can be costly, especially for a start-up. This has led the *Korean* public authorities to set up a method[75] for evaluating a patent and to provide a subsidy to those start-ups willing to implement the process.[76] The subsidy can cover up to 80% of the cost of the valuation whose rate can be up to $20,000. The program is managed by the *Korea Invention Promotion Association (KIPA)* and the *KOTEC (Korean Technology Finance Corporation)*.

[71] How patent subsidies boost R & D, by Mengmeng Yu and Xia Zheng, March 16, 2016 – Managing IP.

[72] https://www.startupindia.gov.in/, accessed on December 12, 2021.

[73] Start-Ups Intellectual Property Protection (SIPP), https://cleartax.in/s/start-ups-intellectual-property-protection-sipp, accessed on December 12, 2021.

[74] Scheme for Facilitating Start-Ups Intellectual Property Protection (SIPP), available at https://ipindia.gov.in/writereaddata/Potal/News/680_1_SIPP_extension_as_approved_by_SIIT.pdf, accessed on December 12, 2021.

[75] Guidebook for SMEs' IP-Business Cycle, Intellectual Property Rights. Experts Group – March 2017, published by the Asia-Pacific Economic Forum.

[76] KIPA Leaflet "Intellectual Property No.1 Partner."

But the most striking characteristic which singles out those countries that moved to the highest level of IP usage is the direct and publicly displayed involvement of the higher echelons of political leaders of the country. In these countries, IP is not only the topic for an undersecretary of state, or a second-level policymaker, it is the topic of the president or of the prime minister, who regularly expresses their interest in the matter and promotes the definition of a national IP strategy. A stance of this sort can be observed in *India*, *Korea*, *China*,[77] and *Canada*.[78] Two particularly vivid examples of such an involvement are *Japan* and the *United States*.

Some years ago, the *Japanese* government created an intellectual property strategy headquarters placed under the direct authority of the prime minister who regularly (usually each year in May) chairs a meeting where they introduce the IP strategic program for the coming year. This meeting is publicized on the japan.kantei.go.jp website, the website of the *prime minister of Japan*.[79] When delving into the Japanese political life, you may come across another pretty sobering detail which teaches a lot about the advances of Japan in the IP area: *Naoto Kan*, prime minister of Japan from 2010–2011, had a background as a 弁理士 (Benrishi), the word for "patent attorney" in Japanese. He also graduated in 1970 from the *Tokyo Institute of Technology*.[80] Imagine a country where a patent attorney can be sworn in as prime minister. This feature of technical backgrounds reaching the highest echelons of the political hierarchy is not an isolated phenomenon in Asia: The former Chinese president *Hu Jintao* graduated as a hydraulic engineer.[81] *Lee Myung-bak*, the former president of South Korea, had been CEO of *Hyundai* and was passionate about mechanical engineering.[82]

The *United States* is another brilliant example of the heights to which IP can soar, *Barack Obama* being a prominent figure in that scene. He would regularly speak about IP: On March 15, 2010, in an outstanding speech before the import-export bank,[83] he uttered these memorable words: "We're going to aggressively protect our intellectual property." He argued: "Our single greatest asset is the innovation and the

[77] "Chinese President Xi Jinping says intellectual property protection is key part of country's development plans," February 2021, https://www.scmp.com/news/china/politics/article/3120118/chinese-president-xi-jinping-says-intellectual-property, accessed on March 1, 2022. See also https://news.cgtn.com/news/2020-12-01/Xi-Jinping-stresses-strengthening-IPR-protection-VRKnTIx5Dy/index.html. China clearly and officially incorporated IP and patents in its 14th Five-Year Plan (2021–2025).

[78] "Government of Canada launches Intellectual Property Strategy," April 2018 https://www.canada.ca/en/innovation-science-economic-development/news/2018/04/government-of-canada-launches-intellectual-property-strategy.html, accessed on March 1, 2022.

[79] https://japan.kantei.go.jp/98_abe/actions/202005/_00025.html, May 27 2020, Shinzo Abe holds a meeting at the IP strategy headquarters (accessed on December 23, 2021).

[80] https://www.britannica.com/biography/Kan-Naoto, accessed on December 23, 2021.

[81] https://en.wikipedia.org/wiki/Hu_Jintao#Early_life, accessed on December 23, 2021.

[82] https://en.wikipedia.org/wiki/Lee_Myung-bak#Business_career, accessed on December 23, 2021.

[83] https://obamawhitehouse.archives.gov/the-press-office/remarks-president-export-import-banks-annual-conference, accessed on December 12, 2021.

ingenuity and creativity of the American people. [. . .] It is essential to our prosperity, and it will only become more so in this century. But it's only a competitive advantage if our companies know that someone else can't just steal that idea and duplicate it with cheaper inputs and labor." Several months later, on September 16, 2011, he personally signed the *America Invents Act* at the *Thomas Jefferson High School for Science and Technology* in Alexandria, Virginia.[84] Then, in June 2013, he launched the war against the so-called *patent trolls*.[85] He could also take advantage of a position created a few weeks before his election in November 2008: the *IPEC (Intellectual Property Enforcement Coordinator)*, a position based at the *White House*. "Dedicated to the protection of the American intellectual property that powers our economy,"[86] the *IPEC* delivers every year the *Annual IP report* to the U.S. Congress.

In those countries where IP became a topic for the commander-in-chief of the nation, a provocative question could be raised: Could we imagine the political power deciding to use the national patent office to privilege the interests of its own residents? That would be a serious breach of the rules governing IP at the international level, especially the *Paris Convention for the Protection of Industrial Property*, which provides that "as regards to the protection of industrial property, each Contracting State must grant the same protection to nationals of other Contracting States that it grants to its own nationals."[87] Some clues, however, cast doubt, for example a paper published in April 2021 by the *EPFL (École Polytechnique Fédérale de Lausanne)*, with an insightful title – "Technology protectionism and the patent system: Evidence from China"[88] – and which tends to demonstrate that in the telecommunications and biotech areas, foreign companies are up to 7% less likely to have their patent applications granted in China than their Chinese counterparts. *Gaëtan de Rassenfosse*, one of the authors, added: "However, China may not be alone: Patent offices worldwide may be favoring their nationals. Lack of enforcement of IP treaties is harmful to the knowledge economy that we so highly praise. We are witnessing the closing of technology borders across nations, and that is a worrying trend."[89]

[84] https://obamawhitehouse.archives.gov/blog/2011/09/16/america-invents-act-turning-ideas-jobs, accessed on December 12, 2021.

[85] https://obamawhitehouse.archives.gov/blog/2013/06/04/taking-patent-trolls-protect-american-innovation, accessed on December 12, 2021.

[86] https://obamawhitehouse.archives.gov/omb/intellectualproperty/ipec, accessed on December 23, 2021.

[87] WIPO website, https://www.wipo.int/treaties/en/ip/paris/summary_paris.html, accessed on December 23, 2021.

[88] de Rassenfosse, Gaétan and Raiteri, Emilio, Technology Protectionism and the Patent System: Strategic Technologies in China (September 1, 2020). Available at SSRN: https://ssrn.com/abstract=2803379 or https://doi.org/10.2139/ssrn.2803379, accessed on December 23, 2021, and https://actu.epfl.ch/news/does-the-chinese-patent-office-discriminate-agains/, accessed on December 16, 2021.

[89] https://actu.epfl.ch/news/does-the-chinese-patent-office-discriminate-agains/, accessed on December 23, 2021.

In countries where IP receives close attention from such a high level, it also results in IP to irrigate all the layers of the society – schools, colleges, universities, businesses, research labs, and institutions – but also the economic and policy circles, the lawmakers, the state authorities and think tanks, and even sometimes the advertising billboards in the airports. It creates what we could call an "IP enabling environment," which greatly facilitates the job of those supposed to raise the IP awareness of students and entrepreneurs. This task becomes much more complicated when IP remains the topic of a limited circle of insiders, or even "the boring legal stuff one has to occasionally look at."

The *United States* is an excellent example of such an enabling environment for IP. It is probable that not many IP professionals have heard about the *CSIS (Center for Strategic and International Studies)*. The *CSIS* is a think tank based in Washington, D.C. that is dedicated to international relations. Its primary focus is diplomacy, military balance, and political, economic, and security issues. In spring 2021, the *CSIS* recruited two new senior advisors: *Walter Copan*, former undersecretary of commerce for standards and technology and director of the *NIST (the U.S. National Institute of Standards and Technology)*, and *Andrei Iancu*, former undersecretary of commerce for intellectual property and director of the *USPTO*. They started their participation in the work of the *CSIS* by an inspiring conference on the topic of "Launching the Renewing American Innovation Project" in conjunction with the issues related to IP and standards.[90] In the United States, IP and standards are considered a power element and hence are the object of the scrutiny of institutions like the *CSIS*. This case is not isolated: *The Diplomat*, a magazine based in Washington, D.C. as well, also occasionally publishes articles about IP issues.[91] *Andrei Iancu* made a funny remark during the above-mentioned conference: Somebody allocated the task to set up a team building on Capitol Hill, the seat of the U.S. Congress, and who would be quite scared by the challenge to find a topic likely to create a consensus among the Republican and Democrat lawmakers would not have to worry too much: IP is the right topic, as all the lawmakers agree on the role of IP in the United States' dominant position. During the same meeting, Andrei Iancu also pointed out a detail which could at least partly explain why the United States can benefit from "an IP enabling environment": the first patent examiner in U.S. history was Thomas Jefferson, one of the nation's founding fathers.

Broadly speaking, the U.S. political leaders often have as part of their team staff members with a good level of IP knowledge.[92] A significant number of U.S. lawmakers, from both parties, have a knowledge of the arcane tenets of IP enabling them to draft bills related to sophisticated topics like patentability subject

[90] https://www.csis.org/events/launching-renewing-american-innovation-project-conversation-andrei-iancu-and-walt-copan, accessed on December 23, 2021.

[91] https://thediplomat.com/2020/12/how-chinas-government-structure-prevents-intellectual-property-protection/, accessed on December 23, 2021.

[92] The Role of Intellectual Property Education In the United States, by David W. Hill and Matthew T. Latimer – Finnegan, Henderson, Farabow, Garrett & Dunner, LLP Washington, D.C.

matter.[93] All the components of the innovation ecosystem are rallied behind IP with regular interactions between them. The number of professional organizations related to IP is fairly high in the United States[94]: *American Intellectual Property Law Association (AIPLA, www.aipla.org)*, *American Bar Association (ABA, https://www.americanbar.org/)*, *National Association of Patent Practitioners (NAPP, https://www.napp.org/)*, *Licensing Executive Society (LES, www.les.org)*, and the *International Association for the Protection of Intellectual Property (AIPPI, aippi.org)*. These organizations are managed by IP professionals who are still working, and they hold regular meetings and conferences. Moreover, they actively lobby the public authorities and policymakers. Besides the organizations strictly linked with IP, it should be noted that: "IP professionals are often members of scientific and technical professional societies, organizations, and associations. In particular, patent attorneys and agents are often members of scientific and technical societies that relate to their scientific or technical background,"[95] like the *American Chemical Society*. This fosters a smooth communication between the IP circles and the scientific and technical ones.[96] In addition to the four *USPTO* satellite offices, the United States is covered by a network of 83 *PTRC* (*Patent and Trademark Resource Centers*[97]) aimed at raising IP awareness of students and innovators all over the country. Most of the stakeholders involved in the innovation process in the United States have a high level of IP awareness. Concerning the IP training courses offered in the technology universities, the situation seems to be more differentiated. But a U.S. patent attorney[98] recently pointed out the following to me: "For at least 150 years, U.S. culture has been one of entrepreneurship, innovation, and 'self-made' start-up businesses. Americans idolize the 'garage inventor' who is successful. Thus, the urge to patent regardless of a formal education of such."

In comparison, some European countries do not seem to be totally on the same page. IP has not yet been clearly brought to the forefront as a strategic issue. Do we have somewhere in Europe, at the government level, the equivalent of the strongly publicized *US IPEC* or of the Japanese IP strategy headquarters? Do we have somewhere in a parliament lawmakers debating about "patentability subject matters"? The *French Assemblée Nationale* published in June 2021 a fact-finding report on the topic "Building and sustaining the digital sovereignty in France and in Europe." The term "patent" shows up 11 times in the 216-page report.

[93] https://www.tillis.senate.gov/2019/5/sens-tillis-and-coons-and-reps-collins-johnson-and-stivers-release-draft-bill-text-to-reform-section-101-of-the-patent-act, accessed on December 23, 2021.

[94] *Op. cit.*

[95] *Op. cit.*

[96] *Op. cit.*

[97] A map of the PTRC is available at https://www.uspto.gov/learning-and-resources/support-centers/patent-and-trademark-resource-centers-ptrc/ptrc-locations, accessed on December 12, 2021.

[98] Monte L. Falcoff, Registered Patent Lawyer, Trademark Lawyer and Principal, 5445 Corporate Drive, Suite 200, Troy, MI 48098, USA (many thanks to him for allowing me to incorporate this quote).

Figures have been cited above which show the low level of filing activity of SMEs, especially that of some of our high-valued start-ups in France.

Beyond the question of quantity, what is in question is also the quality – more precisely the level of usage of the IPR. *Didier Patry* from *France Brevets* recently explained at a hearing before the *French Assemblée Nationale*[99] that successful companies usually have a patent portfolio built by a mixed practice based on patenting the results of their R & D but also on patent acquisition. Unfortunately, the interest in patent acquisition seems to be fairly low in France: France tends to sell its technology, not to acquire technologies from abroad, which explains why the French patent trade balance appeared to be in negative territory some years ago.[100] The idea to buy patents on the market to prepare a counterattack is not a common practice, which is a pity because, as *Didier Patry* said, patents derived from one's internal R & D are not well suited to preparing a counterattack. Moreover, the pursued objective is often to cut the costs, ignoring the fact that low-cost IP is often useless IP. It is not well understood that a minimum amount of money should be spent to obtain a good-quality IP, and that a "rinky-dink patent" has few interests. Too many start-ups in disruptive technology areas – quantum, artificial intelligence (AI), or cybersecurity, for example – are deprived of a "good IP." In addition, the idea that software is not patentable is rather widespread in France, which is a problem, as the digital sector is probably the more strategic one.[101] Other players in the IT sector do not really refrain themselves from patenting software-related inventions: According to an *ipwatchdog* post dated August 21, 2021, *"In First Half of 2021, 63% of U.S. Patents, 48.9% at EPO and 40.1% in China were Software-Related."*[102]

The following statement by the *General Qiao Liang* recalls the situation of many start-ups, even if he did not have IP in mind[103]: "In the event of an epidemic or war, can a country without a manufacturing industry be considered a powerful country?" Transposed into the IP domain, by analogy, the question could read: "In technology

[99] Hearing of France Brevets before the French Assemblée Nationale within the framework of a fact-finding mission on the topic "Building and sustaining the digital sovereignty in France and in Europe," December 17, 2020, available at http://videos.assemblee-nationale.fr/video.10089890_5fdb16f463d39.batir-et-promouvoir-une-souverainete-numerique-nationale-et-europeenne%2D%2Dauditions-diverses-17-decembre-2020, accessible in January 2021.

[100] Michel Neu, CEA, Is your country ready for open innovation? – *Intellectual Asset Management* (IAM) magazine issue 67, August 1 2014.

[101] Total R & D expenditures of the Pentagon suppliers in 2018 (*Boeing*, *United Technologies*, *Lockheed Martin*, *Raytheon*, *Northrop Grumman*): US$8 billion; total R & D expenditures of the digital industry in the United States over the same period (*Amazon*, *Alphabet*, *Intel*, *Microsoft*, *Apple*): $75 billion (figures cited by *Thomas Gomard* in "Guerres invisibles, Nos prochains défis géopolitiques," Tallandier, January 2021).

[102] https://www.ipwatchdog.com/2021/08/26/first-half-2021-63-u-s-patents-48-9-epo-40-1-china-software-related/id=137100/, accessed on December 12, 2021.

[103] Cited by Thomas Gomart in "Guerres invisibles, Nos prochains défis géopolitiques," Tallandier, January 2021.

areas where the competition turns more and more challenging, can a start-up without patents be considered a viable start-up?"

This reality does not seem to be well enough perceived by our policymakers, nor by the society at large, unfortunately. Some striking banner headlines, even in the economic press, which is supposed to have a higher aptitude for scrutiny, show that many are lulled into complacency about the situation.[104] That is extremely concerning, as it jeopardizes the money about to be invested in the various recovery plans recently launched. Those recovery plans need to be combined with a strong IP strategy to be successful. Some enlightened specialists try to flag this, but they apparently have some difficulties in being heard. The whole scene could give the spectator the weird feeling that as far as IP is concerned, we are, in the early 2020s, where we were in the mid-1930s with regard to the armored forces. The opposite camp is the one that understood the advantages that can be drawn from a systematic, structured, massive, and offensive use of a "weapon," which on our side, we often use scarcely and in a very traditional way.

It is therefore necessary to educate, educate, and educate again. Regarding the matter of education, the government of *Australia* published in May 2021 its *Patents Accessibility Review Report*, one key teaching of which is worth a careful read: "Many respondents commented on the need to have a patent strategy, but within an overall commercial strategy, not to patent for patenting's sake. For this reason, it has been emphasized that patenting advice should be housed within overall commercial mentoring and business strategy advice, not treated as a separate silo. No bifurcation of business strategy and IP strategy."[105] This key finding is in line with what we said above. We need to find the good "teacher," having a profile combining strong IP expertise with a strong business management competence. We need people who have both the IP viewpoint AND the business viewpoint. In other words, we need IP strategists to be sent over to our start-ups or other businesses. Do we have a sufficient number of such profiles? The *IAM 300 directory*,[106] even if it should not lead to definite conclusions, is probably one element among others which could at a minimum draw our attention. Out of the 300 top IP strategists listed on this site, many specialists are based in the United Kingdom, United States, Germany, and Japan. In the 2022 edition of the 300 Top Strategy Global Leaders ranking, only

[104] Headlines such as "*Patents: despite the pandemic, France remains one of the most innovative countries in Europe*" could be noticed in the French economic press in spring 2021, further to the publication of a report by EPO. This conclusion was based on the fact that the number of European patent applications filed by French residents increased by 3.1% between 2019 and 2020. A quick analysis of the EPO figures indicates that this 3.1% corresponds to only 321 more patents, which brings back France to its level in 2017. Over the 2014–2020 period, the figures remained stable (around 10,600 applications per year). Figures from Germany remained stable as well (around 25,000 applications per year). Over the same period, China tripled its performance, jumping from 4,680 applications in 2014 to 13,432 applications in 2020.

[105] https://www.industry.gov.au/data-and-publications/patents-accessibility-review, accessed on December 23, 2021.

[106] https://www.iam-media.com/directories/strategy300, accessed on December 23, 2021.

seven are listed in France, and most of them (6/7) are either current (4/7) or former (2/7) employees of *France Brevets*.[107]

The legal side of IP[108] is extremely well taught in France. Those who manage to graduate from our schools and universities of law have a deep knowledge of the mechanics of an IP right. They are fluent in the procedure: its main steps and its timeline, the way to draft claims and get a patent granted, as well as how to analyze the jurisprudence and the conditions of novelty and inventive steps.

We probably now need to put the education emphasis on strategy in order to train professionals who are ready to fully embrace the aforementioned definition from *General André Beaufre*.

It would definitely be unfair to state that IP strategy is not taught at all.[109] Nonetheless, we undoubtedly need not only to tighten the education on IP strategy, but also to promote and broadly publicize the training courses already available, and to even more strongly complement the course offering dedicated to IP law with one focused on IP and business strategy.[110]

We need a framework, or comprehensive training programs, whose goal would be to teach how to draw the best of a patent portfolio into the "dialectic" of two companies competing on the business battleground. In my opinion, the need for such a training course is not totally fulfilled. Some promising elements can be noticed, however: the initiative mentioned in the footnote above by the Strasbourg-based *Center for International Intellectual Property Studies (CEIPI)* itself, and which needs to be praised, as the *CEIPI*, when it was founded, was originally focused on the legal aspects of IP.[111] Quite interestingly, the *CEIPI* organized in September 2021 a conference on the topic of the relations between IP and geostrategy. Another interesting detail: The *CEIPI* is now based in a brand-new building also hosting Sciences Po, the renowned French political science school. This might be encouraging evidence of a rapprochement of two disciplines which so far have had few relations. This could eventually lead to the elaboration of a broadly publicized

[107] https://www.iam-media.com/survey/strategy-300-global-leaders/2022/article/strategy-300-global-leaders-all-individuals.

[108] The *CEIPI (Center for International IP Studies)*, in Strasbourg, is a department of the *Strasbourg Law University*, a compulsory step for all the future French patent attorneys. I use to say that it is our "common pride," so high is the expertise of the people working there.

[109] In the frame of the CEIPI, *Professor Alexander J. Wurzer* specifically developed a Master dedicated to IP strategy which needs to be mentioned, the *Master of Intellectual Property Law and Management (MIPLM)*. Together with this Master, the *CEIPI* also launched an *IP Business Academy* (https://ipbusinessacademy.org/).

[110] Besides the already cited MIPLM, one should also mention the trainings proposed by the *Institut Européen Entreprise et Propriété Intellectuelle (IEEPI)*, focused on IP strategy, and the *INPI IP Master Class*.

[111] Presentation of the CEIPI available at https://www.ceipi.edu/en/ceipi/ceipi-presentation/, accessed on March 4, 2022.

training program dealing with the legal, business, economic, and geostrategic sides of IP.[112] In the IP area, as in many other areas, multidisciplinarity is key.

It should also be noted that the *EGE (École de Guerre Économique, the French Economic War School)* is about to launch a Master II dedicated to standards with some courses on IP, which is a promising initiative as well.[113]

Getting start-ups to use IP is therefore a strategic issue for our sovereignty. But achieving that goal will require us to redouble our efforts. Besides the *Quantum Plan*, the *Battery Plan*, and the *AI Plan*, we also need an ambitious "IP recovery plan." A huge investment in education, appropriately sized funding to help entrepreneurs cope with IP-related costs, further enhancing the way IP is seen and taught, all that is necessary. Yet success is closely linked to a compulsory step: Political leaders at the highest levels must seize the matter. A strong involvement of the "commander-in-chief" and their staff remains a key factor of success.

7 Learnings and Takeaways

For start-ups: Remember, the area in which you are about to play is a competitive place, and you will need to be a fighter, especially if you are active in a strategic technology field.

To go to the *"battle,"* you will need:

- Resources: IPRs are key drivers for accessing resources. Investors are much more likely to fund your project if you own IPRs, especially patents for those of you involved in a technology.
- Of course, filing a patent application, a trademark, and so on has a cost. But keep in mind that a significant part of these costs can be taken on board by the multiple support offers available in Europe. Go to your local chamber of commerce, the patent information center, the incubators, clusters, accelerators, etc. They have plenty of tips and tricks for you to navigate in the network of structures supporting start-ups and IP.
- One cannot go to the battleground without a good knowledge of one's environment: Who are the already active players – the friends, the possible allies, the enemies, the challengers, the predators, the IPR owners – and in which countries, on which market? Before embarking on this road, ask a professional to establish a patent landscape for you. On any battleground, blindness is deadly.[114]

[112] Strasbourg seems to be the ideal location for such a program, as in addition to the players already mentioned, another one should be cited: the *BETA (Bureau d'économie théorique et appliquée)*, a research organization part of the Strasbourg Faculty of Economic Sciences, which focuses its work on the economic aspects of IP.

[113] https://www.ege.fr/formations/executive/normalisation-innovation-et-intelligence-economique, accessed on April 6, 2022.

[114] "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you

- Also, remember that in the early stage of your start-up's life, patents will be useful for you to get money and build your reputation, then to deter potential infringers or at least enable you to negotiate with them. When you reach a good level of maturity, you might become a possible prey for bigger shots: At that time, a patent will become a weapon to counterattack; you will not need to hesitate to acquire the right patents from others to defend your interests. It will be the time for you to enhance your start-up's patent portfolio, also by acquisition.

For public investors or public authorities and other support structures:

- You know that the money you provide to support start-ups is public money; the resources you spend to help them develop are public resources. They are aimed at making your territory more prosperous, to create jobs and hence protect your interest, your lifestyle in a world becoming more and more unstable. If the people you support do not buttress their business strategy on a good usage of IP, the public money and resources you spend on them is likely to get, at least partly, lost, or to serve someone else's interest. You need to closely monitor the business – and therefore IP – strategy of the businesses you support.
- Also keep in mind that the game does not only consist in filing a patent application and getting a claim granted; the purpose is to appropriately put IPRs at the service of the business strategy of your client. Do not disconnect IP from the business strategy, which would be nonsensical. The people you will send over to your clients should preferably have dual expertise in IP and business strategy; otherwise, success will be more difficult to achieve.

For policymakers:

- Considering the U.S. and Chinese stances, it would make sense for Europe to adopt an even stronger position on IP. A strong IP policy should be combined with the recovery plans launched in various technology areas. IP needs to be put at the forefront of the agenda. This is key to protecting European sovereignty.
- In this respect, it may occasionally be wise to have a look at what others do. The Japanese IP strategic headquarters, the U.S. IPEC, the way China supported the usage of IPRs by its residents, and the Start-up India program could serve as good sources of inspiration.
- The IP topic probably now needs to be incorporated into a global strategic vision of European interests. Such a vision could, for example, lead to a European patent alliance or, at the broadest level, to a European IP recovery plan.

know neither the enemy nor yourself, you will succumb in every battle." (Sun Tzu, The Art of War, translated by Lionel Giles, Luzac and Co., London, 1910).

Takeaways

A very early incorporation of IP into your business strategy will greatly foster all your stages of development. This strategy needs to be defensive and also offensive, and should take advantage of the multiple ways IP can be used at the service of a business. We also need to keep in mind that a strong start-up ecosystem backed by a corresponding strong IP policy is an instrument of power for nations in an increasingly harsh global competition.

Acknowledgments Special thanks to:

- My colleagues Julie Zerbib, a true expert on the French start-up ecosystem, and Anne-Catherine Milleron, an expert on the Asian IP scene, for their help in the very early stages of the drafting of this chapter.
- Matthieu Demolin, from Dealroom®, who kindly provided valuable data about French start-ups, especially in the AI area.
- Clarivate Analytics, which kindly provided the patent landscaping screenshot.
- Luc Soler, for the thorough proofreading of the text about his company, Visible Patient.
- François-Xavier de Beaufort and Didier Patry, for their careful review of my paper.
- Martin Bader, who invited me to write this chapter.

Philippe Borne is the head of the French Patent and Trademark Office (INPI) branch office in Strasbourg. Qualified as a pharmaceutical doctor, he joined INPI in 1986 to participate in the design of the Pharmsearch pharmaceutical patent database, a project also involving the Questel-Orbit and Derwent (now part of Clarivate) companies. This permitted him to get in close contact with the patent information professionals from the major pharma/chemistry companies in Europe, especially Germany, and in the United States. Mr. Borne later became deputy manager of the INPI IP search service before joining the regional branch department of INPI in 2008. His main tasks involve raising the awareness of businesses, especially SMEs, about intellectual property and to get them to implement an active IP policy. Patent analytics is one of the subjects he has to monitor as part of his missions. He is a member of the board of the CFIB (the French-speaking patent information user group), and in June 2021, he joined the group of experts of the EPO Patlib network. His current activity allows him to interact with entrepreneurs, IP practitioners, and the whole network of those structures whose objective is to support innovation and the development of businesses. He recently started focusing on the geostrategic aspects of IP.

Strategic Considerations and the Seed-to-Maturity Model When Establishing the Ideal IP Portfolio in the Start-up Context

T. Alexander Puutio

1 Start-ups: A Unique Operational Context

The start-up period is a contextually unique period of operations during which the fate of a company often rests on equal parts luck, skill, and determination to succeed. As other authors have already noted, the start-up period presents a challenge that many companies fail to overcome. In fact, only half of small companies with employees survive to celebrate their fifth anniversary of operations in the United States.[1]

There are numerous factors that make companies vulnerable to closure during the start-up period. Even the best of business ideas can meet an untimely demise in the hands of poor management or due to a lack of funding, lackluster marketing, or simply because of unfavorable market conditions. The start-up period is a unique operational context which poses organizational and technological challenges that can prove debilitating if not addressed properly and in short order. Many have cited the first years of operations as resembling the feat of building a plane while also learning to fly, and from the founders' perspective, it may seem that there is little else to do than work hard and hope for the best.

That's not the entire truth, however. On the contrary, there are several steps founders can take to increase the survival rate of their company that do not depend on external circumstances. Key among them is the proper leveraging of IP.

Recent studies have shown that start-ups with more IP assets are less likely to go bankrupt and more likely to successfully exit via a merger (Kato et al., 2021). In this

[1] U.S. Small Business Administration. (2012). Do economic or industry factors affect business survival? Available at: https://www.sba.gov/sites/default/files/Business-Survival.pdf.

T. A. Puutio (✉)
Asia-Pacific Research and Training Network on Trade (ARTNeT), United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, Thailand

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_21

chapter, we will focus on how the appropriate management of IP assets can make a significant difference in positioning start-ups to survive external supply and demand shocks, traverse over funding gaps, as well as attract potential buyers. We will begin by assessing the company life cycle and the key milestones for IP asset management that exist within the borders of the start-up period.

2 IP Assets and the Firm's Life Cycle

2.1 The Seed-to-Maturity Life Cycle and MVP Design Process

Companies grow and mature at different paces. For some, profitability is immediate while for others breaking even is a multi-year endeavor. Similarly, some devote their first years to research and development in a single market while others scale and expand quickly across their initial horizons.

Drawing general conclusions based on anecdotal evidence of a handful of successful start-ups alone is difficult given the rich variety that exists in the realm of small businesses. However, once we aggregate a sufficient number of data points and add a dash of theoretical considerations into the mix, we can begin tracing the outlines of an average life cycle (Mueller, 1972) that has both intra- and inter-industry applicability.

The most widely used descriptions divide the firm life cycle into five discrete periods of time: launch, growth, shake-out, maturity, and decline. Figure 1 below captures generally held views on the average risk levels, resources, organizational structure, and research and development (R & D) capacities that accompany each of these stages.

Not all firms survive long enough to go through all stages, and some firms may never transition from one stage to another even while remaining financially viable. For example, when faced with low competitive pressures and accompanied by low founder ambitions, it is quite typical for companies to reach maturity without experiencing significant growth and shake-out periods before reaching a level of maturity which can be best considered as a local maximum across a wider topography of maximal points of efficiency that could be reached were additional risks undertaken or more resources added to overcome the boundaries in between. Likewise, some companies reach a stable equilibrium point in their maturity without facing the risk of decline, for example, due to regulatory interventions (such as monopoly rights) or sustaining a consistent level of R & D expenditures above what competitors are able to reach.

The theoretical framework above can be further adapted to the start-up context by means of the seed-to-maturity model captured in Fig. 2. The risk/resources/organizational structure levels remain similar to those in the traditional theory, instead of which Fig. 2 describes typical start-up activities that are likely to take place at each stage. Again, theory is not destiny and start-ups that do not follow this model exist. However, the model provides us with the necessary foundations for introducing theoretical IP asset development and management considerations into the mix.

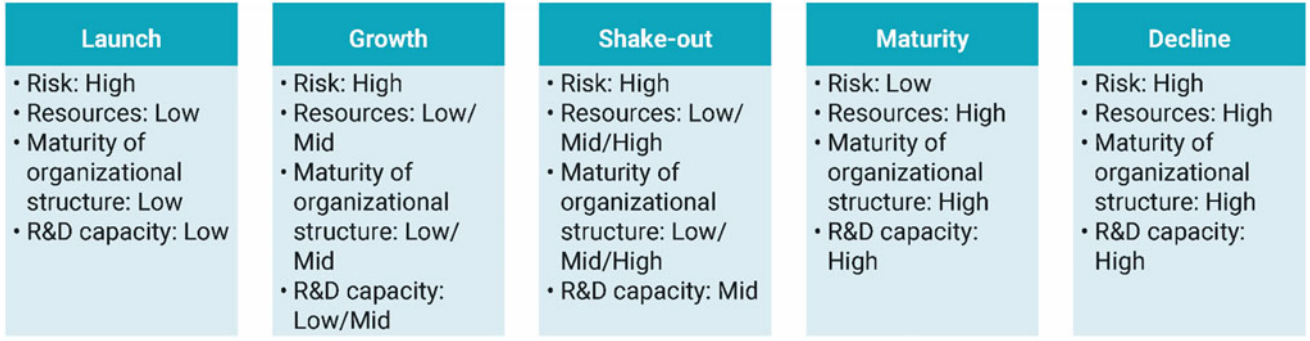

Fig. 1 Traditional firm life cycle theory (author's own figure)

Fig. 2 Seed-to-maturity model of the start-up life cycle (author's own figure)

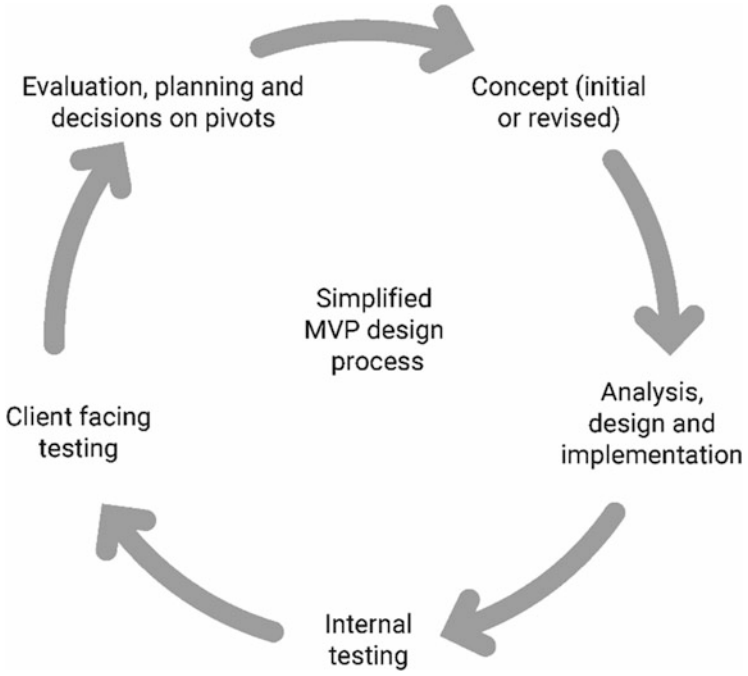

Fig. 3 Simplified lean start-up method to MVP development (author's own figure)

The seed-to-maturity model extends the traditional theory by including a seed/incubation phase prior to launch as well as an expansion stage after growth. The additional real estate allocated to these two categories is more than semantics. First, the expanded scope of analysis allows for examining the minimum viable product (MVP) creation process in greater detail. Second, the inclusion of an expansion stage allows for differentiating between internal, *technology and organizational structure related* growth and external, *market-facing* growth. Figure 3 illustrates the MVP development model (Blank & Dorf, 2020) in more detail, after which we have all the theory we need to start discussing the role of various forms of IP assets and different IP asset management strategies throughout the stages in the seed-to-maturity model.

2.2 Specific Functions of IP Assets in the Start-up Context

Depending on the context, IP assets can be categorized as inputs, outputs, resources, liabilities, components, products, cost centers, profit centers, competitive differentiators, legal deterrents, and more. In addition to the legal exclusive rights that IP assets confer, patents, copyrights, trademarks, and their siblings also perform other functions for corporations, some of which are particularly applicable in the context of start-ups. Below, we will explore some of these functions and then discuss how IP assets fit in with the seed-to-maturity and MVP design model:

- **Raison d'être:** It is not at all untypical for IP assets to be the main, if not sole, reason for the existence of a start-up. In fact, numerous innovations in the pharmaceutical industry, developments in robotics, and advances in AI have led directly to the establishment of start-ups that manage and/or commercialize the underlying IP asset. Inventions that were made within educational and research institutions, corporate spin-offs, and IP holding companies are apt examples of start-ups where IP assets can be seen as having performed a veritable act of genesis.
- **Carving out a competitive niche:** By virtue of their power to exclude competitors, process, product, and brand-image facing IP assets perform a niche-establishing function that is critical for start-ups. Even where IP assets are not a main consideration for start-ups, at a minimum, companies will need to operate under a protected legal name and trademarks that clearly demarcate the boundaries between the start-up and its competitors. On the other end of the spectrum lie, for example, patents and copyrights, with which a competitive niche with legal force can be carved out from the market. Whether the niche proves profitable and whether the particular start-up owning the IP assets will be successful in maintaining the niche in the long run are other matters entirely.
- **Signal value:** Start-ups are risky ventures by their very nature. This riskiness manifests itself in many ways, including as perceived uncertainty and lack of formal authority in the eyes of other market participants, including competitors, potential employees, and venture capitalists. IP assets, specifically those that have been granted after a rigorous governmental certification process and significant R & D inputs, carry positive signal value in and of themselves, in addition to their exclusionary potential. Given that IP assets are the result of creative and innovative work, the mere act of owning them provides external observers with an objective signal of the potential of the company. It is unlikely that external observers will agree in the evaluation of the signal value, but in no case should we expect the value to be negative.
- **Self-generated resources:** In the earliest stages, start-ups are often bereft of financial, operational, or human resources. In line with the value generation theory of IP,[2] a portfolio of patents, a catalogue of copyright-protected works, or the protections conferred by geographical indications can be considered as resources that have both operative and financial functions. What is unique about IP assets is that they are resources that a start-up can generate itself as opposed to, for instance, employees or financing. Combined with typical gaps in other resources and the positive signal value IP assets confer, start-ups are likely to benefit from the ownership of IP assets more than established firms that have already reached maturity.
- **Rallying point for talent and funding:** One cliché worth repeating is that start-ups live or die with their founders. Forming a highly skilled, ambitious, and

[2] See e.g., OECD (2008) Intellectual assets and value generation. Available at: https://www.oecd.org/sti/inno/40637101.pdf, which discusses the value generating function of IP assets.

committed founding team is a first-order priority for all start-ups. When properly managed, IP covering highly sought-after markets or concerning lucrative technologies can be leveraged by management to attract and retain key talent early on in the start-up process. Most start-ups are created before patents or other forms of registered IP assets are obtained. However, the existence of trade secrets concerning, for instance, process or product innovations or simply superior business concepts is often sufficient and can be used to secure talent. As a corollary to the above, the ownership of IP assets has a positive effect on access to funding. For example, IP assets such as patents can be used as collateral and the ownership of exclusionary rights can be attractive to venture capitalists and other private funding sources. However, it should be noted that the positive effects IP has on funding are likely to manifest in later stages of the life cycle after the start-up's business model has been validated.

3 The Seed-to-Maturity Model and the Expected IP Portfolio[3]

As other authors in this book have already noted, IP assets come in many forms. Of these, patents, copyrights, and trademarks are by far the most common asset types that start-ups will encounter, with 646,244[4], 509,744[5], and 434,810[6] registrations (or applications), respectively, having been recorded in the United States in the most recent years (2020–2021). A bevvy of additional assets exists, ranging from trade secrets to geographical indications, industrial design, plant variety protection, and beyond. From this group, trade secrets are by far the most important for start-ups across all industries.

These four main forms of IP assets have different requirements for their existence/granting/registration, and they all carry vastly different implications from a development, internal resources, and effective utilization perspective.

As a result, we can identify valid theoretical and practical reasons for assuming that each of these four IP asset forms is likely to become relevant to the start-up's expected IP portfolio at certain specific stages of the seed-to-maturity model (see Fig. 4). Naturally, there will be significant variation across start-ups based on, for example, the operating industry, institutional and competitive context, and founder goals and priorities. However, a general trajectory can be drawn from trade secrets to mature patent portfolios that is likely to apply to most start-ups globally.

[3] Whereas this section discusses IP assets from the United States' perspective, many of the underlying principles are universal across most jurisdictions.

[4] United States Patent and Trademark Office (2022a) *U.S. Patent Statistics*. Available at: https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm.

[5] United Sates Copyright Office (2021) *Annual Report for fiscal year 2020.* Available at: https://copyright.gov/reports/annual/2020/ar2020.pdf.

[6] United States Patent and Trademark Office (2022b) *Trademarks data.* Available at: https://www.uspto.gov/dashboard/trademarks/.

Fig. 4 The seed-to-maturity model and the expected IP portfolio of a representative start-up (author's own figure)

3.1 The Lean IP Portfolio Approach for the MVP Design Process

The lean start-up method has become an industry standard over the past years. Agility, responsiveness, and efficiency are key principles that in turn inform the MVP design model, which is at the heart of the method itself. Generating and iterating upon MVPs in quick succession is critical to the method, and the timelines involved in typical applications put significant constraints on IP asset strategies, making traditional approaches too slow and cumbersome to be of use. Time- and resource-consuming application and registration processes are eschewed in favor of IP assets that provide automatic protection and which can be dynamically revised without documentation, application, or legal costs involved.

When we consider the threshold for protection, resource intensiveness, enforcement potential, and amenability to dynamic revisions of each of the four main IP asset types, it becomes clear that trade secrets, copyrights, and trademarks form the basis of a "lean IP portfolio." Figure 5 reflects how each of these assets interfaces with the MVP design process.

By ensuring that they meet the minimum requirements for the automatic protection granted by trade secrets (economic value, reasonable efforts to avoid

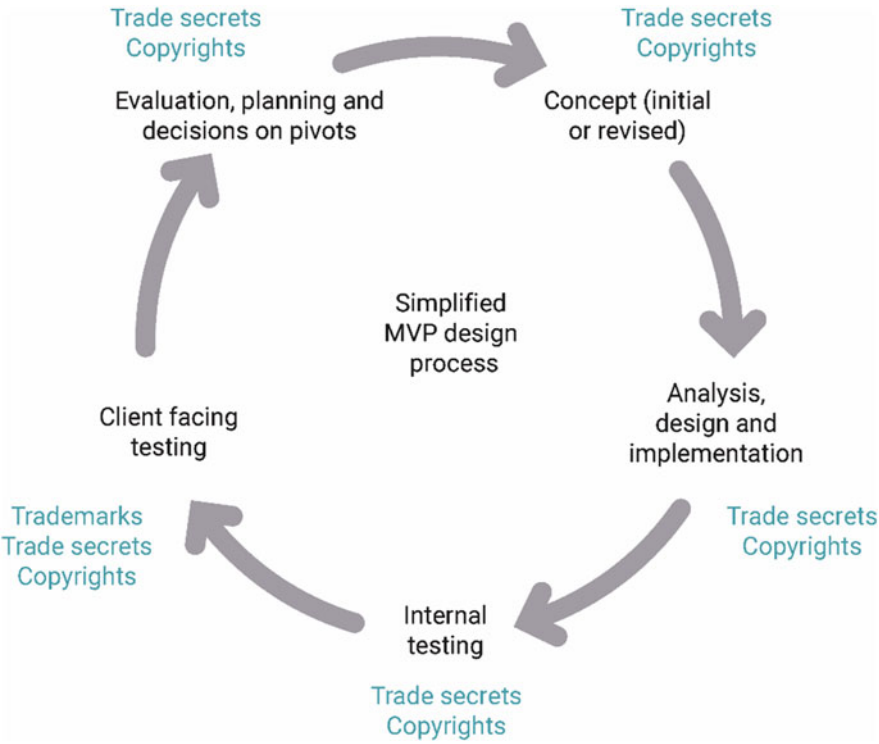

Fig. 5 The main interfaces between IP assets and the MVP design model (author's own figure)

disclosure), copyrights (modicum of creativity, human author), and trademarks (distinctive, first-to-use), start-ups can begin adding entries to their "lean IP portfolio" with minimal effort. In fact, with the proper documentation and cyber and physical security measures in place, the portfolio generates itself automatically alongside the company's research and development activities.

4 Practical Strategies for Maximizing the Value of the Expected IP Portfolio

The expected IP portfolio and the relative importance of various forms of IP presented above is well aligned with data on how important companies rate different IP asset classes to their operations. Based on a 2018 study by the National Science Foundation, trademarks and trade secrets are rated as the most important, with copyrights and patents holding third and fourth place respectively.[7] The reason for this order of ranking arises from the myriad of inherent features and tradeoffs, the most critical of which in the start-up context are captured in Table 1.

Establishing an effective "lean IP portfolio" and effectively managing IP assets throughout the start-up's life cycle asks that founders and business leaders make strategic decisions about how, when, and to what extent the company should seek IP protection. Which practical strategies to deploy depends on the specific business strategy and a number of factors, with the information below being a non-exhaustive list of likely scenarios and potential pathways to maximizing the value of a start-up's IP portfolio.

- **Extended stealth mode:** Not all start-ups benefit from a full consumer- or financier-facing launch. In fact, the MVP design process lends itself particularly well to "extended stealth mode," where products are revised and adjusted rapidly in response to customer feedback. While in stealth mode, formal IP asset registrations and applications should be avoided, apart from provisional patents to establish priority. Non-disclosure agreements and customer confidentiality requirements are critical, as is the need to avoid making otherwise patentable inventions non-eligible due to disclosure to the market.
- **Retaining an early-mover's advantage:** There are decided benefits to being first to market and retaining the competitive advantage after a consumer-facing launch is critical for companies that want to fully capitalize on their efforts. If pursuing this business strategy, start-ups should utilize trade secrets and non-registered copyrights for as long as possible, making sure that the necessary steps to avoid inadvertent disclosure are taken. Trademark applications include both explicit and implied disclosures of both the product type and its category, and formal

[7] National Science Foundation (2018) *Knowledge Transfer and Innovation (Chapter 8).* Available at: https://nsb20181/report/sections/invention-knowledge-transfer-and-innovation/invention-united-states-and-comparative-global-trends.

Table 1 The most critical inherent features and tradeoffs in the start-up context (author's own compilation)

Features IP asset classes	Registration required	Main requirements for granting protection	Enforcement potential and complexity	Disclosure or public use required for protection	Professional/ legal assistance typically required	Ease of commercialization via outsourcing and licensing	Alignment with MVP design process
Trade secrets	No	Economic value, reasonable efforts to avoid disclosure	Low in relation to other IP assets	No	No	Requires NDAs and high levels of trust	Self-generated as part of the MVP design process if necessary requirements met
Trademarks	Not required but typically obtained	Distinctiveness and use	High	Yes	Yes	Easily commercialized	
Copyrights	Not required but can be obtained	Modicum of creativity, authorship	Medium	No	No	Easily commercialized	
Patents	Required	Utility, novelty, non-obviousness, no prior disclosure, patentability	High	Yes (after 18 months of priority date)	Yes	Easily commercialized	Final protection requires lengthy application process
Provisional patents	Required	Same as above	None	No	Yes	Low to no commercial value	Final protection requires lengthy application process

registrations should be avoided until launch so as not to tip off the competition. After launch, trademarks and patent applications should be filed in all key markets for products and services where trade secret protection is unlikely to be sufficient due to, for example, the ease of reverse engineering. Enforcement efforts should be made immediately upon notice of infringing competition.

- **Entering a patent-intensive market:** Today, many IP-intensive industries are surrounded by patent thickets (Shapiro, 2001), which hinder market entry and make entrance riskier and more costly. Apart from proactive inbound licensing to avoid potential infringement, start-ups should seek to aggressively grow their own IP portfolio both before and after entry. In a litigation context, larger portfolios provide more leverage and legal maneuverability, and start-ups should make every effort to front-load patent applications to the extent possible. Patent applications themselves should be drafted in a way that maximizes the scope of excludability.
- **Managing an outsourced labor force and licensee compliance:** Outsourcing tasks such as final production and assembly is a typical strategy for start-ups that either wish to focus on their core competencies or lack the resources for vertical integration. Outsourcing and license-outs are powerful tools for driving efficiencies and extending the reach of the company to new markets, but they both come with tangible risks with regard to IP asset misappropriation. These risks are poignant in the case of trade secrets and non-registered trademarks as well as copyrights, which are particularly susceptible to misappropriation. Contractual arrangements should cover not only confidentiality but also non-compete clauses, covenants against research and development in the same product area, and sanctions for non-compliance. Where possible, local registrations should be made by the outsourcing company/licensor, and trade secrets that cannot be recovered or safeguarded after disclosure to the production partners and licensees should be considered for patent protection instead.
- **Preparing for buyouts and funded exists:** Not all founders aim to ride along with their company until maturity. A growing number of start-ups are established with the explicit intention of being acquired. The components of the ideal IP portfolio in anticipation of exits could include any mix of trade secrets, trademarks, copyrights, and patents. However, in negotiations with potential acquiring entities and VCs, certain IP assets are more easily valuated than others. Patents, copyrights, and trademarks are routinely valuated by economists, legal professionals, and accountants, and numerous methods for generating sophisticated valuations exist (Puutio et al., 2022). As a rule of thumb, registered copyrights and trademarks as well as granted patents see higher valuations overall. Valuing trade secrets is much more difficult in practice, and in cases where there are no competitive markets for benchmarking, agreeing on definite valuations may be all but impossible. As a result, start-ups eyeing expedited exits and easy negotiations should consider emphasizing formally registered forms of IP instead.

5 Learnings and Takeaways

In the hectic day-to-day life of start-ups, it is easy to emphasize product development, customer relations, and teambuilding and to leave considerations of IP for a later time. As this chapter has shown, however, there is no better time to start making strategic choices about IP than the first stages of a company's journey.

Whether a start-up intends them to be or not, "automatic" IP assets, such as trade secrets and non-registered copyrights and trademarks, are a part of the company's intangible asset portfolio from day one. Leveraging these assets to the fullest requires little else than foresight and proactivity, while the returns to properly utilizing them can be immeasurable.

With the right mindset and forward-looking decisions about disclosure timelines, confidentiality, cyber and physical security, and tactical IP registrations and applications, start-ups can establish a "lean IP portfolio" with the right strategic IP assets for each stage of the seed-to-maturity model and MVP design process.

Takeaways

- To better fit the growth trajectories most modern start-up experience, the traditional firm life-cycle theory must be revised to the seed-to-maturity model.
- In the area of technology in particular, start-up growth theories must explicitly address the minimum-viable-product development cycle.
- IP assets are relevant to all start-ups, at a minimum through trade secrets and trademarks.
- A start-up's ability to generate and leverage IP assets changes in predictable ways throughout its journey along the seed-to-maturity model.
- Certain types of IP, such as trade secrets, trademarks, and copyrights, form part of a "lean IP portfolio" and can be used to protect valuable information and knowledge even without registration.

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T. Alexander Puutio is an intellectual property rights, innovation, and economic development expert who currently serves as an IPR Advisor to the Asia-Pacific Research and Training Network on Trade under UNESCAP. He holds a PhD from the University of Turku and has obtained legal and economics degrees from Fordham University, King's College London, London School of Economics and Political Science, and University of London/EMFSS. Dr. Puutio teaches business and society at the NYU Stern School of Business.

Part VI

The Advisor's View

As a general rule of thumb, [. . .], the best practice is to allocate funds for patent registration as soon as possible!
—Roy Melzer
Head of Computing Technologies Department
Ehrlich & Fenster Patent Attorneys

An Introduction to Intellectual Property Rights and Formal and Informal Protection Strategies

Martin A. Bader

1 Capturing Value by Protecting Innovation

An important aspect of innovating is not only *creating* an innovation, but also *capturing* its value – so the winning formula is: *"Create and capture value"* to gain and retain competitive advantage. Therefore, appropriate innovation capture strategies are necessary. Successful market players combine traditional, so-called *de facto* protection strategies, with complementary *legal* ones (see Fig. 1).

The choice of concrete protection means also depends on factors such as the type of innovation, the size and market share of the firm, and the firm's R & D activities. In that context, Gallié and Legros (2012) evaluated seven forms of *formal and informal protection strategies*: patents, design rights, trademarks, copyrights, and trade secrets as formal protection strategies; then the complexity of products and the manufacturing process, and lead-time advantage as informal protection mechanisms. They define the protection strategies as follows:

Selected portions of this book chapter were previously published in the book Gassmann et al. (2021) *Patent Management*. Springer Nature: Cham. Used with permission

M. A. Bader (✉)
THI Business School, Technical University of Applied Sciences, Ingolstadt, Germany

BGW AG Management Advisory Group, St. Gallen, Switzerland
e-mail: martin.bader@bgw-sg.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_22

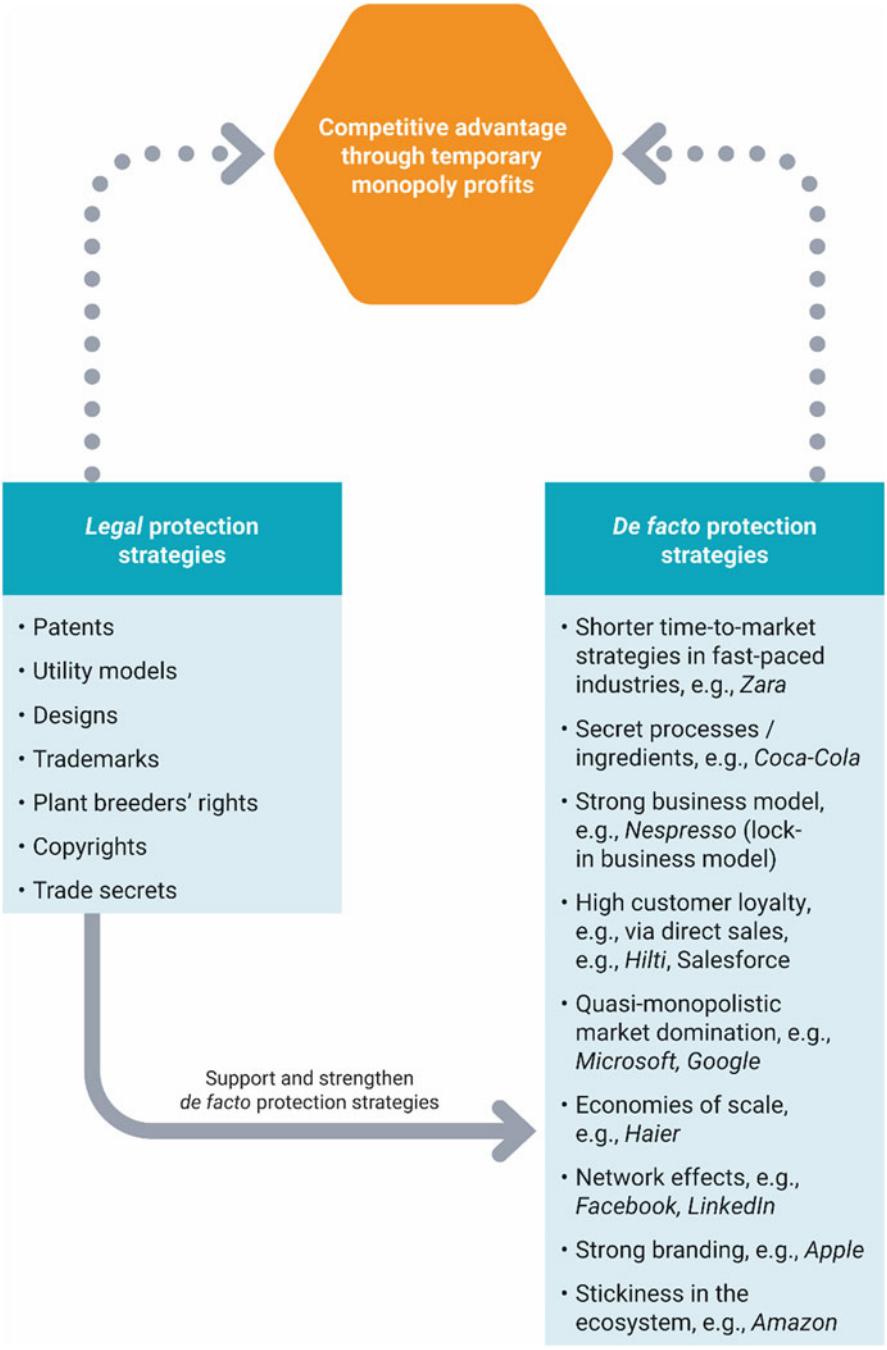

Fig. 1 *Legal (formal)* and *de facto (informal)* protection strategies complement one another (Gassmann et al., 2021)

1.1 Formal Protection Strategies

1. *Patents:* An inventor, who registers a patent, receives the right to prohibit the imitation or use (apart from their own use or selling it) of the invention by others for a limited period of time. This allows the inventor to obtain monopolistic prices when exploiting the innovation. However, when registering a patent, the inventor must disclose the information pertaining to the innovation, hence enabling competitors to "invent around" the patent. This drawback may well overshadow the benefits of being able to implement monopolistic prices for an innovation.
2. *Design patents:* Design patents protect the visual appearance of objects such as the shape, the colors, and the materials. To register a design, two requirements must be met. First, it has to be new, which means that no identical design was published before the registration. Second, it must be unique, which means that the overall appearance must differ from other designs.
3. *Trademarks:* A trademark is a sign, a symbol, a design, or an expression that distinguishes the products or services of a company from those of other companies. Although a trademark is not limited in time, the registering company needs to renew it periodically.
4. *Copyrights:* A firm which registers a copyright receives exclusive rights to the original work and hence obtains the power to determine who may financially benefit from it.
5. *Trade secrets*[1]*:* Trade secrets cover non-public information and enable firms to obtain a competitive advantage over companies that do not own the information. This includes formulas, methods, techniques, processes, and instruments. Firms must formalize the related information and take adequate actions to keep it secret.

1.2 Informal Protection Strategies

6. *The complexity of products and manufacturing processes:* The complexity of products and manufacturing processes constitutes an instrument to capture value from innovation. If a product or service consists of complex processes, technologies, or components that are necessary to build and distribute it, this complexity grants the firm a competitive advantage, since the offerings are made more difficult to imitate.
7. *Lead-time advantage:* In this context, the lead-time advantage is established if firms innovate faster than their competitors. This leads to competitive advantages that enable them to capture value from their innovation.

[1] Although Gallié and Legros (2012) considered trade secrets to be informal protection strategies, it is advisable to recategorize trade secrets as *formal* protection strategies due to the legal requirements being necessary to formally establish a "trade secret" status; however, "secrecy" in general would be a rather *informal* protection strategy.

Further *informal protection strategies* (de facto protection means) include – but are not limited to – building a strong business model, achieving high customer loyalty, a quasi-monopolistic or niche-market domination, making use of economies of scale, exploiting, and multiplying network effects, building a strong brand, or creating stickiness in the ecosystem.

In the following, the abovementioned *formal protection strategies* (legal protection means), meaning the different types of *intellectual property rights (IPRs)*, are explained in detail and elaborated with examples.

2 Types of Intellectual Property Rights

A general overview of the most common types of intellectual property rights (IPRs) is provided in Table 1.

2.1 Patents

What Is a Patent?

A patent grants its owner the (exclusionary) right to prevent others from:

- Commercially producing,
- using,
- offering,
- storing,
- importing, or
- selling the invention,

for a

– specific jurisdiction; or for a
– limited period. ◀

In Europe, an invention in the legal sense solves a technical problem with technology (IPI, 2020). However, a granted patent does not necessarily confer on its owner the right of unlimited use for the invention. For example, other industrial property rights or other regulations may prevent the use of the invention by the inventor or the patent holder. Patents are therefore also referred to as exclusionary rights or prohibitive rights. The other types of industrial property rights also have this characteristic.

The *European Patent Office (EPO)*, for instance, grants patents for inventions which (EPC, Art. 52):

Table 1 Overview of the main types of intellectual property rights (IPRs)

IPR	Subject	Application	Examination	Max Duration
Patent	Technical invention	Yes	Yes	20
Supplementary protection certificate	Pharmaceuticals or regulated chemicals	Yes	No	5/5.5 years
Utility model	Technical invention (no processes)	Yes	No	10 years
Design patent	Visual arrangement, smell	Yes	No	25 years
Topography	Semiconductor circuit	Yes	No	10 years
Plant breeders'/Plant variety right	Plant varieties	Yes	Yes	25/30 years
Trademark	Brand, acoustic sign, color, scent, 3D-shape	Yes	Yes	Extendable every 10 years
	Business name	No		
	Indication of source	No		
Appellation of controlled origin/Protected geographical indication	Local goods, food, and products	Yes	No	Indefinite (typically legislated)
Trade dress	Packaging	No	No	During life of product
Copyright	Software	No	No	50 years
	Writing, architecture, art, music			70 years after death of author
Trade secret	Proprietary processes and information	No	No	Indefinite

Source: Gassmann et al. (2021)

- are new;
- are based on an inventive step; and
- are commercially applicable.

The criteria for *novelty* and for what is *inventive* are "absolute" and apply worldwide, meaning that they are independent of the territorial origin of the knowledge available at the time of the priority date, the so-called *state of the art*, also referred to as *prior art*. The priority date is usually the date of the first filing of the invention application at a patent office. The United States is still an exception, since the principle of the invention date *(first to invent)* used to apply there, rather than the *first-to-file*

principle. Under certain circumstances, in case of doubt, this can be used to substantiate the priority date.

Prior Art

This refers to anything published prior to the filing date in written or oral form, through overt usage, or otherwise made known. There are no restrictions regarding object, language, space, or time. ◄

During the patent application procedure, the patent applicant must determine for which countries they need patent protection. The decision on the subsequent application must be made within one year of the priority date. Since there are various official and translation fees for each country/region named, the selection of countries or regions is typically based on the expected economic benefit that patent protection can potentially achieve in that country. The duration of patents is controlled by the patent applicant through the payment of annual fees, which are usually collected by the patent offices on an annual basis (not in the United States). In most countries, the maximum term of a patent is 20 years after the filing date. In the United States, patents filed after June 8, 1995, also have a term of 20 years.

If patent protection is intended in several countries, patent application procedures can be bundled internationally via the *Patent Cooperation Treaty (PCT)*, and grant procedures for numerous European states via the *European Patent Convention (EPC)*.

Patents Are Exclusionary Rights

Patents are not permissive rights – unfortunately a still widespread misconception, which often leads to erroneous investments in the millions. Patents are exclusionary rights which prohibit the imitation of the protected invention by third parties.

When it comes to the question of what is ultimately accessible to patent protection – products, systems, processes, procedures, software, or even business models – regional legal jurisdictions play a major role. ◄

2.2 Supplementary Protection Certificates (SPCs) for Pharmaceuticals

The marketing of medicinal products, and of some chemicals, can only take place after relatively lengthy approval procedures, which severely restrict the effective patent term , have been completed. After the statutory term of the basic patent has expired, the supplementary protection certificate provides the possibility of extending the effectiveness of patent protection by a maximum of five years with a

maximum remaining term of 14 or 15 years after approval (35 U.S.C. §§ 155, 156; EEC No. 1768/92, EC No. 1610/96, EC No. 469/2009).

2.3 Utility Models

Utility models or *innovation patents* are also sometimes called *petty patents* because they have a shorter duration and cover a more limited range of inventions. The exact legal definition of the utility model varies by jurisdiction more than by patents. In Germany, the *"Gebrauchsmuster"* are technical inventions based on an inventive step and its industrial application, and not on processes. The eight-year Australian innovation patent requires an "innovative step" rather than an "inventive step." Utility models, typically have a 10-year term, like in Austria or Germany, and can nevertheless serve as priority applications to file subsequent patent applications in other countries, or to start early enforcement and litigation.

However, compared to patent protection, there are lower requirements for the required inventive step of a utility model. Utility model applications can, for example, be filed in Austria, Australia, Brazil, China, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Mexico, Poland, Russia, Spain, and South Korea. Not every jurisdiction offers a utility model: Switzerland and the United States do not have a national utility model; Australia is rethinking whether to convert its "innovation patent."

2.4 Design Patents

Two- or three-dimensional manifestations of a product or parts thereof may be protected as designs. In the fashion industry, for example, fabric samples are often protected, while in the consumer goods industry, packaging, such as beverage bottle shapes, is often protected. A protectable design must be new, and it must exhibit a sufficient degree of peculiarity. The maximum term of protection is 25 years, starting from the filing date.

Case Legal Dispute About Design: Apple vs. Samsung

There have been numerous legal disputes between the technology groups *Apple* and *Samsung* over the alleged infringement of protected designs.

The iPad manufacturer *Apple*, for example, sued *Samsung*, a competitor, before the Düsseldorf Regional Court with an application for an injunction for infringement of a registered European Union Community design. According to *Apple*, *Samsung* infringed *Apple's* registered design No. 000.181.607-0001 with its tablet *"Galaxy Tablet 10.1."* The Düsseldorf Regional Court ruled in favor of *Apple* on the ground that the design of the Galaxy Tablet gives the same overall impression, even to informed users, and is therefore worthy of protection.

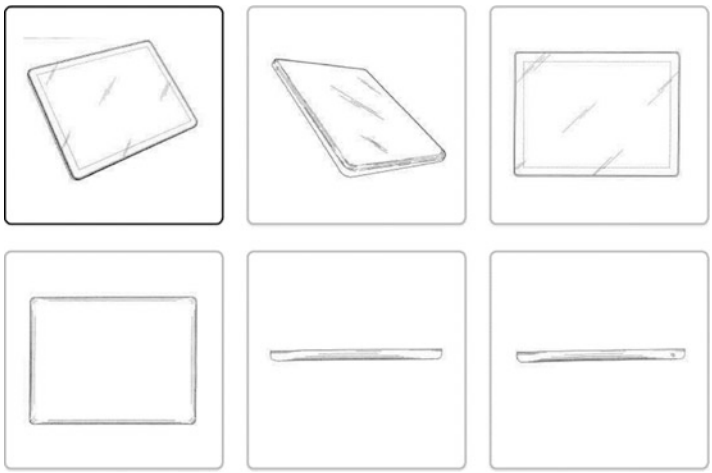

Fig. 2 Excerpt from Apple's European Union community design No. 000.181.607-0001

Samsung filed an appeal, but the appeal was rejected because the Higher Regional Court found that *Samsung's* tablet was an imitation of the iPad (see Fig. 2).

In response, *Samsung* published a successor model which, with a different design, differed from its predecessor model and thus also from the iPad. *Apple* reacted with a renewed application for an injunction and again claimed infringement of its Community design. The Düsseldorf Regional Court rejected this claim on the grounds that the design of the successor model left the user with a different overall impression and was therefore outside the scope of protection (Bartenbach et al., 2013). ◀

In addition to the national procedure, there is also the possibility of depositing designs internationally in the more than 50 member countries of the *Hague Agreement*, including Germany and Switzerland, via the *Hague Model Convention (HMA)*.

If design protection is to be obtained exclusively in European Union (EU) countries such as Germany or Austria, an EU Community design, valid for the entire Community territory, can also be registered. In contrast to German law, it is irrelevant whether the design has an aesthetic content or is functional.

Design protection is also possible in the United States and Japan. In both countries, a cost- and time-intensive, computer-aided novelty examination is carried out, whereby in principle no protection against infringers exists until a grant has been given. In the United States, however, the enforcement of designs has generally proved to be difficult in practice, as more than 70% of designs have so far been declared invalid in infringement proceedings.

2.5 Topography

Topographies are three-dimensional structures of microelectronic semiconductor products and are protectable similarly to inventions. However, a topography can only be protected if it has a "peculiarity." Like utility models, topography registration does not involve any substantive examination by the patent office. Although numerous topographies have been registered to date, this type of property right has not yet had any significant effect in the practice of law enforcement.

2.6 Plant Breeders' Rights (PBRs)/Plant Variety Rights (PVRs)

Plant variety protection rights are exclusionary rights comparable to patent protection, with the aim of protecting intellectual property rights in new plant varieties to aid progress in breeding in agriculture and horticulture. Breeders or discoverers of new plant varieties can apply for protection for varieties of the entire plant kingdom at the respective national plant variety protection offices. A plant variety is in principle eligible for protection if it is distinct, homogeneous, stable, and new, and if it is also designated by a registrable variety denomination. Plant variety protection has the effect that only the owner of the plant variety protection or the owner's legal successor is entitled to market, produce, or import propagating material (plants and parts of plants, including seeds) of a protected variety for commercial purposes.

2.7 Trademarks and Similar Rights

A trademark is a registered right which is suitable for distinguishing the products or services of one entity from those of other entities, and which fulfills the purpose of indicating origin. Trademarks can be registered at the national, regional (e.g., EUIPO), or international (WIPO) level. The most relevant criterion in practice is the distinctiveness from other trademarks, and it should also not be descriptive; the word *"Apple"* can be trademarked for computers but not for a type of apple. The term of protection can then be extended as often as desired. Trademarks can be protected as:

- Words, e.g., *Persil (Henkel)*;
- Letter combinations, e.g., *ABB*;
- Number combinations, e.g., *501 (Levi's)*;
- Pictorial representations and logos, e.g., the Mercedes star *(Mercedes)*;
- Three-dimensional forms, e.g., *Coca-Cola* bottle;
- Slogans, e.g., "It gives you wings" *(Red Bull)*;
- Combinations of these elements as word/picture marks, e.g., *Toblerone*;
- Contourless colors and color combinations as visually perceptible signs, e.g., magenta/grey of *Deutsche Telekom*;
- Acoustic signs, e.g., *20th Century Fox* melody;
- Position mark, e.g., red stripe in *Lloyds* shoe heels.

In addition to classic trademarks, there are a number of other similar rights meant for protecting the symbols of organizations, groups, etc., or for enabling special protection (discussed below).

Trademarks: Some Special Cases (e.g., Switzerland, Europe)

Established Trademarks
Descriptive signs can obtain protection if they become generally known on the market for goods or services of a certain company and if they have "prevailed" in technical jargon (e.g., in Switzerland, *Valser* for mineral water).

Public Domains
Due to their presence over many years, trademarks can mutate into designations for entire product categories, make their way into the general vocabulary, and lose their defensibility. For instance, few Americans today would say "tissue" when the more widely used term is *"Kleenex"*; in the United Kingdom, people say *"to hoover"* when they mean *"to vacuum."* The legal test for this entry into the public domain is whether general reference works have the term.

Famous Brands
Brands like *Ferrari*, *Coca-Cola*, or *Cartier* also enjoy, as an example, in case there is risk of exploitation by third parties, protection for goods and services for which they were not even registered.

Internet Domain Names
The domain and hosting provider *Swizzonic* (formerly *switchplus*) is responsible for the allocation of domain names with the country codes CH and LI and their registration. Domain names can also be registered as trademarks in accordance with the usual principles.

Indications of Source
Indications of source distinguish certain goods or services from each other, not based on the manufacturer of the goods but rather in reference to a particular geographical origin. A distinction is made between direct indications of source (e.g., *Swiss chocolate*), indirect indications of source (e.g., *William Tell chocolate*), and qualified geographical indications (e.g., *Geneva* for watches).

Appellation of Controlled Origin (ACO)/Protected Geographical Indication (PGI)
Protected or controlled designations of origin known as ACOs (e.g., *Tête de Moine*) and protected geographical indications known as PGIs (e.g., *Bündner Fleisch*) are registered in Switzerland in the Register of Agriculture. They can only be registered as a trademark, or as a trademark component under certain conditions.

Extract from: IPI (2020) ◄

2.8 Domain Names

The domain name system (DNS) is coordinated by the Internet Assigned Numbers Authority (IANA – www.iana.org) and the Internet Corporation for Assigned Names and Numbers (ICANN – www.icann.org). Allocation and registrations take place via the respective national, central registries for top-level domain names, as is exemplified below:

- Germany (.de): www.denic.de
- Austria (.at): www.nic.at
- Switzerland (.ch): www.swizzonic.ch
- Generic top-level domains (e.g., .com, .net): www.verisign.com

2.9 Trade Dress

Trade dress is a narrower intellectual property right than trademarks in that it typically applies to packaging, boxes, and the visual appearance. The visual elements combine in such a way as to evoke a feeling of knowing the source in the consumer's perception.

2.10 Copyrights

The only condition is that the intellectual property must be detectable by the senses. Direct embodiment or publication is not required. Software as such is also protected by copyright. However, the protection only applies to the software code as such, but not to the ideas or the algorithms.

Copyright Law

The legal prerequisite of copyright law is that a personal creative achievement is present. No official procedures or other formal requirements are typically required for the creation and enforcement of protection.[2] Works in the copyright sense are creations that have a unique character. These include in particular:

- Literary works of any kind (e.g., novels, scientific treatises, newspaper articles, advertising brochures);

[2] In addition, a voluntary registration of the protected work with the United States Copyright Office – the Library of Congress – makes sense. This makes the work public on the one hand and the Office issues a certificate of registration on the other. In the context of the judicial enforcement of copyrights, registration is even a prerequisite for being able to assert a flat-rate claim for damages provided for by law and for being able to demand reimbursement of legal fees in the event of success.

- Works of music and other acoustic works;
- Works of fine art (e.g., painting, sculpture, graphics), as well as applied art (e.g., objects with a utility value, whereby the deposit as a design patent does not exclude copyright protection);
- Source code or programming text.

Works of personal intellectual creation may be marked with a copyright notice. The © label should then be used in conjunction with the name of the copyright holder and the first year of publication. ◄

2.11 Trade Secrets

Trade secrets cover any confidential business information which provides an enterprise with a competitive edge. Trade secrets encompass manufacturing or industrial secrets and commercial secrets. The unauthorized use of such information by persons other than the holder is regarded as an unfair practice and a violation of the trade secret. Depending on the legal system, the protection of trade secrets forms part of the general concept of protection against unfair competition or is based on specific provisions or case law on the protection of confidential information. The subject matter of trade secrets is usually defined in broad terms and includes sales methods, distribution methods, consumer profiles, advertising strategies, lists of suppliers and clients, and manufacturing processes. While a final determination of which information specifically constitutes a trade secret will depend on the circumstances of each individual case, practices that are clearly unfair in respect of secret information include industrial or commercial espionage, breach of contract, and breach of confidence (WIPO, 2022).

3 Learnings and Takeaways

A key learning for start-ups is to make complementary use of both *de facto* and *legal* protection strategies for sustainable success: creating and capturing value.

Whereas on the one hand *de facto*, also called *informal*, protection strategies comprise, for instance, mastering the complexity of products and manufacturing processes and generating lead-time advantages, on the other hand, *legal*, also called *formal*, protection strategies comprise intellectual property rights such as patents, design, trademarks, copyrights, and trade secrets.

Takeaways
Ten practical tips for start-ups to manage protection strategies and IPRs:

1. Effective protection is often not provided by a single IPR. Innovative start-ups should therefore set up a systematic cluster of complementary IPR types (formal protections strategies) combined with de facto protection strategies (informal protections strategies) to secure their competitive advantages and to capture their business value.
2. Include the financial means for protecting and developing your IP in the financial statements of your value creation and investment plan – IP is no side dish.
3. Carrying out IPR searches, e.g., for patents, trademarks, design, at an early stage is the best way to face reality and to avoid surprises later – do not "duck and cover."
4. In addition to the protection of the basic or early product and service design concepts, alternative or later design variants may also be worth protecting, e.g., to disrupt fast-followers and competitors.
5. A consistent and rigorous tracing and enforcement approach against IPR free riders and infringers acts as a deterrent and increases the barriers to imitation.
6. In-licensing or cross-licensing enables the use of third-party IPRs, but watch out for the induced dependencies created regarding the IPR originator.
7. In the event of a dispute, take this as a serious incidence and act fast – don't waste time by ignoring it at first (these cases do not get solved by shredding the warning letter).
8. In the case of being called on the basis of an IPR of a competitor, it is useful to develop workarounds.
9. For IPR legal procedures, such as filings, registrations, opposition, nullity, or enforcement proceedings, it is advisable to engage an IP attorney.
10. Another option for action is the trade of IPRs as bargains and collaterals: IPRs are regarded as assets that can be traded on a marketplace, including options such as barter, sale, or licensing.

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Martin A. Bader is a European and Swiss Patent Attorney. As well as being a Partner and Co-Founder of the specialized innovation and intellectual property management advisory group BGW AG St. Gallen, he has, since March 2016, been Professor of Technology Management and Entrepreneurship at the University of Applied Sciences Ingolstadt (THI) in Germany. Previously, he was Head of the Intellectual Property Management Competence Center at the Institute of Technology Management at the University of St. Gallen (HSG) and was Vice President and Chief Intellectual Property Officer at Infineon Technologies, Munich. He is a mediator at the Mediation Center for Alternative Dispute Resolution at the World Intellectual Property Organization (WIPO) and has for many years been regarded as being among the top 300 intellectual property strategists worldwide according to Intellectual Asset Management magazine's IAM Strategy 300 index. He is also a long-standing author of numerous specialist publications and an internationally sought-after speaker in the field of intellectual property management.

Important Aspects of IP for Start-Ups: Strategies for Avoiding Common Pitfalls

Louis Lagler and Christian Ebner

1 The Challenges to Protect Intellectual Property

Patents, *trademarks*, and *designs*, together with *copyrights*, are so-called intellectual property rights (IPRs). They are foreseen to protect the result of an intellectual creation, which is why they are also referred to as *intellectual property (IP)*.

In contrast to copyright (*non-registered*), patents, trademarks, and designs are so-called *register rights*, which only take effect when they have been entered in a public register after successful examination of the relevant requirements by the responsible government agency. These rights are limited in *time* and *territory* (i.e., linked to one or more countries) and exist only as long as the renewal fees are paid or, in the case of patents and designs, the maximum term permitted by law is reached.

Despite the importance of intellectual property rights in today's world, many companies and especially start-ups find it difficult to *protect* and *defend* their intellectual property. On the one hand, this is certainly due to the fact that in the age of digitalization, information spreads at great speed, which makes it difficult to react promptly. On the other hand, the subject matter is also very complex. This leads to lengthy and costly processes, especially in patent law. For example, it can take 3–5 years for a patent application to become a granted patent. Intellectual property law also has a strong international dimension. A number of international agreements, such as the *Paris Convention* for the Protection of Industrial Property, must be observed in addition to national law when applying the law.

Intellectual property rights represent an *opportunity* but also a *risk*, namely when the rights of third parties are involved: When developing a new product or launching a new brand, it is often not checked at all, or not sufficiently, whether a competitor

L. Lagler (✉) · C. Ebner
Rentsch Partner Ltd., Zurich, Switzerland
e-mail: lagler@rentschpartner.ch; ebner@rentschpartner.ch

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_23

might not already hold an intellectual property right in this area. If, at the same time, customers are involved with whom one has entered into obligations, such as via a development contract, this can lead to unpleasant situations. Companies are always required, on the one hand, not to infringe the rights of third parties themselves and, on the other hand, to protect and defend their own innovation and creativity against unauthorized use of intellectual property by third parties with foresight. The infringement of third-party intellectual property, but also the lack of protection of one's own innovations, can have far-reaching consequences for a company.

IP rights grant their owners an assertive monopoly for a limited period of time, which gives them a competitive advantage. As mentioned in part VI of this book there are several ways to protect intellectual property (Bader, 2023).

Particularly in the case of industrial company patents together with the revenue from licensing them, represent a significant aspect of the company's value. The entrepreneurial value of trademarks and designs should not be neglected either. Trademarks in particular can reach astronomical values as individual property rights: A study by Interbrand[1] estimated the value of the *"Apple"* brand at around $408 billion, of *"Amazon"* at $249 billion, of *"Google"* at $197 billion, of *"Coca-Cola"* at $57 billion, and the brand value of *"Nescafé"* at no less than $14 billion (Interbrand, 2021).

Not always protectable as intellectual property, but nevertheless of great value to companies, is *know-how*, for example in connection with practical knowledge of production processes, etc. Know-how is related to intellectual property rights in many respects but should be contractually protected best by means of a non-disclosure agreement.

The key assets of technology-focused start-ups usually are their inventions. A patentable invention in the present context is understood as a technical solution of a "technical problem," wherein the solution has not been known to the public before as such. In addition, the invention has to be based on an inventive step, respectively it has to be non-obvious, to obtain a patent which then can be asserted against others.

The principle idea of patent protection is to disclose the solution of a technical problem to the public and in return obtain for a limited period of time an assertive monopoly. However, it has to be considered that the interference with a patent by a third party cannot be prevented by just owning a patent. Often it is necessary to actively make a third party aware of the existence, for example by sending a warning letter. Even then the reaction usually is not friendly in a sense that the challenged party reacts cooperatively and refrains without further resistance.

In reality, a start-up has to overcome several hurdles and problems to protect its inventions and successfully enter business:

Effective protection On the one hand, the inventions have to be protected in the best possible manner by appropriate patent applications to prevent them from being stolen or copied by someone else. On the other hand, it must be secured that the

[1] https://interbrand.com/best-global-brands/ (accessed May 25, 2022).

product or process made according to the one or more inventions does not infringe on other patents belonging to third parties, which could result in destructive litigation. Therefore, securing freedom to operate (FTO) is at least as important as appropriate patent protection.

Patentability Very often practical problems arise from the requirement that inventions are only patentable when they are new, meaning that they have not been disclosed to the public before filing. As the public is everyone not bound to confidentiality, e.g., publishing scientific papers or talking to potential clients or investors without sufficient written confidentiality and thereby revealing the invention can be very critical.

The chicken and egg problem As reliable patent protection is relatively expensive, a real "chicken and egg" problem arises: How can potential investors be convinced when it is impossible to talk to them without endangering the novelty of the invention? When involved, investors usually also want to have a certain security with respect to freedom to operate. This topic is often underestimated and not handled properly.

Besides dedicated know-how and skills, inventions are often the only commercially valuable assets to which a quantifiable value can be asserted. Therefore, protecting these assets is crucial for companies, regardless of the envisioned business strategy. If an exit strategy is pursued, the interest of a potential investor lies in the technology and thus in the intellectual property assets of the start-up. If a growth strategy is pursued and the product launch is successful, a start-up cannot outcompete large companies in workforce or financial resources, which makes solid and reliable protection of its assets important to prevent copycats from entering the market. Furthermore, if financial funding from investors is sought, the question of intellectual property protection almost always arises.

Start-ups are unique market participants with unique requirements and setups. In this chapter we draw from our practical experience to highlight the most common aspects that start-ups are being faced with along their journey.

2 Lessons and Cases

2.1 Lesson 1: Ensure that the Invention Actually Belongs to You

A crucial issue of intellectual property which is often forgotten is the question of actual ownership of the invention. To provide a complete picture, it has to be strictly differentiated between ownership and the *right to be named as inventor*.

Several inventors may contribute to an invention and there may also be several applicants as "owners." In more complex cases, it is more than advisable—to avoid conflicts—to regulate the rights contractually even before filing and taking into account statutory provisions (e.g., with regard to inventions made by salaried

employees). Mistakes made here can only be corrected later with difficulty or not at all.

It is often wrongfully assumed that due to the mere fact that a person or a group of persons invented a new technology, they automatically own the right to this invention. In reality, the situation is far more complex and depends on different provisions in national patent law and thus the country in which the inventors are located, respectively employed, as well as the employment situation of the inventors.

Many patent systems, including the European Patent Convention (EPC), assume that the inventor(s) is the rightful owner and therefore entitled to file a patent application. However, the national employment law often contains provisions according to which the employee's work results belong to the employer or according to which the employer is at least entitled to claim the right to the invention in return for compensation payments to the inventor(s).

Therefore, for assessing ownership of the invention, the following questions must be addressed:

- Who are the inventors?
- Were the inventors employed when the invention was developed?
- Where were they mainly employed when the invention was developed?

The first question—*Who are the inventors?*—seems trivial at first glance. However, in particular in the start-up ecosystem, there are various different players which may be considered as providing a contribution to the invention. For example, many university spin-offs are founded based on a research project conducted in the course of a bachelor's, master's, or doctoral thesis of one of the founders. As these projects are typically not only developed by the students themselves, but also under the supervision and guidance of a professor, the professor may at least be considered as an inventor. Also, scientific collaborators outside their own research group or university may have contributed to the invention and may thus also be considered as co-inventors. In addition, many university spin-offs are, at least at the beginning, often based at their university and may thus also conduct research with undergraduate students or employ laboratory assistants who act under the guidance of one of the founders. Start-ups may also raise the question if an investor of a start-up, who urges the start-up to further develop a certain product or idea, should be considered as a co-inventor.

As can be seen, the question of who is an inventor is not always a trivial one. In general, only natural persons who creatively contributed to the invention are considered as inventors. Therefore, financiers or vicarious agents fulfilling mere manual tasks, such as a laboratory assistant conducting experiments assigned by a supervisor, are often not considered as inventors.

The second question—*whether or not the identified inventors were employed when the invention was developed*—is important because many national employment laws contain provisions according to which there is at least some entitlement of the employer to the work results, i.e., the invention. The extent of such provisions varies significantly among different countries, which is why the third question is

important: *Where were the inventors mainly employed* when the invention was developed? While Switzerland, for example, has very strict and employer-friendly rules according to which an invention in the business field of the employer made by an employee whose main task is to invent (such as a research scientist or an engineer) automatically belongs to the employer, other countries are more employee-friendly. A prominent example is Germany, having a special law, the Germany Employee Invention Act ("Arbeitnehmererfindergesetz"), which foresees compensation payments for the inventors if the employer decides to claim the invention.

The second question is not only important for the initial invention, i.e., the core invention based on which the start-up is founded, but also for any further developments and improvements which may be made after founding the company. Not only university spin-offs but also other technology start-ups offer students to conduct research projects within their company. As undergraduate students are typically not employed by their universities, the right to an invention belongs personally to them. Thus, start-ups which offer such projects must ensure by means of contracts that any invention, development, etc. is transferred to the start-up.

The second and third questions are crucial for start-ups, as many start-ups are either founded in a university setting by undergraduate or graduate students, who may be employed by their university, or by founders with industry experience, who may still have been employed by their former companies when the invention on which the start-up is based was made. Thus, in both these examples, the university or the former employer may validly claim a right to the invention. In conclusion, it is therefore of utmost importance for a start-up to carefully assess the question of ownership of the invention based on which the start-up was founded.

2.2 Lesson 2: Be Aware not to Destroy Novelty Before Filing a Patent Application

In principle, inventions can be carried out without patent protection, provided they are not covered by third-party rights. Patent protection is therefore not mandatory. However, if there is no patent protection*, de facto no action can be taken against copiers and imitators.*

Many emerging technology start-ups in the field of life sciences, engineering, or information technology are founded based on a core invention or development. As start-ups typically cannot compete, neither in workforce nor in financial resources, with large industrial companies in these sectors, their invention paired with their know-how undoubtedly represents the start-up's key asset, which is why it is of utmost importance to protect this asset. Importantly, this is independent of the ultimate goal of the start-up. It is irrelevant if the start-up pursues an exit strategy or a growth strategy. In any case, protection of the invention is crucial either as a major selling argument to a potential buyer or in order to secure market exclusivity for the developed product during the growth phase of the start-up.

While it is in theory possible at least for in-house conducted processes to protect developments and *know-how by secrecy* (e.g., specific process parameters in a

production process, such as temperatures, pressures, treatment durations, etc.), such a strategy is typically either not possible, because the launched products can easily be analyzed and reverse-engineered by competitors, or not advisable, because maintaining absolute secrecy is hard to achieve in a growing company in light of common staff fluctuations.

For these reasons, obtaining patent protection for the key development already at an early stage is usually the procedure of choice for technology start-ups in order to protect their inventions.

Before patent protection is pursued, the awareness of the *patentability requirements of novelty and inventive step* is crucial. Novelty is an absolute criterion for obtaining a legally valid patent. This means that an invention can only be protected if it has not been disclosed to the public by any means prior to the filing of the patent. Importantly, the *public* can in this case be represented by a single person who is not bound to a non-disclosure agreement ("NDA"). Furthermore, neither the form of disclosure (orally, in writing, presentations, etc.), nor the location (anywhere on the world), nor the language is relevant. The danger of destroying novelty of the own invention is often higher for start-ups than for established companies. The reasons for this are, among others, the need to describe and display the technology to investors and at start-up competitions in order to raise funding. Furthermore, in university settings of spin-offs, the pressure from academic partners, such as the university, collaborators, or professors, to publish the key developments in a research journal is usually high.

The following real-life example aims to illustrate this issue: A *technology-driven start-up* had a close cooperation with a material research group at a local university. In their joint-development project, they developed a new method for manufacturing 3D printed materials. In need of publications for increasing their chances of receiving research grants, the academic researchers urgently wanted to publish the results of the project in a peer-reviewed journal. It was absolutely crucial that the researchers informed the collaborating start-up beforehand, which allowed them to jointly file a patent application before the paper draft had been submitted to the journal. This situation illustrates the pitfalls of such a collaborative project. If the researchers had not informed their partners about the envisioned paper submission and no patent application had been filed before the journal published the paper, this publication would have been novelty destroying prior art in many jurisdictions, such as Europe.

Indispensable disclosures must be ensured, usually by means of references to confidentiality and corresponding agreements (e.g., NDAs). This should also be accompanied by training of the company's own employees and labeling of information exchanged with third parties. After the initial filing of a patent application, confidentiality is usually less critical. However, an NDA is often still appropriate before publication of the patent application, which takes place shortly after 18 months of the first filing date (priority date).

Although not being exhaustive and the authors strongly recommend to seek legal assistance for drafting an NDA, a typical NDA should in general cover the following aspects:

- Definition of the parties
  - Shall subsidiaries also be covered by the NDA?
  - Shall there be a restriction regarding the individuals having access to the information?
- Subject and purpose
  - Subject of protection must be defined
  - Definition of the information which shall be kept secret
  - For start-ups working with large industry partners: Shall it be allowed to advertise the collaboration/project with the partner?
  - Definition of purpose of use in relation to the confidential information
  - Form of information exchange (writing, delivery of items, oral, visual, etc.)
- Duties
  - Use of the information only for the defined purpose
  - Prohibition to make information available to third parties
  - Duty of care (using the same care and discretion to avoid disclosure, publication, or dissemination as the information-receiving party uses with its own similar information)
- Burden of proof
  - Should be with the information receiver, as otherwise it is hardly possible to prove an NDA breach
- Return/deletion of information after project has been evaluated
- Exceptions
  - Information which was already known to the recipient or made available without obligation of confidentiality
  - Information which has been obtained independently from the project
  - Information that has been gained after the project has been evaluated
  - Duty of promptly informing the other party if a court orders to disclose the information
- Requirement of written form for terminating the NDA
- Disclaimer of the information-disclosing party that the information is provided "as is" without warranties of any kind, and no liability for any damages arising out of the use of information disclosed under the NDA
- Clarification that no licenses under any trademark, copyright, or patent are granted by this NDA or any disclosure of information made under it (such licenses would belong in a separate development or other collaboration agreement)
- Place of jurisdiction, applicable law
- Sanctions in case of breaching the NDA
- Duration of the NDA
  - Definition of beginning and end of NDA

While NDAs provide some security when talking to externals, absolute security against self-generated novelty destroying prior art is to file a patent application before the invention is disclosed to any third party outside the start-up company. Following this logic, a *patent application should be filed at an early stage of the*

start-up. Sometimes, this is even done before the company has been founded. Noteworthy, almost any investor will ask the start-up whether their idea is protected by a patent or a patent application because patent protection significantly increases the security of the investment, prevents copycats from entering the market, and thus contributes to the success of the company.

2.3 Lesson 3: Choose the Right Filing Strategy

When it comes to patent protection, however, major concerns of start-ups are, understandably, the costs. This holds in particular true in light of the above, i.e., patent protection for the core development of the start-up should be pursued at a very early stage; however, at this stage, money is typically a major issue for the young company. Patents are powerful intellectual property rights, as they provide a 20-year monopoly for the patented technical solution. However, compared to other intellectual property rights, such as trademarks and designs, patents are relatively expensive. This is largely due to the high maintenance fees and because patents are geographic rights. This means that protection exists only in those countries in which the patent is active. As all intellectual property offices incur fees for obtaining a patent and for maintaining it in force, the costs can rise significantly, which makes it necessary to align the financial resources, the business strategy, and the intellectual property strategy of the young company.

After filing a respective request and payment of the related fees, the examination procedure of a patent application starts. In this stage, the application is examined as to its patentability in relation to the prior art, among other things with regard to novelty and inventive step (obviousness). Anything that has been made known in any way before the priority date, including by the applicant themself (e.g., at trade fairs, in brochures, discussions, scientific papers, etc.), is mostly no longer patentable. Therefore, secrecy is crucial (training of employees, secrecy agreement with third parties, as well as correct marking of documents exchanged with third parties).

In terms of *filing strategy*, the most efficient way is to perform a national first filing to secure a priority date and then file an international patent application within 12 months of the first filling, claiming priority of the earlier national application (see Fig. 1).

The priority application reserves the priority date, i.e., everything which has been published before the priority date forms prior art against the patent application. Then, after 12 months, an international application can be filed. The international application has the advantage that it provides for a valid patent application in 155 member states (as of February 2022) by a single filing in a single language. In contrast to a direct national route, only one filing and search fee must be paid and translation costs are at this stage dispensed with. Within another 18–19 months (i.e., in total after 30–31 months of the first filing), the applicant has to decide in which countries/regions the application shall be pursued further. This nationalization step is a major cost-intensive step, as any national/regional patent office selected requires fee payments; national representatives have to be appointed and translations may now

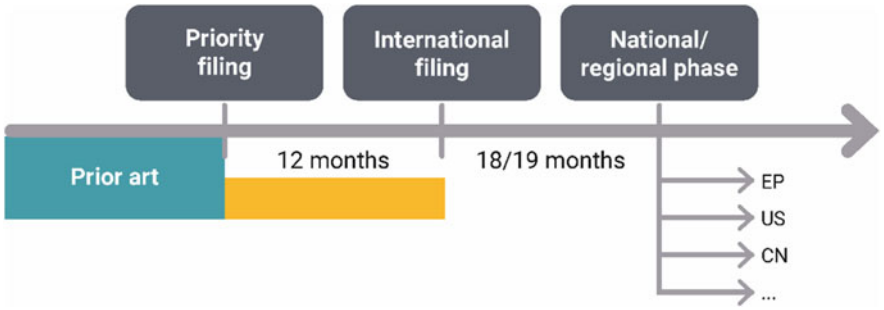

Fig. 1 Start-up filing strategies (authors' own figure)

become necessary. For a start-up, filing in the described manner has the advantage that the major costs are not due within the first year of the filing (as would be the case for multiple direct national applications), but are shifted two-and-a-half years into the future. This provides the start-up with valuable time to find investors for financing the further patent prosecution and/or to bring the product to market, which not only allows to generate income, but also allows for identifying over-performing and underperforming markets. The latter is beneficial, because the international application must only be nationalized after two-and-a-half years of the first filing. Thus, markets in which the product underperforms may not be pursued further, while the national phases can be entered in countries in which the product launch has been successful.

In summary, the filing strategy presented above provides more flexibility and shifts the major costs two-and-a-half years into the future from the first filing, which allows time to find investors or launch the product.

After founding the company and filing the first patent application, start-ups, being typically highly technology focused and thus innovative, significantly improve and develop their invention further. Additionally, the core technology may also be applied to other business segments or other products or the product portfolio is extended. If the improvements are made within the first 12 months of the first filing (i.e., within the so-called priority year), these improvements may be included in the international application. In this case, it must be ensured that the improvements are kept confidential until the international application has been filed because since these have not been described in the priority application, they can in many jurisdictions not validly claim the priority date and will therefore possess the filing date of the international application as the relevant date. For completely new developments, or if the priority year has already expired, a new patent application should be filed according to the filing strategy outlined above.

A real-life example of a *life sciences start-up* being active in the field of pharmaceutical drug research explains this scenario: The company filed a priority founding application based on promising biological data obtained for 15 newly developed compounds. The independent claim of the priority founding application covered among others those 15 compounds. Within the priority year, the company

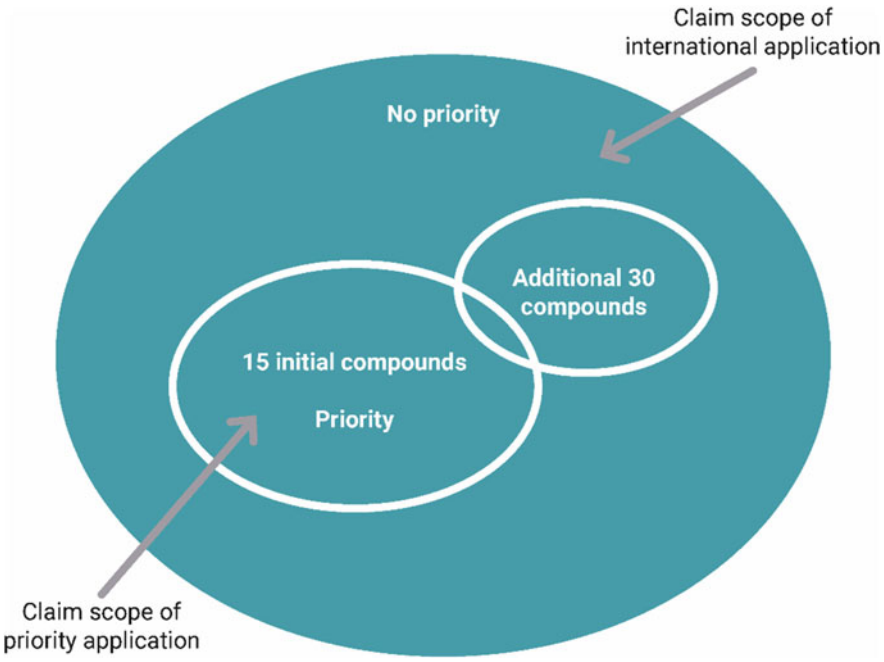

Fig. 2 Broadening the claim scope of a subsequent application (authors' own figure)

conducted further experiments and identified an additional 30 compounds, which also showed promising results. While certain ones of these new compounds were covered by the independent claim of the priority application, some of the new compounds were outside the priority claim scope (see Fig. 2).

Therefore, the independent claim of the subsequent international patent application has been broadened in a way that it covers all discovered compounds. It is, however, important to note that at least under European practice, only the subject matter which was already present in the priority application can benefit from the priority date. The compounds which were not disclosed, and which did not fall under the claim scope of the priority application possess the filing date of the international application as the relevant date for assessing prior art. Therefore, it was crucial that these new compounds were kept confidential until the international application had been filed.

2.4 Lesson 4: Find the Right Balance Between Budget and Scope of Protection

Patents are powerful tools for securing a company's intellectual property. However, compared to other registered intellectual property rights, such as designs and trademarks, patent rights bind significant financial resources. Therefore, it is crucial

to allocate the company's budget for intellectual property in the most efficient manner.

The filing strategy described in Fig. 1 allows a start-up to shift the major costs for entering the national phases with its international application two-and-a-half years into the future, a time span which should be used for securing funding for this cost-intensive step. Importantly, the decision in which countries the international application is pursued further cannot significantly be extended and this decision is terminal, that is, it is not possible to enter further national phases after, for example, 5 years from the filing date. The patent application automatically lapses in all countries in which the national phases are not entered. Entering the national phases in all 155 member states of the PCT is, however, not an option due to the high costs associated with this decision.

The following graph provides an overview of the total costs of an illustrative patent family over the years. The costs are shown in thousand Swiss Francs (CHF) and include all official fees with annuities, as well as local and foreign patent agent costs (see Fig. 3).

In 2010, a prior art search for a new invention had been conducted. In 2011, it had been decided to file an initial Swiss priority application. The costs in 2011 included drafting and filing the priority founding application.

As can be seen by the green bar rising in 2012, a PCT, an international application (PCT), had been filed 1 year later, claiming priority of the Swiss priority-founding application. The costs in 2012 were mainly caused by the official fees for the PCT application, including the search fee and the international filing fee as well as the inclusion of newly developed embodiments. Then, two-and-a-half years after the priority date, i.e., in 2013, national and regional phases had been entered in China, Europe (via a European patent application), and the United States, which can be seen by the respective rising bars. Thereafter, the examination proceedings began before the corresponding patent offices. In the European proceedings, a third party intervened, which raised the costs for examination proceedings. Finally, in 2016, the European patent was granted and was then validated in the EPC contracting states: Austria, Switzerland, Germany, Denmark, Finland, France, Italy, the Netherlands, Portugal, and Sweden.

The ratio of the costs per year and country of this patent family from the beginning of drafting in 2010 to the end of 2021 is around CHF 900 per country and year.

As can be seen, the selection of countries which are further pursued is a critical decision and should by no means be taken out of a mere gut feeling or influenced by the fear of missing out. For thoroughly assessing the optimal solution, a start-up should answer the following questions:

Where are your core markets? If your business analysis reveals that you will earn 60% of the revenues in the United States and 30% in Europe, it is important to cover these markets. Markets in which you may only earn single-digit revenues without growth potential may not be of utmost importance for patent protection. Of course, it is clear that a broader geographic scope increases the security against competitors

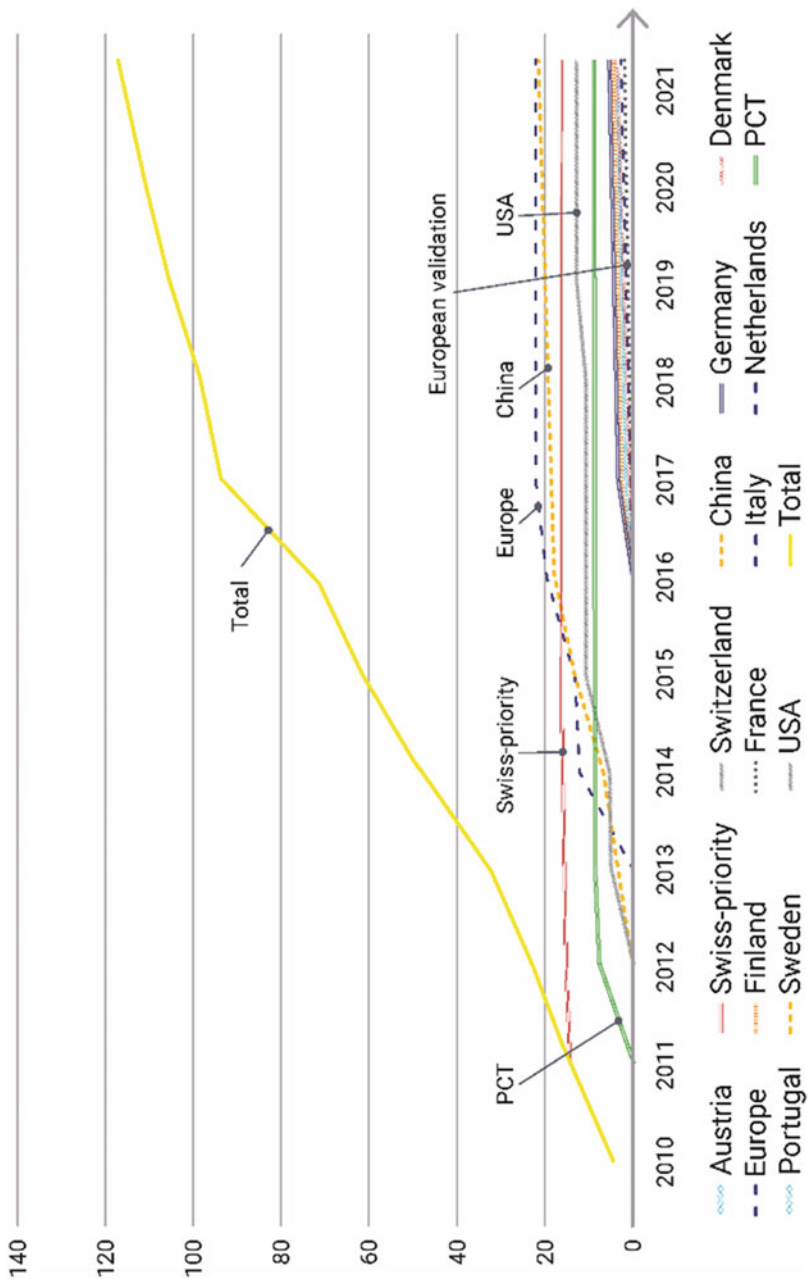

Fig. 3 Costs of an exemplified patent family over its lifetime (authors' own figure)

and copycats, but in view of the typically limited financial resources, the start-up's business analysis is a valuable starting point when assessing an optimal distribution of these resources.

What are potential growth markets? Besides your core markets, potential growth markets may also be considered for nationalizing an international application. If a specific market is seriously considered as a growth market, due to increased demand or growing prosperity, it may in addition to the identified core markets be advisable to select the one or two most promising growth markets. It should be considered that a patent has a maximum duration of 20 years and therefore it may be competitive advantage to reserve exclusivity also in a market which is considered to be growing significantly within the next years.

Where are your competitors located? The location of your competitors' facilities is valuable information when considering in which countries an international patent application shall be pursued further. If you protect your invention in the countries in which your main competitors are domiciled, then you can prevent them from copying your invention in their facilities and distributing it from there to the world.

What is your budget? Although it would be highly desirable to strive for world-wide protection of your invention, financial resources are limited and worldwide protection is neither possible nor typically necessary. Considering the questions above allows you to reach a deliberated decision for pursuing a suitable IP strategy with the available financial resources.

2.5 Lesson 5: Do not File a Quick-and-Dirty Provisional Application

To obtain strong patent protection, the invention, including examples and variants, should be described as completely and precisely as possible in the first application, since after the filing date amendments which go beyond the original disclosure content of the application are no longer possible. Therefore, great attention must be paid to the content of the first application, as it is usually only during the examination procedure (approximately 3 to 5 years after the filing date) that it becomes apparent whether the features of the invention have been correctly described. Founders being of the opinion that the priority founding application, respectively the provisional application, is not as important as the following international patent application, may, due to financial constraints and concerns, consider drafting the patent application themselves.

However, in the authors' experience, the priority founding application is the wrong project to save money on by drafting the application without professional support. Metaphorically speaking, building a patent portfolio may be compared to building a house. The priority founding application resembles the foundation of the house. If the foundation is defective, everything on top of it will suffer from it.

Often observed issues in applications having been drafted without professional support include:

- Describing the invention too narrowly such that the resulting scope of protection is small and competitors may easily find work-around-solutions;
- Describing the invention too narrowly or too broadly without suitable fallback positions such that the patent claims are not new over the prior art, which may only be retrieved in examination proceedings at a later stage;
- Describing the invention in an unclear manner, e.g., claiming only the result to be achieved, without disclosing how this result is actually realized;
- Describing the invention in a non-enabling manner, for example if essential features or crucial experimental results are missing.

One might be of the opinion that such issues are not crucial in the priority founding application, as professional help may be sought for filing the subsequent international patent application after 12 months and these issues can then be taken care of. However, such a proceeding may have fatal consequences. Especially in Europe, the requirements for validly claiming the priority of the priority founding applications are very strict. In particular, only the subject matter which is disclosed in the priority founding application can validly claim the priority date. Furthermore, if a priority founding application does not describe the invention in an enabling manner, the priority claim is typically invalid.

A subsequent international application may therefore not be entitled to the priority date, and the relevant date until which prior art will be considered will therefore be the filing date of the international application (see Fig. 4). This may in some cases not be exceedingly serious, but it is not uncommon that filing a priority founding application is equated by unexperienced applicants to assuming that the invention is now protected and that it can be shared with the public, for example via the company homepage.

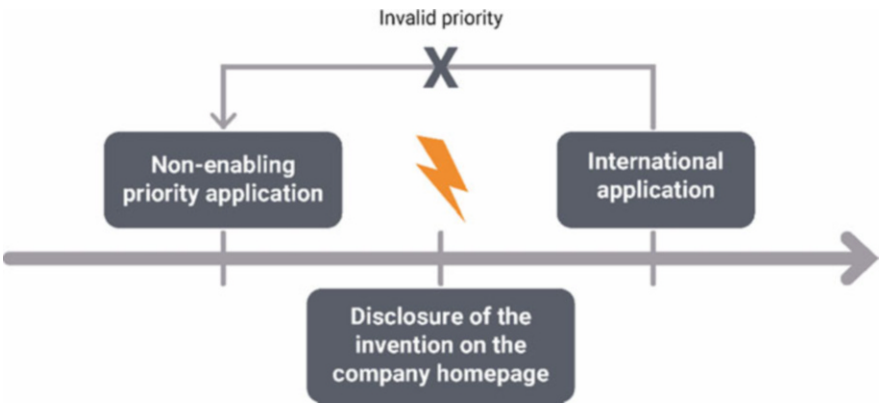

Fig. 4 Invalid priority (authors' own figure)

If such a publication of the invention is made in the priority year, i.e., before filing the subsequent international application, the own homepage disclosure forms in the scenario of an invalid priority claim prior art against the international application. In the worst case, the homepage disclosure may destroy the novelty of the claimed invention and suitable patent protection becomes impossible. This shows how crucial it is to take drafting of the priority application very seriously and seek professional guidance.

2.6 Lesson 6: Make Sure the Patents and Products are in Line with Each Other

By the time examination proceedings begin, the invention may have changed to certain extents. A constant dialogue and information comparison between the applicant and the patent attorney entrusted with the procedure is therefore highly important. In particular, when a company grows, it is not uncommon that patent prosecution and product development diverge. As patents bind significant financial resources, both the business strategy and the intellectual property strategy of the start-up should be kept aligned. In order to do so, at least annual portfolio review meetings should be conducted, in which it is assessed whether the current products are still covered by the patents. For example, it may be possible that a product is redesigned after some years in a way that it is not covered anymore by the patent claim. Alternatively, the patent claims may have to be restricted during examination due to colliding prior art documents, which may lead also to the fact that not all products are covered anymore by the claims. Portfolio review meetings aim to avoid such situations and to identify patents which may over time not be required anymore. This allows to reallocate the start-up's financial resources for protecting new inventions.

The following illustration serves to demonstrate this pitfall: A *medical technology start-up* has filed a patent application for a new blood testing device. The initially filed independent claim on the device is considered as not new in view of the prior art. However, it becomes clear from the examination proceedings that restricting the independent claim to a hydrophilic test strip coating would render the independent claim new and inventive. The entrusted patent attorney communicates this finding to the responsible IP person of the applicant, who assumes that all products marketed by the company include such hydrophilic coating on the test strips and instructs the patent attorney to restrict the claims accordingly. In the meantime, however, the development team found out that such a coating is not necessary and due to the lower production costs, the company plans to sell devices having test strips which are not hydrophilically coated. Unfortunately, however, the patent application had been restricted to devices having a test strip which is hydrophilically coated. Ultimately, this leads to the unpleasant situation that not all of the sold products are protected by the patent right. This illustrative example shows how crucial it is to align the IP strategy and the business strategy of the company and to ensure that the responsible persons are in regular exchange.

2.7 Lesson 7: "Perform a Thorough FTO Analysis"

Obtaining an own patent is often confused with having freedom to operate ("FTO"). This assumption is not only incorrect but can also be highly dangerous for an emerging start-up. Patents are exclusive intellectual property rights, which provide the proprietor with an up to 20-year monopoly for the claimed invention. This means that the proprietor can prevent competitors from manufacturing, selling, or offering the invention in any country in which the patent is valid.

However, the mere reason that a patent has been granted for a given invention does not mean that the invention can be marketed without infringing on another third party's intellectual property rights. The following example from the pharmaceutical sector illustrates this issue: *Pharmaceutical Company A* holds a valid patent for a pain reliever. The pain reliever efficiently decreases pain but leads to abdominal pain. *Start-up B* finds out that if the pain reliever is administered together with a specific vitamin, the occurrence of abdominal pain is prevented. The start-up may receive a valid patent for this combination because this combination is new and seems to be inventive. However, the start-up cannot market the combination product without the consent of the pharmaceutical company because the pain reliever itself is protected by a patent of Pharmaceutical Company A. In such a case, the start-up would require a license from Pharmaceutical Company A. This example demonstrates that own granted patents do by no means guarantee that the patented invention does not infringe on any other patents and can be marketed freely. Such scenarios may even open up the way for new collaboration projects. It frequently occurs that the clever ideas and approaches of a start-up cannot be commercialized without potentially infringing a patent right of a large player in their relevant business field. However, in some instances, the large company may have already abandoned the corresponding project; therefore, an initially negative result of a potential IP conflict may lead to a fruitful collaboration.

Neglecting or only half-heartedly taking this issue into account can—in addition to legal proceedings due to patent infringement—require considerable project delays and additional costs, e.g., due to necessary workarounds to avoid patent infringement.

Start-ups are often confronted with the question as to whether they have freedom to operate, i.e., whether they are free to market their product without infringing other patents. This question is of importance not only for potential investors but also for customers, who may integrate the start-up's product in their own products, for example a new functional textile material in a car or in an apparel item.

In order to answer this question, an FTO analysis has to be conducted. An FTO analysis comprises two parts, namely an FTO search, in which potentially relevant patents and patent applications of third parties are identified, and the FTO assessment, in which the risk for infringement of the identified patents and patent applications is assessed. There exist many third-party providers offering an FTO analysis, which however only deliver the results of an FTO search. While this is certainly helpful for generating a first overview of potentially conflicting IP rights, such searches do only half the job. The actual analysis part mostly consists of a

detailed comparison of the specific product(s) which are (to be) offered and sold by the start-up and the pending patent claims of the identified patents. As this assessment requires profound knowledge of national case law and infringement assessment practice, the actual analysis part of an FTO analysis should be done by a qualified patent attorney.

A fundamental problem of an FTO analysis is that patents are usually only made available to the public within 18 months after filing. Thus, an FTO search can usually not cover the most recent filings which occurred within the last one-and-a-half years, which is why an FTO analysis should at least be repeated once after 18 months. Furthermore, it normally takes 3 to 5 years until a patent is granted. Thus, if a potentially problematic patent application is found, it is far from certain whether a patent will ever be granted and, if so, what its claims will be. If the application appears to be sufficiently relevant and "threatening," there is nothing left to do in this case but to analyze the content of the disclosure in detail and to assess the proprietor's possibilities for adapting the patent claims. The disadvantage of uncertainty is contrasted by the advantage for potentially affected parties that, in the case of patent applications which have not yet been European patent applications, by means of a so-called "third-party observation." After the patent has been granted, the possibilities are much more limited, and the effort is often many times greater. Early knowledge of relevant third-party property rights at the application stage also has the advantage that more time is available to adapt to the situation and, for example, to develop non-critical alternative technical solutions (workaround solution) and to collect relevant prior art in order to attack the patent if necessary. Thus, if a potentially relevant application is discovered during an FTO analysis, its legal status should be continuously monitored.

In the interest of low entrepreneurial risk, it is advantageous to carry out a freedom-to-operate analysis at an early stage and, if possible, before major investment decisions are being made. However, this is only possible to a limited extent because, for example, many detailed technical solutions in a larger development project are only realized in a concrete manner in the course of the product launch. In many cases, therefore, a multi-stage approach with at least (1) a first step at an early stage; (2) a second step before major investments; and (3) a third step at or immediately before market entry makes sense. It should be noted that relevant IP rights may also emerge at a later stage due to the delayed publication and the duration until grant.

3 Use Cases

Case: University Spin-Off

A doctoral research project at a local university focusing on a novel technology in the field of life sciences culminated in such promising results that three entrepreneurs decided to found their start-up company based on these key results. In this situation, one of the founders had still been enrolled in the graduate school

program and was therefore employed by the local university, while the other founder had worked on the project during her undergraduate studies in the course of her master's thesis. After discussing IP protection both with their supervising professor as well as the technology transfer office of the university, it was decided to pursue patent protection for their invention. At the outset, it was clear that the university was at least partially entitled to the rights of the invention, as one of the founders had been 100% employed by the university. However, the university did not own all rights to the invention because the other founder had been an undergraduate student without being employed by the university at the time the invention was made and thus she was personally entitled to parts of the invention. As she transferred her rights to the newly founded company, the patent application was filed in both the name of the university and the start-up company. The start-up and the university further negotiated a license agreement according to which the start-up became the exclusive licensee of the technology. Other important aspects which should be covered in such license agreements are the distribution of responsibilities for patent prosecution, i.e., where and how the patent application shall be pursued further, as well as the distribution of costs for patent prosecution.

For filing the first patent application, it had been decided to file a national priority founding patent application due to the lower filing and search fees as compared to, for example, a European patent application. Within 12 months after the priority filing, an international patent application was filed, claiming priority of the first national patent application. This filing strategy had significant financial advantages for the young start-up company. While it would have been hardly possible to directly file various national patent applications in all their important markets, namely the United States, Europe, Japan, South Korea, and China, the international filing strategy allowed for filing an application which is valid in these countries/regions without directly incurring substantial costs within the first year of their journey, a time at which financial resources were not yet readily available.

After filing the international application, the founders showcased their technology at various different start-up competitions and demonstrated its value to potential investors, which not only allowed them to secure early funding in an amount of over €100,000 and awards, but ultimately allowed them within one-and-a-half years after filing the priority application to successfully close a first major seed round. As the patent application had already been filed and the founders accurately ensured that non-disclosure agreements were used with third parties, it had been made sure that no own novelty destroying publication had been generated. Furthermore, the company already attracted the interest of various customers and could market its first products relatively early, which generated further income for the young company.

Having generated considerable financial resources within the first 2 years after filing the priority founding patent application, the start-up had sufficient money available to invest in the cost-intensive step of nationalizing their international application after two-and-a-half years from the first filing in the important

markets. Depending on the length of the patent application, the costs for entering the national phases in the "big five"—*China*, *Europe*, *Japan*, *South Korea*, and *the United States*— range generally between €30,000 to €40,000 covering official fees, translation fees, and the fees of the local representative who must be appointed.

The start-up further implemented internal innovation meetings at which they discuss newly developed technologies and processes. Together with their patent attorneys, they assess the potential of the new developments and ultimately decide on whether or not to file a new patent application.

This example shows that although patent protection is a cost-intensive intellectual property right, a major part of the financial burden can be reduced by filing an international application, which provides the company with two-and-a-half years of time to launch the product and secure sufficient financial resources to finance a solid global patent portfolio. ◄

Case: Established Start-Up

A start-up has developed an innovative solution in the field of mold making for injection-molded items. After initially difficult times, the start-up has finally obtained a product order for several injection molds which after production will be shipped to various countries around the world, where they are used by other companies specializing in the manufacture of injection-molded items on behalf of an international corporation. Before the order is placed with the start-up, the latter prepares a quote. Then, the project manager, together with the general manager, signs the contract with the client, which is a large international cooperation. The contract is in English and is, due to its length and complex wording, not studied in detail. The clauses concerning the warranty are also only skimmed over and seem at first glance to be in order. The start-up has been awarded the contract because it can again significantly reduce the cycle time with a new idea for cooling. The head of the development department of the start-up recently saw a similar solution on the booth at a trade fair of a competitor. He came up with an idea of how to achieve even better cooling by swirling the cooling water. The first injection mold is working very successfully, and it seems that the remaining molds can also be successfully implemented for production.

During a plant tour, in which an employee of the competitor participates, the head of the development department proudly explains the cooling of the mold, which is still in the facility of the start-up for testing purposes. A few days later, the managing director receives a letter from the patent attorney of the competitor with reference to a patent family of the competitor, which includes property rights in Europe and the United States. In the letter, the managing director of the start-up is requested to confirm in writing that the start-up will not infringe the competitor's intellectual property rights. Furthermore, it is requested to disclose how many of these molds have already been delivered. In the event that the competitor's property rights are nevertheless infringed, the competitor would reserve its right to file a lawsuit for patent infringement.

The start-up now has to seek counsel of a patent attorney, which it has not deemed necessary before. After an analysis, the patent attorney concludes that a patent infringement would be affirmed by a court with a high probability. She therefore recommends refraining from implementing the technology in question, as this could result in charges being brought against the start-up and their customer in particular for infringing the competitor's patent. The start-up is now faced with the problem that without the new cooling system, the promised cycle time cannot be met, but if the new technology is implemented, there is a risk of one or more patent infringement suits, which would put the start-up and its customer in particular at risk. The start-up's future is at stake. The large order threatens to become a massive and potentially existence-threatening problem. In such a scenario, the next options for the start-up include (a) negotiate with the competitor and try to obtain a license and (b) collect facts and evidence which challenge the validity of the competitor's patent rights.

Obtaining a license from the competitor may be difficult to achieve, in particular in light of the rather aggressive behavior of the competing party. In fact, the bargaining position of the start-up would be much better if it had something to offer in return to the competitor. If the start-up had filed a patent application on the cooling system, before disclosing it to the public, it would have been possible to negotiate a cross-license. This exemplifies another important aspect of securing its own intellectual property by filing patent applications, namely, to generate a larger patent portfolio which increases the company's bargaining position.

Collecting facts and evidence to challenge the competitor's patent rights does not necessarily mean that the start-up must actively attack the patents in *inter partes* proceedings, at least not yet. However, if the start-up was in a position to present a strong case based on new material which shows that the claimed invention had already been known before the relevant date of the corresponding patent, the bargaining position of the start-up is increased. A convincing case may even make the competitor reconsider to file an infringement suit as it may risk to lose its patents, or it may at least increase the chances for settling the issue in an amicable manner. Obtaining such facts and evidence is often not easy. Many patent families comprise different family members in different countries. For example, a patent family having granted patents in *China*, *Europe*, *Japan,* and *the United States* means that four well-recognized patent offices conducted searches and/or performed a detailed examination proceeding in which the patentability of the application has already been assessed. However, this does by no means mean that a granted and examined patent cannot be validly challenged. In fact, around *almost 70% of the granted patents attacked in opposition proceedings at the European Patent Office are revoked* or at least restricted in scope, because the opponent presented new facts and evidence which challenged the patentability of the claims held allowable during examination (Burema & van Duijvenbode, 2016). Furthermore, patent offices focus their searches mainly on patent literature and in the life sciences field also to the scientific literature. Understandably

however, patent offices do not search for and are also often not aware of relevant brochures, presentations at meetings, or on the competitor's homepage. ◄

4 Learnings and Takeaways

Protecting their intellectual property is crucial for technology- and science-driven start-ups. Importantly, this is relatively independent of the pursued business strategy. In most cases, a successful exit requires a strong IP portfolio because potential buyers are often interested in the technology developed by the start-up. If this technology is not sufficiently protected, then the buyers themselves or competitors can readily copy the technology, which decreases the attractiveness to buy the corresponding start-up. Also, growth strategies rely in many cases on secured intellectual property. The core asset of technology- and science-driven start-ups is the developed intellectual property. While being agile and creative, start-ups cannot compete with the economic and human resources of large industrial players in their field. Therefore, it is of utmost importance to secure the technological advance to successfully pursue a growth strategy.

Takeaways

The lessons discussed in this chapter for start-ups securing their intellectual property aim to avoid many common pitfalls along the journey of a start-up:

1. Ensure that the invention actually belongs to you.
2. Be aware not to destroy novelty before filing a patent application.
3. Choose the right patent filing strategy.
4. Find the right balance between your budget and scope of protection.
5. Do not file a quick-and-dirty provisional application.
6. Make sure that patents and products are in line with each other.
7. Perform a thorough FTO analysis.

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Louis Lagler works as patent attorney and as an advisory engineer. His principal activities are the areas of mechanics, injection molding technologies, electrical engineering, computer software, especially computer aided design (CAD), and finite elements methods (FEM). He studied mechanical engineering at the Swiss Federal Institute of Technology in Zurich (ETH), focusing on airplane statics and lightweight construction, as well as combustion engines. After the conclusion of his studies, he worked as a scientific assistant at the institute for lightweight construction and cableway techniques together with Prof. Dr. Hans-Reinhard Meyer-Piening and was in charge during 3 years for a Brite-Euram project as well as for holding lectures on fiber composites and structural stability. From 2012–2018, Mr. Lagler was president of the Association of Swiss Patent and Trademark Attorneys. Now he is a member of the board of the Association of Swiss Patent and Trademark Attorneys.

Christian Ebner studied chemistry at the Swiss Federal Institute of Technology in Zurich (ETH) and specialized in the field of complex organic synthesis. After his master's thesis at the Scripps Research Institute in La Jolla, California, he conducted his postgraduate studies at the Laboratory of Organic Chemistry at ETH Zurich. His dissertation focused on the area of natural product synthesis, reaction development, and the synthesis of bioactive target molecules.

Christian Ebner is a European and Swiss Patent Attorney at Rentsch Partner Ltd. and advises many start-up companies on patent protection, patent enforcement, and their IP strategy. At Rentsch Partner, he is in charge of the Start-up Desk and regularly organizes IP workshops and IP strategy assessment for technology and life sciences start-ups.

Blind As a Mole? How Patent Data can Help Start-ups to Compete

Sevim Süzeroğlu-Melchiors

1 The Deal Is: Exclusionary Right in Return for Disclosure

Since the first recorded patents in the 15th century, patent applications have been systematically recorded. If a patent application meets the requirements of novelty and is innovative, it is granted a patent.

Today, the long-term trend of increasing patent applications can be observed year by year with impressive growth rates. The *World Intellectual Property Organization (WIPO)* patent statistics published in 2022 state that in 2020, 3.3 million patents were filed worldwide, of which 1.5 million were granted. In total, there are 15.8 million patents in force globally. In 2020, the *China National Intellectual Property Administration (CNIPA)* led the ranking of the top applicant countries with 1.4 million patent applications received. This vast amount of patent data in different languages makes it difficult to make full use of patent data, especially for non-IP specialists such as start-ups.

The advantages of the patent system are clearly there. The overall idea is to promote the development of innovation by granting the inventor exclusionary rights and in turn publishing and reciting essential aspects of the invention accessible to everyone. Those who can read patents and can handle this data can take advantage of an enormous pool of information and knowledge and get insight into industry trends and future research and developments worldwide.

S. Süzeroğlu-Melchiors (✉)
Technical University of Applied Sciences Regensburg (OTH Regensburg), Regensburg, Germany
e-mail: sevim.suezeroglu-melchiors@oth-regensburg.de

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_24

But data is only useful if transformed into information or into a "story." Correctly interpreted patent data becomes actionable and valuable information, and is the source of further development and inspiration.

Therefore, the purpose of this chapter is to provide readers with insights and hands-on recommendations regarding the following:

1. Understanding how patent data can support start-ups in identifying opportunities and help in avoiding risks.
2. Describe the most important patent-based search reports and analysis along the venture life cycle.
3. Present in-depth examples for a technology scouting of "biodegradable materials" and show the making of a patent landscape for "quantum computing."

Taken together, this contribution should enable the reader to identify and make best use of patent data and analytics.

2 Patent Data-Based Search: An Insightful Means for Start-ups along the Venture Life Cycle

It is crucial that start-ups identify *opportunities* and potential *risks*. A start-up's ideas often develop or become more concrete over time. Based on my experience with university start-up teams, few start-ups think about patent searches or patenting their invention in the early phases. Above all, gaining knowledge can foster new ideas and inspire especially at the beginning. Patent data is a valuable source for searches along the four venture life cycle phases:

- Seed phase patent search;
- Start-up phase patent search;
- Growth phase patent search;
- Maturity/exit phase patent search.

Figure 1 shows a selection of patent searches along the four venture life cycle phases.

2.1 Seed Phase Patent Search

Start-ups can use a patent search to identify the likelihood to generate patents and the potential infringement risk, develop a distinctively unique selling proposition (USP), and get an overview about all relevant players in a specific technology space. In the seed phase, the innovation processes are about identifying opportunities, analyzing them, and then developing ideas to exploit these opportunities. The idea is continuously detailed, validated, and modified. At this point, the business idea should be turned into a prototype with minimum requirements as quickly as possible. This is referred to as minimum viable product (MVP) or minimum functional product (MFP). At this stage, the aim is to reach customers and investors as quickly as

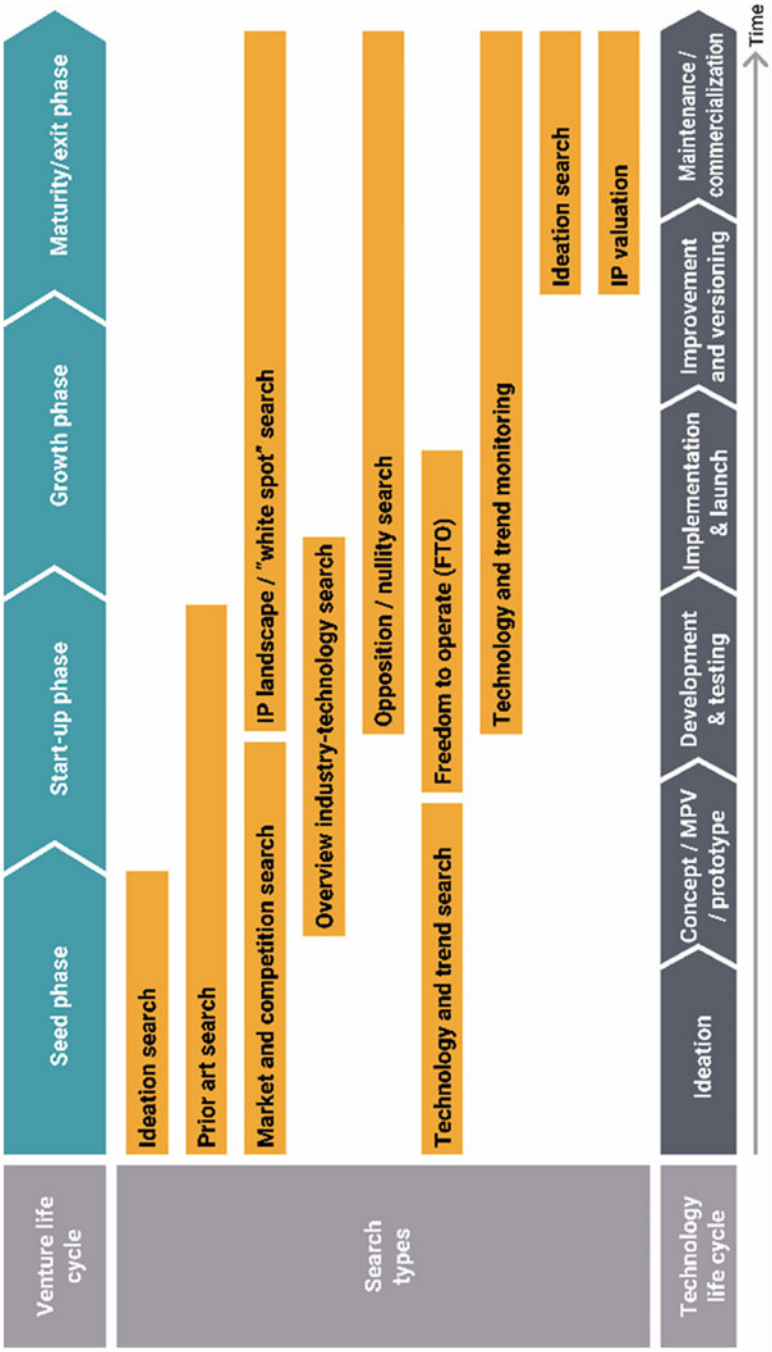

Fig. 1 Patent data-based search along the four venture life cycles (author's own figure)

possible with a novel and valuable idea or product to collect feedback. Patent data can be used in this phase to search for prior art and novelty and can be a source for the ideation itself.

A conflict that start-ups face within this phase is that they disclose their invention intentionally or unintentionally to the public. Start-ups often find themselves in a tension between marketing their innovative idea to attract potential customers and investors on the one hand. By doing so, they might risk losing novelty if disclosing too much information on the other hand.

2.2 Start-up Phase Patent Search

At this stage, the legal entity and company are established. Core activities within this phase are prototype development, product and technology development, and testing. The lean start-up concept suggests to quickly proceed to market launch, collect feedback, adapt, and improve. In this phase, the idea develops into a commercialized offer. It is particularly important to check beforehand whether any rights of third parties are infringed. A freedom-to-operate (FTO) search is usually carried out for this purpose. The FTO search should be conducted by an expert such as a patent lawyer or a patent searcher. This type of search is certainly time consuming and costly. Therefore, the patent should be of high value and strategic importance to the start-up. Consequently, not all start-ups can afford an FTO in the early phases.

2.3 Growth Phase Patent Search

The growth phase is typically characterized by a large and/or exponential growth of the venture. In this phase, the focus is on expansion and diffusion into further market segments and countries. During this phase, successor versions are often launched, the customer base is expanded, and various strategic partnerships are developed. In most cases, existing or new competitors have entered the market and/or copycat products and substitute solutions have become established. Patent search can help to detect if other parties – for instance, competitors – are infringing own protected products and solutions with an opposition or nullity search. Patent data can be used to track whether new technologies are being developed via patent landscapes and can help to monitor new technologies and trends on a regular basis. When the results of patent searches such as "white spots" are properly integrated into the R & D process, this again can be the source for new innovations.

2.4 Maturity and Exit Phase Patent Search

In the maturity phase, the company is at its peak. The constantly changing customer needs can be satisfied, internal discipline and organizational culture can take effect, and production operates with maximum efficiency. However, the maturity phase is also characterized by increased competition, indifference on the part of customers to

the company's services, and saturation of the market. The company then enters a phase of maturity or stabilization, which represents the peak of the company's development.

Various life cycle theories either see the decline of a company as an inevitable fate once it has reached a certain level of maturity, or the company succeeds in reinventing itself. In the maturity phase, patent data can be used to renew *ideation*. In the event of an exit through M & A activities, selling, or liquidation of the venture, the valuation of the IP becomes relevant. As already described within the investor view section of this book, IP is most crucial at the early and exit stages. For this purpose, patent data is used to evaluate firms' technological claims. This goes into the monetary *value of the patent*, which in turn adds to the *valuation of intangibles* of the company. Figure 2 illustrates an overview of patent reports, search questions, and specifications.

Overall, a patent-based search can answer important questions within the development and growth process of the start-up, such as:

- Is your idea truly "new"?
- Are all competitors known and what is the competition doing?
- What does the technological space look like and can it serve for inspiration and ideation?
- Do competitors and other market players infringe the start-up's protected patents?
- How much is the value of the start-up's IP?

One important *limitation* to be mentioned is that patent applications are published *18 months* after their earliest filing date. This means that the actuality of the researched data is at least 18 months old. In the time span between the search date and the last 18 months, further patent applications may have been filed since these have not yet been published. There is always a probability that the patentable idea is no longer new.

3 Overview of the Most Common Patent Searches

3.1 Ideation/Technology Scouting

A patent search can inspire the start-up with existing solutions, and research and development, even without the intention of filing a patent application. For example, it can give the founders detailed insights into a technical subject area. Comparing your IP whether registered or not to published patents could stimulate you to come up with new ideas or improvements for innovations and inventions. Particularly, it can help to assess if the start-up's invention is really a USP [1] and if the differentiating power is clear and distinctive compared to market leaders, established and known companies.

[1] Unique Selling Proposition (USP).

Search type	Search question(s)	Time / start-up life cycle phase	Result(s)	Challenges/ limitations	Typical search strategies
Ideation/ technology scouting	• If a certain technology is increasingly used by market participants and implemented? • Is there a trend for the application of the technology AB in sector X recognizable?	• All start-up life cycle phases • For strategic consideration or questioning about the relevance of certain technologies	• Evaluation and analysis of patent activities in the selected technology area	• Expressive interpretations of analysis results without bias	• Relatively broad search string and statistical analysis and interpretation • Use of IPC classes
Prior art search and novelty search	• Is solution ABC patentable? • Which solutions can be used (>20 years old)?	• Seed phase / start-up phase • Usually after ideation / disclosure of invention	• Prior art / assessment of patentability • "Unprotected" prior art	• Unlimited data volume - there is no exclusion criterion per se	• IPC classes** and/or semantic + citations/ similarity search • Narrowing >20 years
Freedom-to-operate analysis	• Are there any existing IP rights to the ABC solution?	• Start-up phase / growth phase • Typically to be completed prior to "commitment" or "go-decision"	• Statement about the freedom to operate of the solution ABC regarding searched patents	• Focus and limitation of the search	• Restriction to active IP right and relevant countries • If necessary, further restriction (e.g. selected applicants)
Industry and technology search	• How should the patent situation for the subject area AB be assessed in general (risk, IP protection, competitor activities)?	• Start-up phase • Early at the beginning of start-up / product development	• General findings on a topic area/ technology • Derivation of findings for later detailed consideration/ follow-up	• Achieve actual relevant search result to ensure meaningfulness of interpretation	• Relatively broad search string and statistical analysis and interpretation
Market and competition search	• Are companies X, Y, Z working on the AB topic? • What is is company X working on right now?	• Seed phase / start-up phase • Often in case of concrete suspicion / indication of competitor activity	• Overview of significant IP activities of defined competitors	• Ensuring that all applicant names of a competitor have been taken into account	• Restriction to applicants • Focus on recent past
Opposition / nullity / validity search	• Is a granted or pending or about to be granted IP right legally valid or contestable?	• Start-up phase / growth phase / maturity phase • After discovery of the relevant IP right	• Assessment of the legal validity or attack ability of a third-party IP right	• Patent has already been searched by examiner (PTO)* • Find other "search possibilities"	• Consideration of already performed patent searches • Often focus on non-patent literature • Based on the focal patent right
IP landscape/ white spot search	• How does the technology space and market players look like? • Are there "white spots" in the patent landscape?	• Growth phase / maturity phase • After market launch / continues improvements of product/ technology	• Overview of current patents in any technical space • Identification of "white spots" which lead to new business opportunities which are not described through patents yet	• Limitations of search • Lack of relevant data or wrong data and inaccurate statistics	• Technology classes and / or semantic + citations / similarity search • Seek out the important information while eliminating the noise of irrelevant data and documents

* Patent and Trademark Offices (PTO)
** International Patent Classification (IPC)

Fig. 2 Overview of patent reports, search question(s), and specifications (author's own figure)

Another benefit is that trends can be observed and recognized at an early stage. Innovative products and technologies can often be identified well in advance of their market launch in the form of disclosed patent applications. The time lag between patent publication and market launch varies widely among industries. In some industries such as life sciences and pharmaceuticals, it may take over 10 years on average until the product is launched (Lexchin, 2021). In other industries with short technology life cycles like software-driven technologies or automotive engineering, the time lag is only one year or less. Then patent information is a source for short-term product technology monitoring. In either case, companies can benefit from patent-based technology and trend scouting to:

- Identify new disruptive innovations and trends;
- Monitor long-term and short-term technologies;
- Spot upcoming and new competitors;
- Screen technology field for complementary technologies.

In the following special section, an excerpt and a simplified description to create a technology scouting using patent intelligence for the technical field of "*biodegradable solutions for primary packaging"* are described.

Technology Scouting: Evaluating Biodegradable Solutions for Primary Packaging[2]

PatSnap is a global IP software and services company focusing on innovation intelligence services that can help to manage risk, spot new opportunities, defend innovations, and keep an eye on the competitive landscape.[3]

A. Identify Main Business Question(s):

- What well-known *biodegradable materials blends* are being used for *primary packaging*?

The result of the first search iteration leads to a list of biodegradable material(s). Next, further questions are identified for each material spotted, such as:

1. How is biodegradability?
2. To what extent is it commercialized?
3. What does the SWOT[4] analysis for material look like?

[2] Based on data provided by the PatSnap research and analytics team, PatSnap Ltd., Singapore. Used with permission.

[3] https://www.patsnap.com

[4] Acronym for strengths, weaknesses, opportunities, and threats.

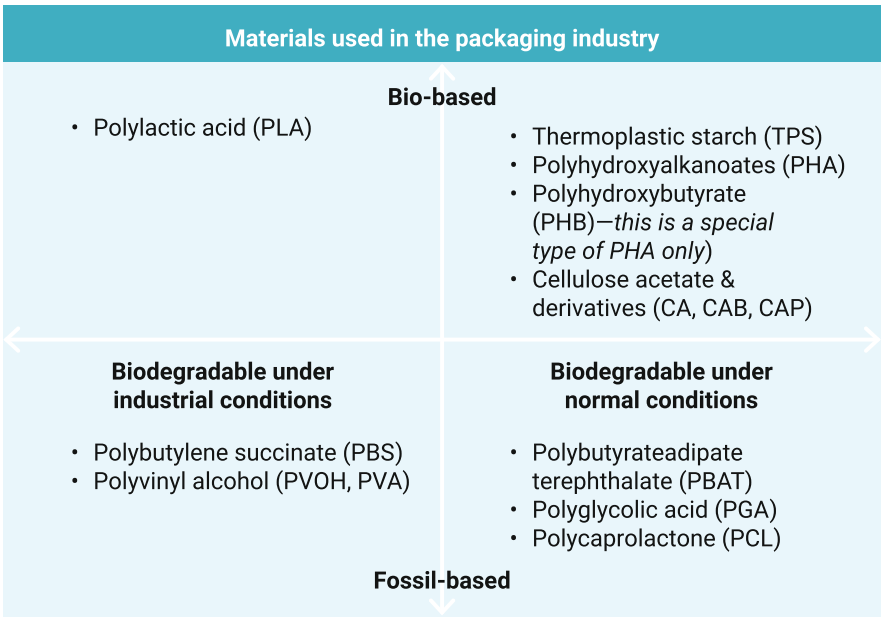

Fig. 3 Materials positioning within the packaging industry (source: Patsnap analytics team)

4. Is there a work-around already available to overcome any weakness of the material?
5. Who owns IP on the material or is commercializing it and where?

B. Overview of Materials Used in the Packaging Industry

A positioning within the industry highlights existing material technologies. Figure 3 plots the researched materials into a 2 × 2 matrix with the following fields: *bio-based* versus *fossil-based* and *biodegradable under industrial conditions* versus *biodegradable under normal conditions*.

C. In-Depth Analysis of Each Material – Here Polylactic (PLA) Has Been Shown

Patent activities for Polylactic (PLA) technologies are analyzed. The patent documents are interpreted. Findings are summarized, such as:

- A non-cellulose-based solution, although cellulose-based blends are under research;
- Widely researched and adopted by the packaging industry players;
- Already in commercial use by companies like *NatureWorks* and *Total Corbion PLA* for food packaging;
- PLA has good moisture barrier properties.

Market Status

Polylactic acid (PLA) is already widely used in packaging applications, especially in food packaging. It is anticipated that the growing consumption of packaged foods will further drive the packaging industry to employ this as a primary biodegradable material over the coming years – global market for PLA was expected to become more than $5 billion by 2020.[5]

The high market and research activities in PLA are a signal for stronger future growth, and more companies are expected to enter this domain, which means more options and better availability of packaging.

Biodegradability

PLA is biodegradable under certain circumstances (Tsuji & Shinya, 2021), as enzymes like Proteinase K, which can catalyze the hydrolytic degradation of PLA, are not available in the environment except on rare occasions. That is why there has been research on various blends of PLA to improve its biodegradability. On the plus side, PLA commonly uses cornstarch as a raw material, which is available in abundance and is also biodegradable.

D. Which Solutions Are Existing to Counter Weakness of PLA
Table 1 provides an overview of weaknesses and solutions of PLA technology.

E. Market Players Identified (Selection) Providing PLA Packaging or Owning Technology for PLA Packaging
Table 2 provides an overview of market players and technologies for biodegradable solutions. ◄

3.2 Prior Art Search and Novelty Search

Most innovations are not genuine innovations. Someone else somewhere else in the world has already presented the invention to the public and/or patented it. Prior art is *any* evidence that your invention is already known, as stated in the advisor's view part of this book. The purpose of the prior art search is to find out if the invention is already known.

Is the invention or idea new? Few innovations are truly new. Findings in one area have often been known for a long time in another. The novelty search is carried out specifically on the basis of an existing invention, in order to determine the obvious prior art. But even if an idea is novel, novelty on its own may not mean much. To be patentable, an invention needs to have a commercial potential and there needs to be a

[5] https://www.grandviewresearch.com/industry-analysis/polylactic-acid-pla-market (accessed November 02, 2022).

Table 1 Weaknesses and solutions of PLA technology (source: Patsnap analytics team)

Weaknesses	Solutions
Low strength (fragility) and **shelf life**[a]	*Total S.A.,* under the name of *Fina Technology Inc.*, has filed a couple of patents that seem to counter this particular weakness of PLA – [US10125249B2] and [US9796842B2]; both of these patents discuss a biodegradable polystyrene blend that is strong enough to be used in a wide variety of applications. However, there isn't any explicit indication that this blend is in commercial use. CJ CheilJedang Corp., a South Korean food company has a patent [US9328239B2] that talks about a biodegradable blend of PLA containing polyhyroxyalkanoates, which improves reproducible mechanical properties for the overall composition.
PLA is **degradable only under certain conditions**[b]	A Netherlands-based company by the name of *BioFutura* has developed a proprietary crystalline PLA (CPLA) material that is a combination of PLA (70–80%) and chalk (20–30%) and other biodegradable additives. According to the EN-13432 composting standard,[c] CPLA products are 100% biodegradable and compostable, i.e., in an industrial composting facility under optimum conditions (oxygen, moisture, and heat), this PLA will be fully composted in 8–12 weeks.
Poor oxygen barrier properties compared to petroleum-based plastics, such as polyethylene terephthalate (PET) or polystyrene (PS)	The research paper by Carosio et al. (2014) discusses a layer-by-layer deposition technique on commercially used PLA thin films (30 μm thick) in order to increase their barrier properties to oxygen and water vapor. *Unitika* has filed quite a few patents on a couple of different PLA blends, i.e.: PLA +Wax in [US7972669B2], [KR1376642B1] and [JP05264176B2]; PLA + Silicate in [KR1183260B1]. According to their patents, these blends will have excellent moisture and oxygen barrier properties. However, there is no indication that these blends are currently commercialized.

[a]https://www.biofutura.com/en/materials/pla (accessed November 02, 2022)
[b]http://www.biosphereplastic.com/biodegradableplastic/uncategorized/is-pla-compostable/ (accessed November 02, 2022)
[c]European Standards EN 13432:2000 Packaging. Requirements for packaging recoverable through composting and biodegradation

Table 2 Overview of market players and technologies for biodegradable solutions (source: Patsnap analytics team)

Market players	Solution	Geography	Comment
TAG Packaging Start-up Established 2014	*TAG Packaging* produces 100Bio™, the world's first 100% compostable foam food packaging. The non-toxic product line that includes disposable tableware, bowls, and fresh food trays completely biodegrades in a commercial compost in less than nine weeks. The packaging is made from Polylactic Acid (PLA), a plant-based bioplastic. After useful life, 100 Bio™ foam can be recycled, incinerated, composted, or even converted back into lactic acid.	Headquarters: El Segundo, California, USA	The certified PLA is sourced from *NatureWorks LLC*, a company based in Minnesota, USA. PLA foam has suitable material properties including cut, leak, and heat and shock resistance. *TAG Packaging* also provides customized foam packaging for Electronics and Cosmetics Packaging.[a]
Unitika Company Established 1889	*Unitika* has filed quite a few patents on a couple of different PLA blends, i.e., PLA + Wax in [US7972669B2]; [KR1376642B1] and [JP05264176B2]; PLA + Silicate in [KR1183260B1]. They claim that these blends will have excellent moisture and oxygen barrier properties. However, there is no indication that these blends are currently commercialized.	Headquarters: Osaka, Japan Presence: USA, Germany, Brazil, China, Thailand, Indonesia, Hong Kong, Japan, South Korea, and Vietnam	*Unitika* being a functional materials manufacturer seems to have a good hold on advanced materials and their biodegradable blends.
Total S.A. Company Established 1956	*Total S.A.* is one of the major players when it comes to PLA; they filed a couple of patents, [US10125249B2] and [US9796842B2] under the name of *Fina Technologies* (a subsidiary of	Headquarters: Tour total, Courbevoie, France Presence: Africa, Asia-Pacific, Europe, Middle East, North and South America	In 2016, *Total* and *Corbion* entered into a joint venture to develop PLA-based bioplastics. Two years after the collaboration, they successfully produced Luminy® PLA-based resins that are 100%

(continued)

Table 2 (continued)

Market players	Solution	Geography	Comment
	Petrofina, which merged with *Total* when it acquired *Petrofina* in 1999), which centers on a blend of PLA with polystyrene. These blends claim to hold the mechanical properties of polystyrene while making the overall composition biodegradable.		biodegradable and renewable.[b] Now, it might be the case that they have protected these PLA resins using [US'249] and [US'842], which might give them an edge over the other suppliers.
SUN YAT-SEN University University Established 1924	This university, along with *Jiangsu Southern Packaging Co Ltd.*, is researching how to prepare a tailored composition of PLA that has excellent and easy-to-process mechanical properties. They filed this patent in China [CN106751625A] in 2018.	Headquarters: China Presence: China	*Jiangsu Southern Packaging Co Ltd.*, the partner of *Sun Yat-Sen University*, is one of the leading producers of rigid and flexible packaging products in China. This indicates that the university can be a good partner for research work in China.
South China University University Established 1952	This university has done research on the composition for a biodegradable plastic using a blend of Chitin and PLA; they filed a patent in 2018 [CN106221160A].	Headquarters: China Presence: China	Chitin is the second most abundant biopolymer on earth. Research indicates an immense possibility of using this resource, i.e., from the waste produced by the seafood industry. This PLA blend can be an inexpensive alternative compared to others, and since the university is the sole proprietor, there is a chance that they might be willing to license out this technology.
M & H Plastics Company Established 1973	*M & H Plastics* offers packaging solutions to various industries. They recently started focusing on environmentally responsive products and trialed PLA in various	Headquarters: Rushden, Northhamptonshire, UK Presence: Australia, USA, UK, Europe	In 2010, haircare company *Philip Kingsley* used biodegradable solutions of *M & H Plastics* for the packaging of its products. *M & H* also claims that the material

(continued)

Table 2 (continued)

Market players	Solution	Geography	Comment
	manufacturing processes.		decomposes at a very fast rate and provides environmental benefits. *M & H Plastics* already has some experience in handling the packaging of cosmetics.
Vanjoin Hubei Industry Limited Company Established 2006	*Vanjoin Hubei Industry Limited* makes PLA-based bottles, jars, cups, and straws for food and beverages. The company's PLA-based material is biodegradable, and they claim that their products can completely biodegrade in 80 days.	Headquarters: Wuhan, Hubei, China Presence: Middle East, Northern Europe, Southeast Asia, Central America, South America.	*Vanjoin Hubei Industry Limited* already exports PLA-based products to the Middle East, USA, Russia, Australia, Japan, Greece, Malaysia, Philippines, Colombia, and Belgium.[c] Because of its wide geographic reach, particularly in China and Southeast Asia, it can be evaluated as a potential supplier option.

[a] https://www.onehundredbio.com/technology/ (accessed November 02, 2022)
[b] https://www.totalenergies-corbion.com/media/hv5fpt4m/factsheet_luminy-pla-neat-resins_20220324.pdf (accessed November 02, 2022)
[c] https://bioplastics.en.alibaba.com/company_profile.html?spm=a2700.icbuShop.88.27.f6113d72hCLO3M (accessed November 02, 2022)

significant improvement on prior art (EPO, 2022). The novelty search is carried out specifically on the basis of an existing invention, in order to determine the obvious prior art. The obvious prior art serves to determine the surplus of the invention, which is then the basis for the claim of the patent.

3.3 Freedom-To-Operate (FTO) Analysis

Publication acts as a warning. It clearly proves the ownership of IP. The freedom-to-operate search or analysis is intended to clarify the freedom of use of an invention. The accuracy of the search is often a cost issue and should be set against a fixed budget. The question is: *How much is clarity about the freedom of use worth?* This is accompanied by the question of whether any freedom-to-operate analysis should be carried out extensively and is correspondingly expensive. For more details about the FTO analysis, see the chapter "Important aspects of IP for start-ups: Strategies for avoiding common pitfalls" (Lagler & Ebner, 2023).

3.4 Industry and Technology Search

An industry and technology search aims to identify new innovations, new technologies, and new products in a specific industry or technological domain. This search generates findings, such as technology utilization rate, number of players in the space, new entrants into an industry, and how the technology developed over the last years. The insights can be used to derive operational and strategic actions. Often the industry and technology search leads to a further in-depth assessment supplemented by various patent and non-patent literature.

3.5 Market and Competition Search

The market and competition search focuses on competitors in a specific market environment that can be allocated on the basis of a technology. The search for applicants and owners enables a focus on individual competitors. The search results show which applicants and patent owners are working on technological topics, their strategic orientation in the past, and provide a glimpse into possible future directions. At this point, it must be mentioned that there are patent application strategies that distort precisely this information and aim to mislead competitors.

3.6 Opposition/Nullity Search

The goal of the opposition search or nullity search is to identify prior art in order to take action against an interfering competitor's patent right. If this is done within the opposition period, it is called an opposition search; otherwise, it is called a nullity search.

Companies usually install an ongoing monitoring process to identify new patent applications at an early stage and to take action against them in case of a possible infringement of their own protection space. The results of this search serve to strategically secure the company's own intellectual property rights and minimize the intellectual property rights of competitors. Usually this search is done either by third party vendors or in an in-house patent department.

3.7 Patent Landscape and White Spot Search

Patent landscaping is often used by technology start-ups and established companies to gain a comprehensive overview of patents, prior art, and competitors' activity in a particular technical field.

Again, the challenge is to limit the search scope and number of iterations to a useful means, as a search can become very time-consuming and information overload has less additional benefit for the outcome.

Early-stage landscapes are of particular interest to start-ups. In early stages of prototyping and product development technology, landscapes can be very insightful

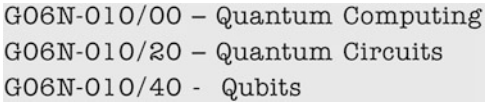

Fig. 4 Search by patent classification (source: Questel)

for start-ups for identifying "free" or "white" spots for research and development and for designing patenting strategies.

Typically, these landscapes cover a technical field in the broadest sense and may include alternative solutions, products, or methods to those under development. For instance, a start-up providing solutions by use of quantum computing methods (see example below) might look at other methods of performing similar solutions or structurally analogous solutions for other purposes. A tech start-up might look at other companies addressing the same market niche and examine how they solve technical problems in their field. The following special section highlights the generic steps to conduct a patent landscape and identify white spots in the technical field of *"quantum technology."*

The Making-of: "Patent Landscape Quantum Technology"

This section has been provided by Dr. Roland Gissler, *Questel Germany Holding GmbH*, Munich. *Questel* is a global IP software and services company offering comprehensive software for searching, analyzing, and managing inventions and IP assets.

The making-of a patent landscape is presented in a simplified three-step approach:

1. Step 1: How to get started
2. Step 2: The way to the final result set
3. Step 3: Analysis and results

Step 1: How to Get Started

The first task is to find the patent publications in the field of quantum computing. Since this is a very new and rapidly evolving technology field, we cannot expect to rely completely on the patent classifications. But there is an appropriate IPC/CPC[6] – for example Fig. 4:

Nonetheless, the G06N-classification is not always used. This means the classification search needs to be complemented by a text search. After some optimization, we chose the search query as shown in Fig. 5, where we are restricting to active patent publications only:

As always with text-search, a certain amount of hits that do not belong to our technical field are included in the search results and this one thus needs to be refined.

[6] International Patent Classification (IPC), Cooperative Patent Classification (CPC).

Fig. 5 Search query including text search (source: Questel)

```
((
QUANTUM COMPUT+ OR QUANTUM
COMMUNICATION+ OR Q_BIT? OR QUBIT?)/
TI/AB/ICLM OR (G06N-010/00 OR G06N-
010/20 OR G06N-010/40 OR G06N-010/60
OR G06N-010/70 OR G06N-010/80)/
IPC/CPC ) AND ( STATE/ACT=ALIVE
))
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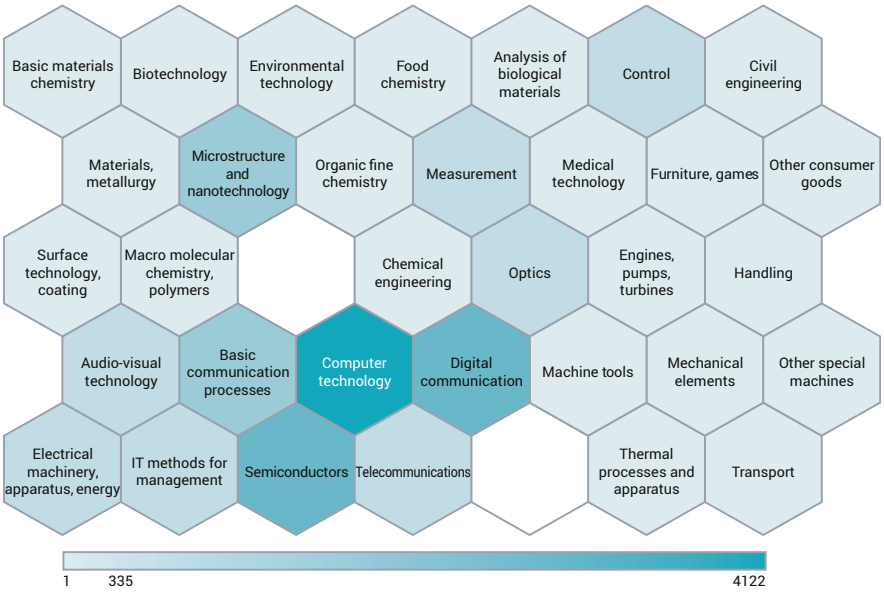

Fig. 6 Technological domain overview with spot on "biotechnology," "food chemistry," and "quantum computing" (source: Questel)

A proven and systematic method to track such false hits is the "technical domain" overview which we can apply to the roughly 6,440 hits we ended up getting from the search command above:

We check such uncommon technological domains as "biotechnology" or "furniture/games" to identify and remove false hits from our basic set as illustrated in Fig. 6. We reduce our data set to about 5,600 patent families.

Step 2: The Way to the Final Results Set

Since the G06N-classification is not always used, we create our own user-field for categorizing the patent families. After some trials, we decided on the following categories:

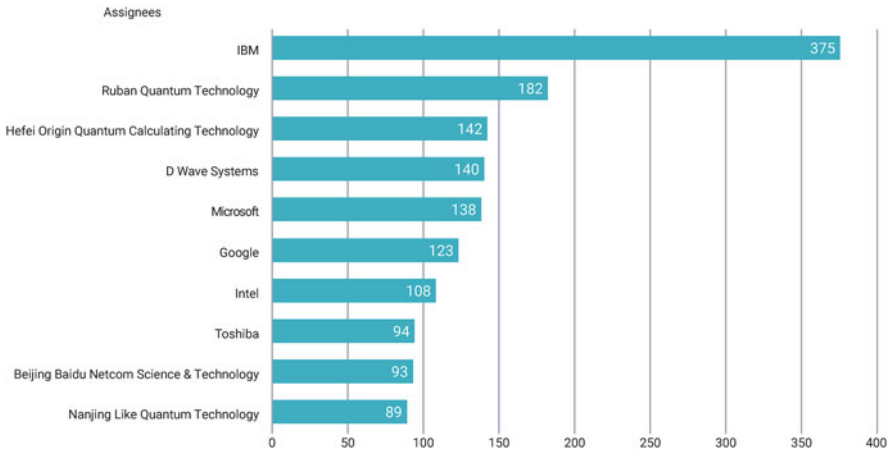

Fig. 7 Top 10 assignees in quantum technology (active patent families) (source: Questel)

- Application software
- Combined hardware and (system-)software
- Error detection and correction
- Hardware
- Quantum communication
- System software
- Video, image processing

The challenge becomes to efficiently assign these categories to the patent families. This is achieved in following three steps.

1. For the approximately 5,600 patent families we extract the main IPC,[7] and according to the meaning of the actual main IPC, we assign one of the seven categories.
2. There is a part of the 1,025 patent families in IPC G06N-010 which is so broad that it is necessary to break it down into the seven user-defined categories.
3. There is a part of 439 patent families where the main IPC does not allow to assign these patent families to one of our seven categories. So, this is done manually.

After all these optimizations, we finally have a set of 5,491 active patent families in the field of quantum computing, and this is our basis for all subsequent analysis steps.

Step 3: Analysis and Results

U.S. and Canadian assignees are the top filers in quantum technology, and they also dominate the field of so-called generalist players (see Fig. 7), present in all

[7] International Patent Classification (IPC).

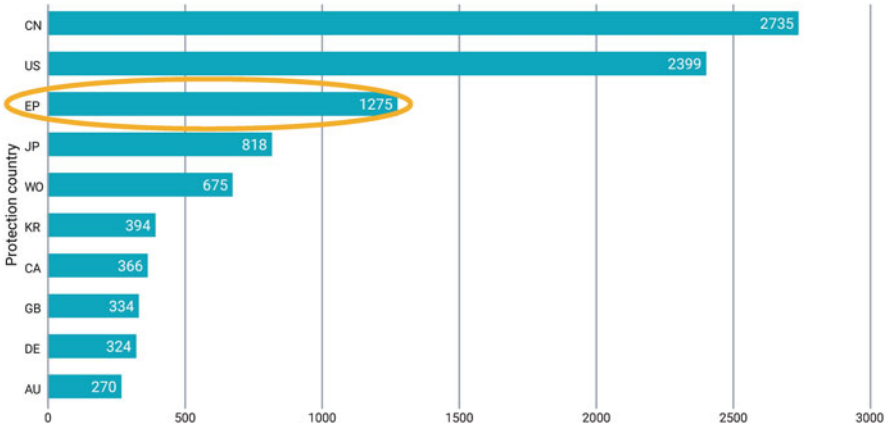

Fig. 8 Patent families by protection countries (= market countries) (source: Questel)

relevant quantum technology fields and thus able to produce complete quantum computing systems on their own.

Another fact worth noting is that European assignees are underrepresented. Europe is seen as an important market for quantum technology, hence the high number of EP-filings and some national European filings, but we see a very low number only of EP-priorities and even if we were to add the numbers for the national filings in Europe like Germany (DE) and Great Britain (GB), their number would still be far below the top countries, the United States (US) and China (CN) as shown in Figs. 8 and 9.

In order to determine the generalist players, we display the overview for the seven categories:

Figure 10 shows the main categories – quantum computer hardware, system software, and application software – while "error detection" is an important and probably the most important system software aspect, and quantum communication is the most important application.

A generalist player is an assignee with IP rights in all relevant categories. We define as relevant such categories where an assignee needs to have their own IP-rights in order build a complete quantum computer. Obviously, these categories are hardware, system software – or the "combined hardware and system software" plus error detection which is always needed with quantum computing.

Such generalist players are the U.S. or Canadian companies in the top 10 filers like *IBM*, *D-WAVE-SYSTEMS*, *Microsoft*, *Google*, *Intel*, and *Northrup Grumann*. Only then some smaller CN assignees and one Japanese are following.

CN assignees, which often have their focus in hardware and quantum communication, came later to the game but are catching up quickly. With the present trend, the Chinese top-assignees will surpass all the others, with exception of *IBM*, in the next five years – in terms of filing quantity.

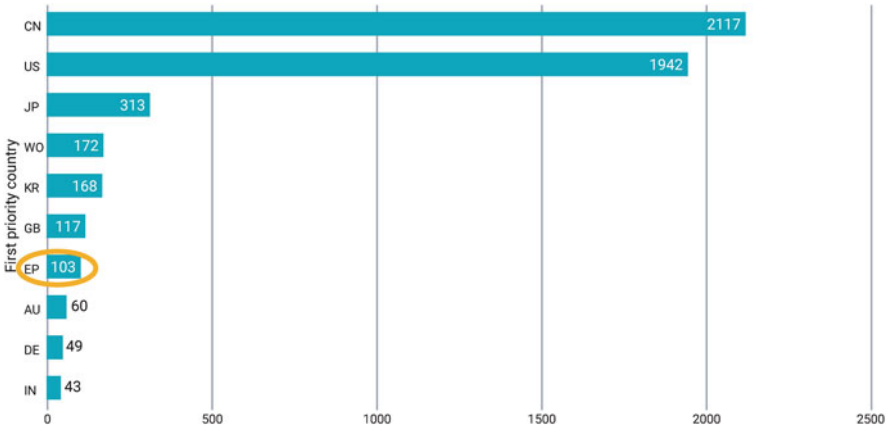

Fig. 9 Patent families by priority countries (= inventor countries) (source: Questel)

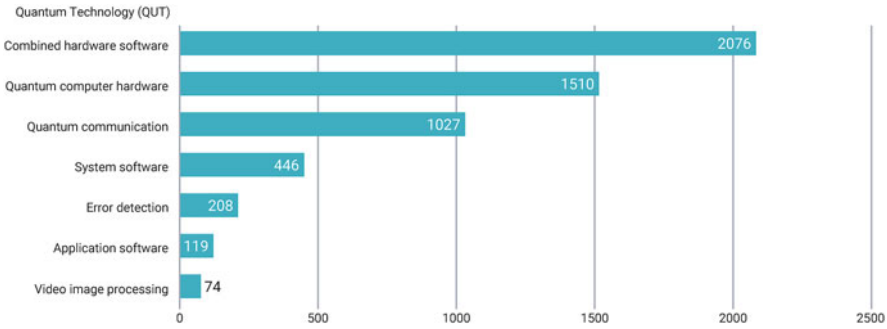

Fig. 10 Quantum technology categorization (active patent families) (source: Questel)

The reason is that all U.S. assignees, with exception of *IBM*, are not increasing their filing activity.

A typical example is *D-WAVE*, which has been active for many years but on a constant (low) filing level. Nevertheless, *D-WAVE* patents reveal the highest number of third-party forward citations, which is an indicator for patent value.

The assignee with the fastest growing IP portfolio is *RUBAN Technologies*, which has a focus on quantum communication and combined hardware and software as illustrated in Fig. 11. However, all 182 patent families of *RUBAN* have so far been published exclusively in China – and many are utility models.

With the described procedure, we have a reliable basis for our investigation of the technical field of "quantum computing" and can continue our analysis in more depth.

A method for diving deeper into the technology is to subdivide some of our seven categorization fields like "hardware," "combined hardware and system

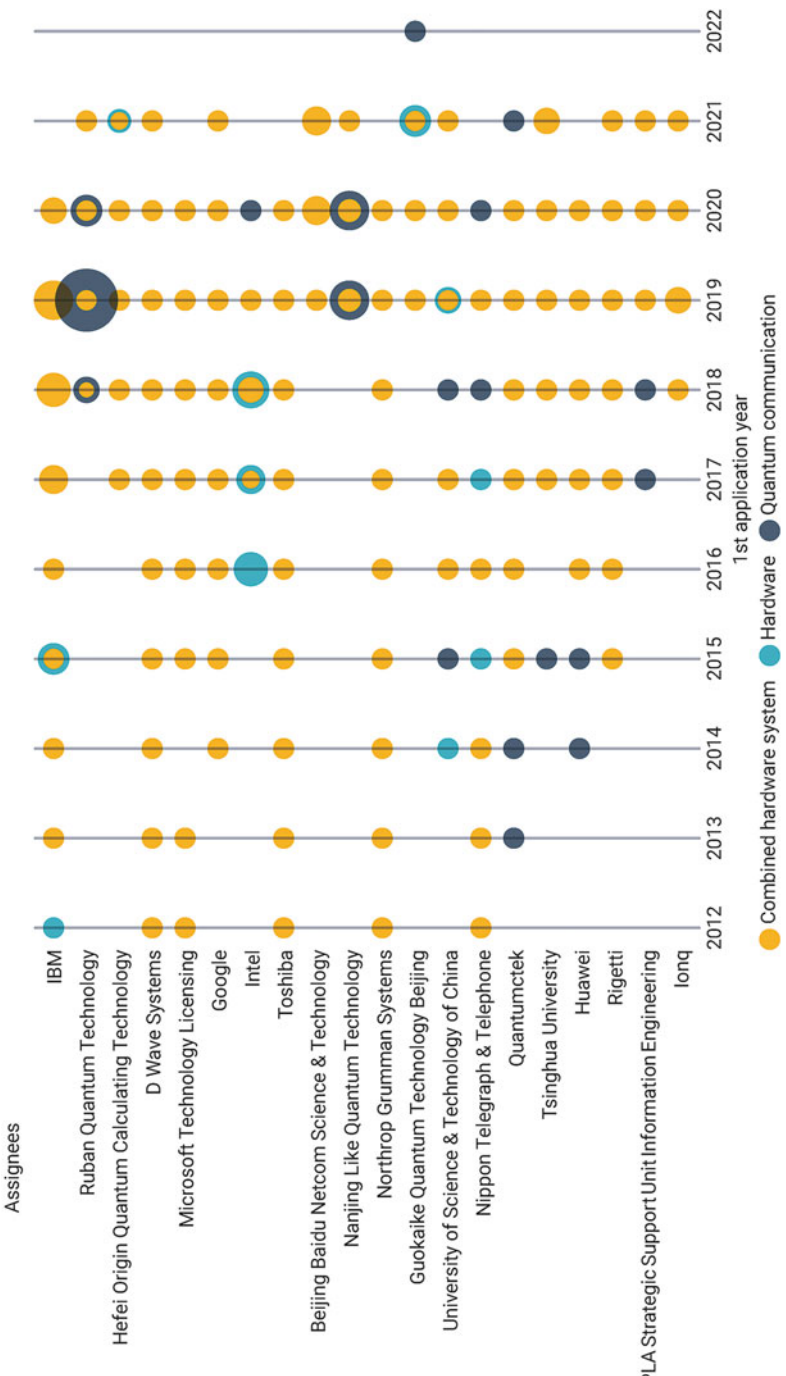

Fig. 11 Filing trend for categories hardware, combined hardware systems SW, quantum communication (source: Questel)

software," or "application software." Then we can visualize, for example, the technology used for creating and maintaining the Q-bits, which are at the core of each quantum computer, with the following subcategories:

- Supraconductivity, optical methods, radio waves, etc. and correspondingly for the field of "application software"

Example for a Patent Landscape Executive Summary Report:

- We have analyzed the patent landscape for the field of *quantum technology* with a main focus on *quantum computing* and retrieved 5,241 active patent families.
- The patent scene is dominated by U.S. and Canadian and Chinese (CN) assignees. European assignees are underrepresented.
- There are very few generalist players which are present in all relevant quantum-technical fields and thus enabled to build complete quantum computing systems. They are the U.S. or Canadian companies in the top 20 filers like *IBM*, *D-WAVE-SYSTEMS*, *Microsoft*, *Google*, *Intel*, and *Northrup Grumann*. Only then some smaller CN assignees and one Japanese are following.
- In software for quantum computing, error detection and quantum communication are the most covered areas. Most CN applicants have a strong focus on quantum communication.
- The filings of CN applicants are growing rapidly. At the actual pace, in terms of filing volume, the major CN applicants will surpass all the other ones with the exception of *IBM*, whose portfolio is increasing noticeably compared to the other U.S. assignees.
- In terms of citation numbers and related quality metrics, the CN assignees show low numbers only, mainly because they concentrate on domestic applications with a high percentage of utility models. ◄

4 Conducting Patent Searches: A Practical Guide with Examples

4.1 IP Search Tools and Patent Databases

There are various IP search tools and IP databases available in the market which can be differentiated by IP right (e.g., focusing on patents, trademarks, designs, domains). Another distinction pertains to commercial and non-commercial IP databases:

- **Non-commercial IP tools and IP databases**[8]**:** Among the most important non-commercial patent databases are the databases of the *Patent and Trademark Offices (PTOs)*. Most PTO databases include data relating to patents, trademarks, utility models, design, and offer a different search products or search tools. The PTO databases are free of charge. Some free IP search tools are Espacenet (European Patent Office), Patentscope (WIPO), Patent Public Search (US PTO), DEPATISnet (German PTO), and also Google Patents, which is mostly using the same databases as patent offices.
- **Commercial IP tools and IP databases**[9]**:** Commercial patent databases are not freely available. Examples of commercial IP databases are: Thomson Innovation, and Lexis Nexis. The data stock of commercial patent databases is usually not larger than that of non-commercial patent databases. However, commercial patent databases usually offer better search fields and more complex search options, as well as analysis, reporting, and visualization tools.

Commercial IP software tools are broadly available on the market. They make use of diverse IP data such as patents, trademarks, etc. to offer comprehensive or specialized EMS[10] solutions. Examples of high-level categorization include IP life cycle management tools and IP intelligence tools. Table 3 shows a non-exhaustive list of leading IP software tools.

4.2 The Patent Search Process

Conducting a patent search often requires experience and patience. Each search can produce different results depending on the order in which semantic searches are run, cleaned up, and added to again. The patent search process is an iterative process. Figure 12 shows a generic overview of a patent search. The ideal search starts with a definition of the search question(s).

There are three main motivations for patent searches which determine the search types: to identify risks, evaluate generation potential, and use data intelligence. Patent risks can be detected through freedom-to-operate searches and opposition research. With prior art searches, ideation searches, and white spot analyses, the potential for generating patents can be identified. Competitive, technology, and trend research can be used to gain IP intelligence about the market and competitors.

The search question and nature of the research determines the scope and the research strategy. We can distinguish between a broad and a deep patent search. Patent searches with high depth are prior art searches and FTOs, which explains the costs implied for such searches. An overview search, on the other hand, provides

[8] https://worldwide.espacenet.com, https://patentscope.wipo.int, https://ppubs.uspto.gov, https://depatisnet.dpma.de, https://www.patents.google.de

[9] https://www.thomsoninnovation.com, https://www.lexisnexis.com

[10] Enterprise Management Systems (EMS).

Table 3 Overview of leading IP software tools in alphabetical order (author's own compilation)

Company	IP Software Tool	Description	Life cycle management	IP intelligence
Alt Legal. Inc.	Alt Legal	Focus on law firms	Yes	N/A
Anaqua Inc.	Lecorpio, ANAQUA for corporations, diverse tools	Big provider; industry suitable; diverse languages	Yes	Yes
AppColl Inc.	Invention and prosecution manager	Focus on invention disclosure process and partially IP	Yes	N/A
AZ Software	PatInForm	Small company with focus on small German companies	Yes	N/A
GoodIP	GoodIP	Focus on IP evaluation, IP-backed financing and investments for start-ups	N/A	Yes
Berggren	Greip	Focus on smaller companies and start-ups	Yes	N/A
Biszsolutions Software Inc.	IP Space	Focus on smaller companies and start-ups	Yes	N/A
Bruegmann Software GmbH	PatOrg Suite	Focus on smaller companies and start-ups	Yes	N/A
ClaimMaster Software LLC	ClaimMaster	Tool for drafting claims	Yes	N/A
Clarivate	Memotech, Thomson Innovation, The IP Manager, Unicom, IPFolio and diverse tools	Big provider; industry suitable; diverse languages	Yes	Yes
Continux	Continux IP Management Software	Focus on smaller companies and start-ups	Yes	N/A
Computer Packaging Inc. (CPI)	Patent Management System, diverse tools	Big provider; industry suitable; diverse languages	Yes	Yes
Dataanalytics Inc.	Juristat	Focus on analytics and business intelligence	Yes	Yes
Decision Design Corporation	DocketTrak	Focus on IP law firms	Yes	N/A

(continued)

Table 3 (continued)

Company	IP Software Tool	Description	Life cycle management	IP intelligence
Dennemeyer	DIAMS iQ, Octimine, diverse tools	Big provider; industry suitable; diverse languages	Yes	Yes
GSI GmbH	WiNPAT	Big provider; industry suitable; diverse languages	Yes	Yes
Helios Intellectual Property	Helios Complete™ IPM Platform	Focus on smaller companies and start-ups	Yes	N/A
Innovation Asset Group	Decipher	Tool focus on cost estimation and invention disclosure	Yes	N/A
Inteum Company LLC	Inteum	Focus on innovation and technology transfer with major clients in the area of universities and research institutes	Yes	N/A
IPPO Ltd.	WebTMS	Tool for trademark management	Yes	N/A
IPShark	IP Shark	Tool for brand protection	Yes	N/A
Knowledge Sharing Systems LLC	KSS TechTracS	Focus on technology transfer and innovation management	Yes	Yes
LumenIP	docketengine	Additional application only focused on docketing	Yes	N/A
Microsystems	Patent Companion	Support system for drafting of patents	Yes	N/A
MindMatters Technologies Inc.	Innovator Enterprise	Focus on early life cycle management – idea management, invention disclosure management	Yes	Yes
Neustle Software Inc.	PatentWizard	Support system for drafting of patents	Yes	N/A
OP Solutions	PATTSY	Focus on patent attorneys and law firms	Yes	N/A
Patsnap	Patsnap	Focus on analytics and business intelligence	N/A	Yes
Patrix	Patricia IP Management	Big provider; industry suitable; diverse languages	Yes	Yes

(continued)

Table 3 (continued)

Company	IP Software Tool	Description	Life cycle management	IP intelligence
Quantify IP	Company Portfolios Revealed; Portfolio Estimator	Focus on patent searches and analytics	Yes	Yes
Questel	Orbit, Markify, Innosabi, diverse tools	Big provider; industry suitable; diverse languages	Yes	Yes
Reva Ware	Reva Trademark	Focus on trademarks	Yes	N/A
Royalty Zone	Royalty Zone	Purely focused on royalties	Yes	N/A
TM Cloud Inc.	TM Cloud	Focus on trademark docketing	Yes	N/A
Trademarknow	Portfolio 360	Focus on trademarks	Yes	N/A
Unycom	Unycom Enterprise	Big provider; industry suitable; diverse languages	Yes	Yes
Wellspring Worldwide	Wellspring IP Software	Focus on smaller companies and start-ups	Yes	N/A

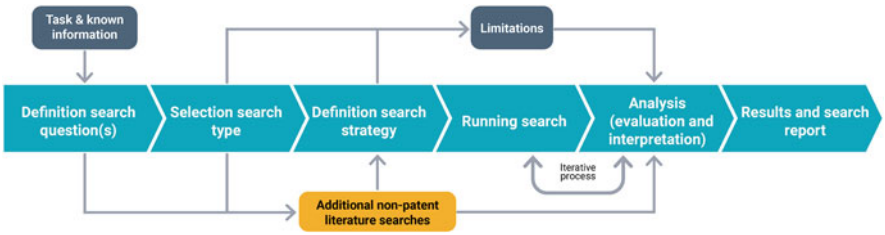

Fig. 12 Overview generic patent search process (author's own figure)

insights that are less deep, with information on a broader technology space, as shown in Fig. 13.

Based on the search question and search type, the search strategy is defined. There is no definite end of a search; therefore, time management is crucial. Search results need to be checked for plausibility and results must be iteratively adjusted or supplemented. Often search hits have to be cleaned up manually. The quality of the search report increases with the number of report iterations and experience of the patent searcher and validation of results.

Adding non-patent literature might be useful to gain further awareness of industry characteristics and competitor strategies.

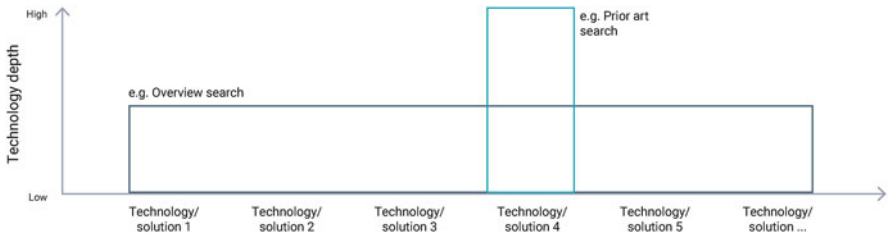

Fig. 13 Overview generic patent search process (author's own figure)

The iterative search process is repeated until a reasonable number of hits has been achieved and the results can be plausibly interpreted. Finally, the search report summarizes the results and limitations of the search.

5 Learnings and Takeaways

Patent data is a known indicator for future innovations and technologies. Patents are used to conduct competitor analysis, generate new own innovations and developments, avoid third-party rights infringement, and identify possible infringers of own rights.

This chapter provided an overview of common patent search types, relevant questions, and generated insights. Certainly, some searches cannot be carried out by unskilled persons; therefore, the start-up should consult IP professionals in order to obtain meaningful results. Sources of errors in the patent search are clearly human mistakes which are often unavoidable but must be taken into account and addressed. Also, it is uneconomical to spend an infinite amount of time on searches. Limitations must be clearly stated.

In many cases, depending on the industry, the market launch of a product still takes a while, even after a patent has been granted. In other industries with short technology life cycles, start-ups may not be well advised to protect their IP through costly patenting. However, the investment in patent searches and the know-how about competition and technological space will certainly pay off.

Frequently, start-ups are too often neglecting IP searches in practice. This isn't surprising given the limited capacities and resources they have. Potential reasons for this include the lack of knowledge about the information content of the patent databases, the not inconsiderable effort required for familiarization with the search applications, as well as the complex patent search process itself.

Key learnings for start-ups are to make the most use of patent data to *identify opportunities* and *minimize risks*.

The worst-case scenario is that a start-up infringes an existing active patent. Anyone who uses an active patented invention of others commercially, either intentionally or negligently, is liable for damages. Therefore, the guiding principal is: *Ignorance is not an excuse*.

Takeaways

- **Patent data can help to keep an eye on trends, technologies, and competition**
  IP data is a useful source for start-ups along all four venture phases. Patent data can be utilized to gain in-depth insights into the technological fields and existing and new competitors and their products and solutions.
- **Start-ups should avoid presenting their patentable idea to public**
  In early phases, it is enormously important for start-ups not to disclose their invention until patentability is assessed and further proceeding is strategized.
- **Prevention is better than healing**
  One elementary risk in the early stages of the start-up is that the idea has already been patented by someone else. Consequently, there is a danger that the start-up infringes a third-party patent. Therefore, the start-up's first step is to check novelty and freedom to operate (FTO).
- **There is no "right" search strategy**
  Different searchers arrive at different results. A patent search requires experience and patience. For each patent search, the additional benefit has to be weighed against the time invested.

Acknowledgments The author wishes to thank Dr. Roland Gissler for providing the making-of patent landscape within the special section of this contribution. The author wishes to thank Jeffrey Tiong, Sam Wiley, and Christie Thompson for their consent to provide data and material on IP analysis and technology scouting. An additional thanks goes to the PatSnap Research and Analytics team for their contribution in developing the technology scouting on biodegradable materials.

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Dr. Sevim Süzeroğlu-Melchiors is Professor of Digital Entrepreneurship and Finance at the Technical University of Applied Sciences Regensburg. In her previous role as CFO and Management consultant, she accompanied many inventors and founders in different phases of the innovation process. Today, she is a leading appraiser for IP valuation projects, advises companies in their further strategic orientation, and follows her passion to encourage students for start-ups by raising awareness, qualification, and support in teaching and practice.

Technical Patent Circumvention: How Start-ups can get Around Infringed Patents

Oliver Mayer and Frank C. Schnittker

1 Context of Technical Patent Circumvention

Legal patent disputes pop up in the media from time to time. These usually involve large corporations and large sums of money. Well-known examples include the dispute between Apple and Ericsson or Apple and Samsung over smartphone technologies. Overall, the number of patent disputes is rising continuously. In China, there were over 200,000 cases between 2013 and 2017; in the United States in the same period, there were about 11,000 cases and in Germany about 1,300 cases. Besides the legal aspect to bypass a patent, there is another avenue to an existing IP right in an absolutely legitimate way with alternative technologies or concepts. In this chapter, a *guideline* is presented on how this can be done effectively, in a structured way and in a relatively short amount of time with the help of TRIZ.

The term patent strategy describes a planned and structured approach to developing and maintaining a large number of patents of both strategic and operational value. It takes into account past, present, and future developments in a defined field of technology. The approach following a respective strategy aims at two applications:

- Improvement of an existing inventive idea/a legally valid patent/broadening of the scope of protection, in particular of patent families;
- Circumvention of an existing patent.

O. Mayer (✉)
Mayer Engineering, Munich, Germany
e-mail: mayer@ibom.de

F. C. Schnittker
THL Engineering, Damme, Germany
e-mail: frank@thl-engineering.com

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9_25

When improving an existing inventive idea/patent, methods are applied to achieve further realizations of structural elements or functions with other technologies and/or components, or by omitting just such. In this way, the original, first available solution can be extended in its scope of protection, meaning strengthened and thus made more secure against non-obvious circumvention solutions of others.

Technical circumvention. is about analyzing an existing patent (usually of a competitor) using methods and developing alternative solutions beyond the respective protected subject matter.

Patent circumvention. solutions almost always lead to new property rights, whereby one's own position vis-à-vis competitors can be consistently expanded. In the case of a circumvention constraint, TRIZ offers solutions which, by applying the basic principles according to Altshuller et al. (2008), create solution spaces with limited effort within a short period of time – and provide manifold inventive solutions and execution alternatives. A basic approach for patent circumvention by applying principles of TRIZ (2016) is given in VDI Richtlinie 4521 (VDI 4521 part 2).

The basis in both cases is a *legally valid patent*, in the case of patent reinforcement if it's one's own or, in the case of patent avoidance, that of another.

In the following, the process is presented as a theory and subsequently substantiated by means of a technical example.

2 How to Get Started: A Guideline for Technical Patent Circumvention

2.1 Elaboration of the Patent Basis

The starting point is the problem/task to be solved. It is a matter of concretely identifying, from a general situation, the technical problem that stands in the way and that needs to be solved. In patent jargon, this is referred to as the underlying problem, which presents itself to the skilled person against the background of the prior art and calls for an inventive solution . A person skilled in the art in this context is an average knowledgeable person in the technical field of the patent. In the patent world, patents present printable, suggested solutions, which is conducive to the patent circumvention method using TRIZ.

In this first step, a comprehensive *prior art patent search* is conducted, and all patents deemed relevant therein are listed in a ranking according to the value of the features placed under protection. The abundance of patents is analyzed with respect to the characterizing and especially the compelling features. These are the features without which the desired functionality simply cannot be ensured and must therefore be explicitly present within the characterizing part of the patent claims. This is done for each patent individually on the basis of a feature list and analysis. The result in the case of several patents to be circumvented is a comprehensive comparison of features, whereby attention should be paid to the fact that many features which at first appear dissimilar can be equivalent in their effect – thus often already at this

early stage of the circumvention procedure, different solution paths for the same task become apparent, which gives the skilled person quite good indications of obvious or even obvious circumvention possibilities.

In the next step, the patents are sorted again by valence or relevance according to the number of compelling but different features needed to fulfill the function to be circumvented. The patents with the lowest number of features of the same type or equivalent function are the focus of further investigation. They represent the state of the art of the closest (non-infringing) technology, are therefore far enough away from the infringing subject matter in the patent sense, and ensure a certain so-called "freedom to operate" at this point in the circumvention procedure.

Now here is the difference from the classical approach to patent infringement avoidance : The focus is on avoiding the closest prior art that has the fewest compelling features rather than a maximum of such features. TRIZ thus follows the principle of "*less is more*," which, expressed in patent language, represents the *broadest possible scope of protection,* and can produce *higher quality IP rights*, which in turn are much more difficult to circumvent in many cases.

This procedure creates the basis for developing a possibly better alternative or so-called "*Roadblocks*" for competitors in a targeted manner with TRIZ.

2.2 Functional Analysis

The core idea in patent circumvention is to make a functional analysis of the system for the patent specification to be circumvented (see also VDI 4521 part 2 (of 3)). Functional analysis consists of two steps: detection of the hardware part (=components) on the same hierarchical level and analysis of the functional interactions between the components (see Fig. 1). The functional interaction is defined as the answer to the question: "What parameter of the object of the function is changed by the functional element (aka function carrier)?"

The components of the system are listed and the interactions between the components are determined (see also VDI 4521 part 2 of 3). This procedure is used to analyze the independent claim(s) of the patent. Thus, the protected function is represented graphically, and the relevant components are identified in their functionality. The functional analysis can be done on system level (Functional Analysis) as well as on effect level (Substance–Field–Model). It is important that

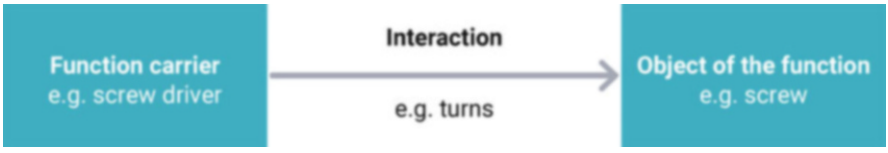

Fig. 1 Functional analysis (authors' own figure)

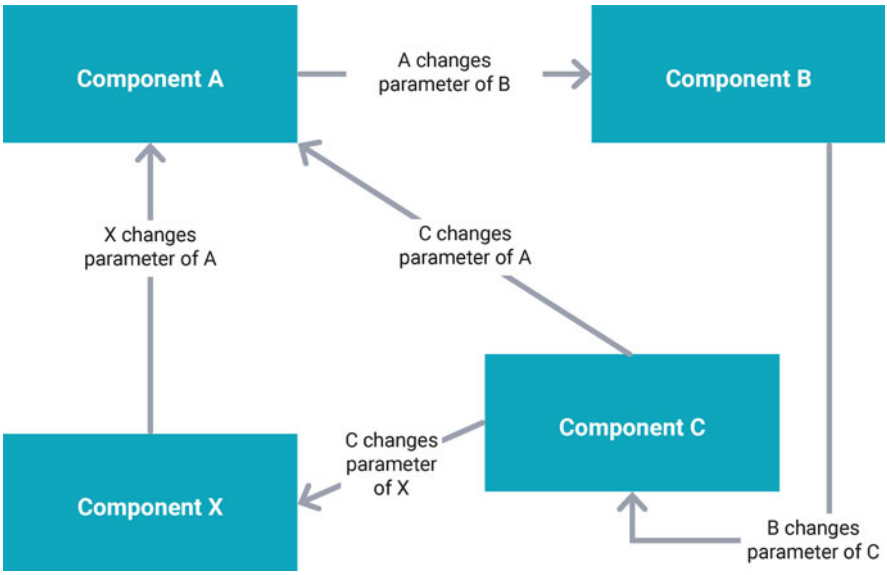

Fig. 2 Graphical display of a functional analysis (authors' own figure)

the mandatory features are clearly defined and modeled as independent components (see Fig. 2).

2.3 Trimming

One way of circumventing a patent or extending its original scope of protection is to preserve the overall function of the system *while modifying or eliminating at least one component*. To this end, a systematic approach is taken. Each component is trimmed from the system, that is, one pretends that these components no longer exist (trimming the component). Then, three rules are applied to preserve the functionality of the component:

Rule A: The function carrier can be trimmed if the object of its function can be removed.
Rule B: The function carrier can be trimmed if the object itself can perform the function.
Rule C: The function carrier can be trimmed if another component can take over the function.

Alternatively, another technology can be developed that takes over the functionality of the trimmed component.

In case of success (at least one component was trimmed, preferably one that was mandatory), the new system can be developed. Or if it is a patent of its own, it can be improved.

Case: Wind Turbine

A wind turbine consists of rotor blades (today usually three arranged at 120°) which drive a hub in the nacelle. This hub usually drives a generator via a gearbox, which feeds the generated electricity into the grid. For the safe operation of a wind turbine, the grid must be "available," e.g., there must be no blackout. The wind turbine must be able to operate against the resistance of the grid, so to speak.

In the event of a grid failure and when wind is blowing, the wind turbine must be shut down safely. Since the grid has failed and is no longer supplying energy, and at the same time energy is needed to turn the rotors out of the wind, for example, an alternative source must be available. The task is to provide energy to bring the wind turbine to a safe state.

When searching patents, a large number of similar proposals can be found. The patent with the least number of compelling features was identified as the intellectual property right of *Enercon* inventor *Aloys Wobben*:

The compelling feature is clearly the energy storage device (capacitor) that provides the energy to transition to a safe state.

A functional analysis is performed for the existing system. Figure 3 represents the system context. The compelling component, in this case the "Battery," is trimmed in the further step (components crossed out).

Since the function of the "Battery" works exclusively and directly via the "Inverter," this component can be trimmed at the same time. The next step is to consider how the function of the "Inverter" and "Battery" can be replaced. Which component(s) can replace the function?

The TRIZ method suggests an analysis of the available resources (see also VDI 4521 part 3 (of 3)). Since this case is about the provision of power/energy, the following resources come into question: height of the hub above ground: potential energy, rotor blade with its change (top - bottom: potential energy), rotor shaft with kinetic rotational energy.

Going through the possibilities, the rotating shaft appears to be the best option. An additional generator on the main shaft, which produces energy when the grid is down, can replace the "inverter" and "battery." Once the wind turbine is in a safe state and the rotation decreases, the energy is no longer needed. Once the grid is available again, the wind turbine can be operated normally.

In this way, the overall system has the same functionality as the original system but with different components. In this way, the original patent is circumvented, since the mandatory element, the energy storage (Capacitor), no longer exists. ◄

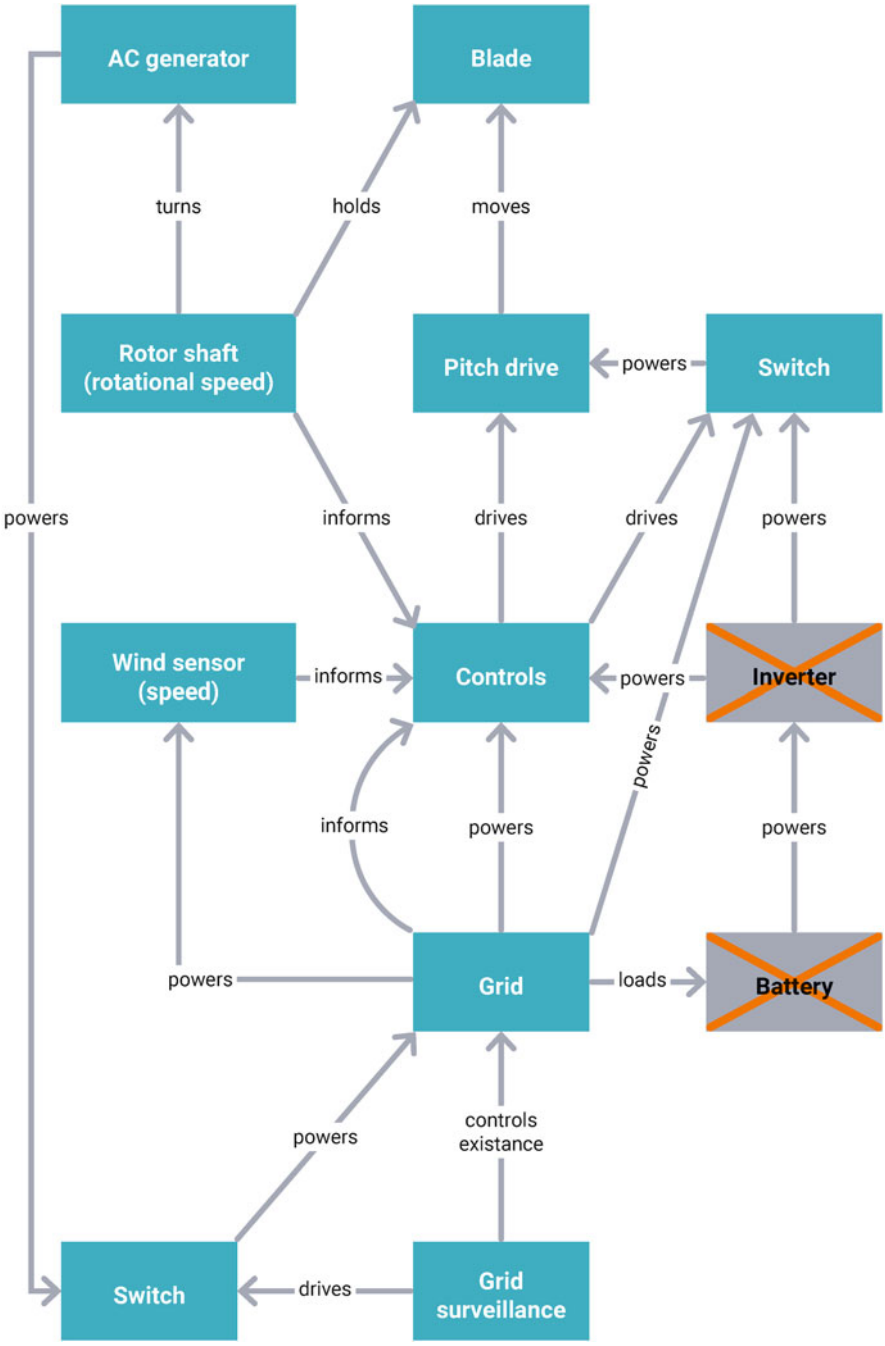

Fig. 3 Functional diagram for a wind turbine based on GE-GRC Munich, ETS (authors' own figure)

Case: Lighting System

A company wanted to develop a new lighting system which shall be controlled by a user interface with wireless technology. When checking the patent landscape, they found that this idea had already been patented by a competitor. Therefore, they used the technical patent circumvention procedure to find an alternative solution. The starting point was a patent, which had as first independent claim (see Fig. 4):

Thus, a functional diagram was generated as follows (see Fig. 5):

At the end, the independent claim looked like this (see Fig. 6):

The next step was to identify the component with the least number of functionalities. In this case it was component C8. After identification of this component, it was trimmed. The technical task was to find a solution that kept the functionality of the system without component C8 (see Fig. 7).

As this task could be solved, the patent wasn't infringed anymore and freedom to operate was gained (see Fig. 8). ◄

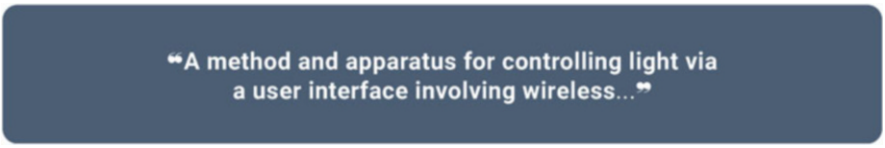

Fig. 4 Starting point patent's first independent claim (authors' own figure)

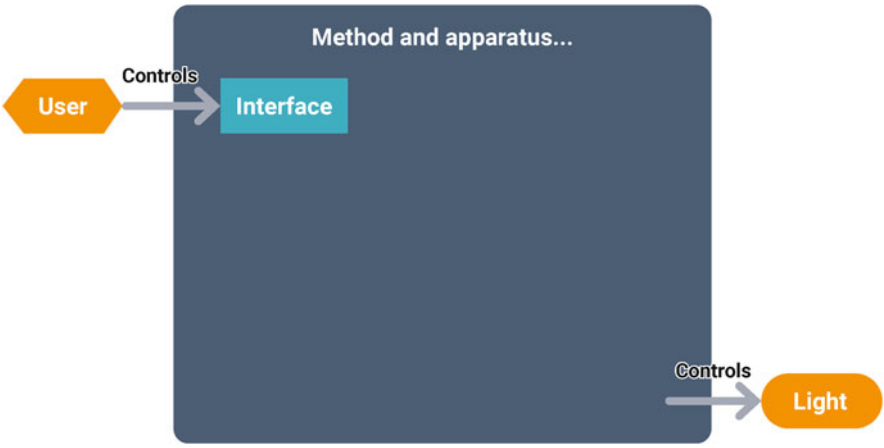

Fig. 5 Graphical display of a functional analysis of the lighting system state 1 (authors' own figure)

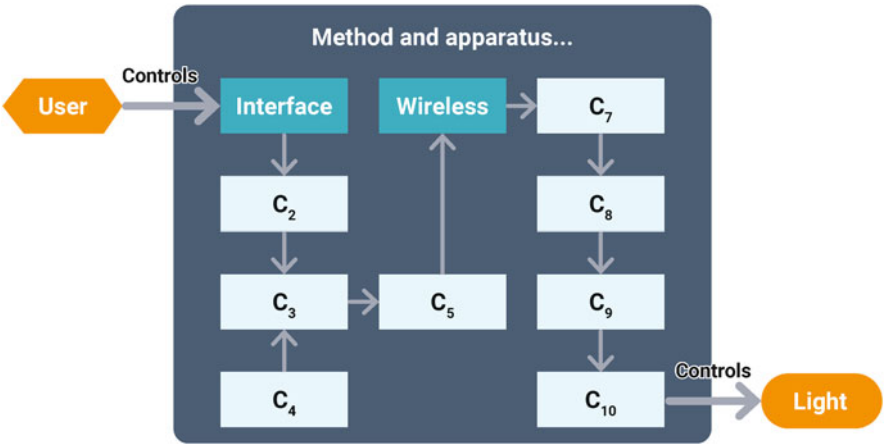

Fig. 6 Graphical display of a functional analysis of the lighting system state 2 (authors' own figure)

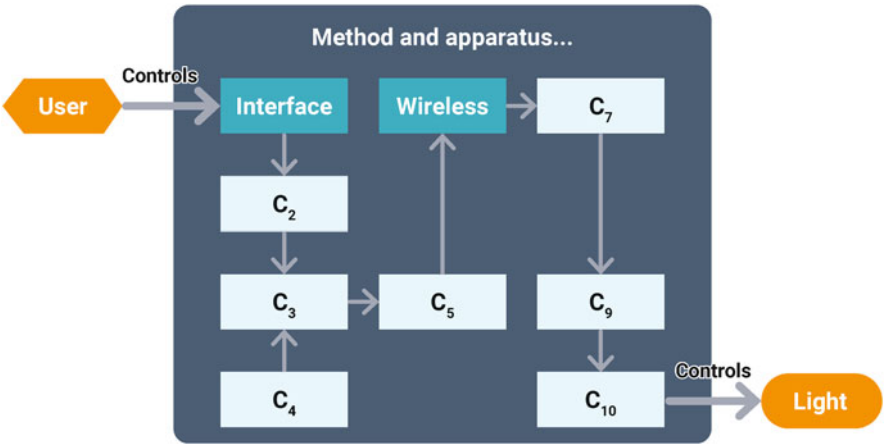

Fig. 7. Graphical display of a functional analysis of the lighting system with trimmed component C8 (authors' own figure)

Fig. 8 Gained freedom to operate with regard to starting point patent's first independent claim (authors' own figure)

3 Learnings and Takeaways

In case one gets stopped by a competitor patent, not only legal actions should be taken, but also systematic technical steps to circumvent a patent by trimming components while maintaining the functionality of the system.

Takeaways
Procedure for technical patent circumvention:

- Analyze the patent claims; identify the least important feature per independent claim and work on that.
- Create a functional analysis of the patent by underlining each noun in the patent claims and identifying its functions.
- Trim the simplest component.
- If there is a solution, use TRIZ to figure out how to get around the new invention, making one's own patent more robust.
- Start-ups benefit from TRIZ method to circumvent existing patents as one scenario to overcome protection barriers.

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Oliver Mayer graduated from the Technische Universität München (TUM). He holds a PhD in Solar Water Pumping from the University of the Armed Forces in Germany. In 2002, he received his postdoctoral lecturer degree (Habilitation) with the Venia Lengendi on Energy Conversion.

After having worked for two years as a consultant for solar water treatment in several developing countries, Dr. Mayer joined KMW company, where he was responsible for system logistics. In 2004, he joined the newly opened GE research facility for Europe in Munich. He was responsible for distributed, hybrid power generation as well as innovation methodologies and quality management. Since 2007, he has been involved in TRIZ. Today, he is one of two TRIZ masters in Germany and one of four in Europe.

Frank C. Schnittker graduated from the Technical University Berlin and has since been working in the area of innovation and IP management. He is a registered U.S. patent practitioner, advising and representing clients on patent matters before USPTO and WIPO. In addition, he lectures and publishes on IP management. Mr. Schnittker's involvement with TRIZ dates back to 2006. He was part of a team developing the world's largest mobile crane, applying TRIZ methodology and consecutively filing outstanding patents for award-winning innovations. Mr. Schnittker is a standing member of the VDI expert committee applying and refining TRIZ methods and co-authored VDI 4521, part 1-3.

Glossary

Abbreviations

ACO	Appellation of Controlled Origin
ADAS	Advanced Driver-Assistance Systems
ADR	Alternative Dispute Resolution
AI	Angel Investor
AI	Artificial Intelligence
AUM	Assets Under Management
B2C	Business to Consumer
BEV	Battery Electric Vehicle
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIP	Continuation-in-Part Patent Application
CIR	Crédit Impôt Recherche
CRADA	Cooperative Research and Development Agreement
CRCs	Cooperative Research Centres
CTO	Chief Technical Officer
DCF	Discounted Cash Flow
DeFi	Decentralized Finance
DNS	Domain Name System
EBITDA	Earnings Before Interest, Tax, Depreciation, and Amortization
EFG	Enterprise Finance Guarantee
EMS	Enterprise Management System
EPC	European Patent Convention
ESG	Environmental, Social and Governance
ETI	Entreprise de Taille Intermédiaire
EV	Electric Vehicle
FTE	Full-Time Equivalent
FTO	Freedom to Operate
GDP	Gross Domestic Product
GIFTTM	Global Intangible Finance Tracker

M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
https://doi.org/10.1007/978-3-031-16993-9

HMA	Hague Model Convention
HR	Human Resources
HTB	High-growth Technology Business Initiative of EPO & LESI
IA	Intangible Assets
IFRS	International Financial Reporting Standards
IGC	General Index of Courses, by the Ministry of Education, Brazil
IP	Intellectual Property
IPM	Intellectual Property Management
IPO	Initial Public Offering
IPR	Intellectual Property Right
IRR	Internal Rate of Return
KOL	Key Opinion Leader
KPI	Key Performance Indicator
KYP	Know Your Product
LBO	Leveraged Buyout
LP	Limited Partner
M&A	Mergers and Acquisitions
MD	Managing Director
METS	Mining Equipment Technology Services
MFP	Minimum Functional Product
ML	Machine Learning
MOIC	Multiple of Invested Capital
MSE	Midsize Enterprise
MVIP	Minimum Viable Intellectual Property
MVP	Minimum Viable Product
NDA	Non-disclosure Agreement
NFT	Non-Fungible Token
NOL	Net Operating Loss(es)
OSS	Open-Source Software
PbD	Privacy by Design
PBR	Plant Breeders' Right
PGI	Protected Geographical Indication
PCT	Patent Cooperation Treaty
PE	Private Equity
POC	Proof-of-Concept Program
PRO	Public Research Organization
PPE	Tangible PPE Assets: Plants, Physical Properties, and Equipment
PVR	Plant Variety Right
R&D	Research and Development
ROE	Return on Equity
ROI	Return on Investment
RRM	Royalty Relief Method
RTTP	Registered Technology Transfer Professional
SaaS	Software as a Service
SAFE	Simple Agreement for Future Equity

SAFT	Simple Agreement for Future Tokens
SDGs	Sustainable Development Goals
SEO	Search Engine Optimization
SEPs	Standard Essential Patents
SINOVA	Secretariat for Innovation of UFSC, Brazil
SME	Small and Medium Enterprise
SPAC	Special Purpose Acquisition Company (aka "blank check")
SPC	Supplementary Protection Certificate
TLO	Technology Licensing Office
TRIZ	Theory of Inventive Problem Solving (TIPS)
TT	Technology Transfer
TTO	Technology Transfer Office
UAV	Unmanned Aerial Vehicle
URL	Uniform Resource Locator
USF	University Seed Fund
USP	Unique Selling Proposition
UTF	University Technology Fund
UX	User Experience
VC	Venture Capital/Venture Capitalist
VCU	Vehicle Control Unit
VOIP	Voice over Internet Protocol
VP	Vice President
WACC	Weighted Average Cost of Capital

Institutions and Associations

ABA	American Bar Association
ACATE	Association of Technology Companies of Santa Catarina, Brazil
AIPLA	American Intellectual Property Law Association
AIPPI	International Association for the Protection of Intellectual Property
AUTM	Association of University Technology Managers
BDC	Business Development Bank of Canada
CEIPI	Center for International Intellectual Property Studies
CGPDTM	Office of the Patents, Designs and Trade Marks (India)
CIA	Primavera Innovation Center, Florianópolis, Brazil
CII	IT Industrial Condominium, Florianópolis, Brazil
CIP	Center for Intellectual Property
CIPO	Canadian Intellectual Property Office
CNCPI	Compagnie Nationale des Conseils en Propriété Industrielle
CNIPA	China National Intellectual Property Administration
CSA	Canadian Securities Administrators
CSIRO	Commonwealth Scientific and Industrial Research Organisation

CSIS	Center for Strategic and International Studies
CVCA	Canadian Venture Capital and Private Equity Association
DARPA	U.S. Defense Advanced Research Projects Agency
DPMA	German Patent and Trademark Office
EC	European Commission
EGE	École de Guerre Economique (French Economic War School)
EPFL	École Polytechnique Fédérale de Lausanne, Switzerland
EPO	European Patent Office
ETH Zürich	Swiss Federal Institute of Technology Zurich
EU	European Union
EUIPO	European Union Intellectual Property Office
FAPESC	Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina, Brazil
FDA	Federal Drug Association
FINA	Canadian House of Commons Standing Committee on Finance
FINRA	Financial Industry Regulatory Authority
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
IDF	Israeli Defense Forces
IEEPI	Institut Européen Entreprise et Propriété Intellectuelle
IGE	Swiss Federal Institute of Intellectual Property
ILPTO	Israeli Patent Office
INPI	French Patent and Trademark Office
INPI	Brazilian National Institute of Industrial Property
IPEC	Intellectual Property Enforcement Coordinator
IPOS	Intellectual Property Office Singapore
IRAP	Canada's Industrial Research Assistance Program
IRCAD	Research Institute against Digestive Cancer
IRPI	Institut de Recherche en Propriété Intellectuelle
ISED	Innovation, Science and Economic Development (Canada)
ITC	United States International Trade Commission (USITC)
JPO	Japan Patent Office
KIPA	Korea Invention Promotion Association
KIT	Karlsruhe Institute of Technology
KOTEC	Korean Technology Finance Corporation
LES	Licensing Executives Society
LESI	Licensing Executives Society International
NACO	Canadian National Angel Capital Organization
NAPP	National Association of Patent Practitioners
NATO	North Atlantic Treaty Organization
NCFA	National Crowdfunding and Fintech Association of Canada
NIH	National Institutes of Health
NIPMO	National Intellectual Property Management Office (South Africa)
NIST	U.S. National Institute of Standards and Technology
NRC	National Research Council

NRCan	Natural Resources Canada
NRF	National Research Foundation
NSERC	Natural Sciences and Engineering Research Council of Canada
NSF	National Science Foundation
OECD	Organisation for Economic Co-operation and Development
OCS	Office of the Chief Scientist
PATLIB	PATent LIBrary – Patent Information Center of the EPO
PRC	People's Republic of China
PTRC	U.S. Patent and Trademark Resource Centers
SARIMA	Southern African Research & Innovation Management Association
SATT	Sociétés d'Accélération du Transfert de Technologies
SEC	Securities and Exchange Commission
SGDSN	Secrétariat Général de la Défense et de la Sécurité Nationale
SIPP	Start-ups Intellectual Property Protection
SR&ED	Government of Canada's Science and Research Tax Incentive Program
TUM	Technical University of Munich, Germany
UCT	University of Cape Town
UFSC	Federal University of Santa Catarina, Brazil
UKIPO	Intellectual Property Office of the United Kingdom
UN	United Nations
USPTO	United States Patent and Trademark Office
VBW	Bavarian Industry Association
WIPO	World Intellectual Property Organization

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M. A. Bader, S. Süzeroğlu-Melchiors (eds.), *Intellectual Property Management for Start-ups*, Management for Professionals,
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