Studies on Entrepreneurship, Structural Change and Industrial Dynamics

Giulio Bosio · Tommaso Minola
Federica Origo · Stefano Tomelleri
Editors

Rethinking Entrepreneurial Human Capital

The Role of Innovation and Collaboration

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Introduction

Giulio Bosio, Tommaso Minola, Federica Origo, and Stefano Tomelleri

Abstract The last decades have witnessed a number of structural changes (such as increasing demand for skill, population ageing and new waves of technological progress) that are posing new challenges to firms, also in terms of entrepreneurial human capital. In this context, entrepreneurship education plays a crucial role for the development of entrepreneurial skills, including the value of collaboration in the business activities. This book focuses the attention on entrepreneurial human capital by investigating to what extent it can be stimulated by entrepreneurship education through activities that combine collaborative practices and innovation. This introductory chapter provides a background for the book, a brief overview of its main contents, pointing out, for each chapter, the main research questions, methodology and results. Finally, it proposes some avenues for future research on the relationship between entrepreneurial human capital, innovation and collaborative practices.

Keywords Entrepreneurial human capital · Collaboration · Innovation · Structural change · Multidisciplinarity

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In the last decades, a number of structural changes have been posing new challenges to organizations. On the one hand, socio-demographic changes such as increasing female educational attainment and labor market participation, population ageing and migration flows have increased the diversity of potential workforce, requiring more articulated and flexible Human Resources policies (Shen et al. 2009). On the other hand, recent waves of technological progress, particularly in Information and Communication Technology (ICT), have deeply changed the nature of (several) jobs, causing massive flows of job creation and destruction (Autor 2015).

The most recent wave of technological progress, labeled Industry 4.0, differs from the previous "industrial revolutions" for the increasing interconnection between the real and the virtual world, especially in manufacturing. New ICT applications now allow to collect and process a large amount of information (the so called *Big Data*) for production and service deployment purposes, to integrate systems at all the production stages, to link machines and workers both within and outside the firm (involving suppliers, distributors and sometimes also final clients). Intelligent robots and tools exploit the potentially continuous flow of data to re-configure themselves in order to respond in real time to any change in the production cycle and/or in customers demand, thereby enabling an increasing customer segmentation and product personalization.

This new wave of technological progress is likely to impact both employment levels and composition within the firm and, ultimately, the skills required in the production process, including what has been referred to as *entrepreneurial human capital*: a complex and multidimensional asset, made of specialized, high-level entrepreneurship-specific skills and knowledge related to different business-related aspects, such as sales, negotiations, product development, and risk judgment (Shane 2003).

There is a substantial consensus among scholars and policy makers about the effects of entrepreneurship as a key driver of innovation and economic growth. Furthermore, recent theoretical and empirical evidence shows that entrepreneurial human capital is a distinct channel through which firm-specific human capital drives endogenous growth (Ehrlich et al. 2017). However, we know relatively little about the various and nuanced dimensions and antecedents of entrepreneurial human capital. So far there has been little attempt to evaluate in what ways the latent entrepreneurial capacity and knowledge can be developed or adapted to the changing working or business conditions. In this context, the main question is whether and how entrepreneurial skills can be effectively taught and learned. A complementary question is how to measure the stock of this specific kind of human capital and identify the set of skills that must be fostered. Finally, it is crucial to better understand the causal link between entrepreneurial human capital and firm's performance, especially in terms of innovation capacity and competition in international markets. To properly answer these questions, it is necessary to focus on the role and characteristics of entrepreneurship education as the privileged tool to promote entrepreneurial intentions and skills. Entrepreneurship education, in fact, should help students to develop the entrepreneurial knowledge that facilitates them to identify and act upon entrepreneurial opportunities (Hahn et al. 2017). The potential returns of entrepreneurship education are then not limited to the start-up of new companies or to the creation of new jobs. In a more comprehensive vision, entrepreneurship education should provide key competences to all students, regardless of their future employment status, to turn ideas into action, also by increasing creativity and self-confidence (European Commission 2008).

Furthermore, the greater pressure faced by firms to be flexible, innovative and adaptable in increasingly dynamic business environments has led to new forms of organizations and work, generating the urgency for collaboration both within and between firms, often requiring to cross geographical and technological boundaries (Hagerdoorn 2002). This process has involved private firms, organizations as well as public institutions.

Today competitive markets call for knowledge and information sharing as a key mechanism in driving both individual and organizational success and development. Taking a deeper look, the new technological revolution requires not only the need to create new connections and links between different social agents and firms, but also different perspectives in which economic and social development comes from collaboration practices.

The latest wave of technological progress has highlighted that innovation and collaboration are intrinsically related and their nexus may be exploited as a potential source of competitive advantage (Dyer and Singh 1998). Indeed, collaborative practices and partnerships raise the development of organizations, enhancing access to resources and funding as well as providing, at the same time, a mean for long-term sustainability. It also stimulates the exchange of tacit knowledge among people. In this way, how, why and when collaboration occurs within and among organizations represents an emergent and still largely unexplored area of research that has the potential to greatly advance knowledge on the application of these new practices in a wide range of areas.

The growing dynamics of collaborative practices are raising increased attention on the relevance of the concept of "soft skills", such as cooperation, team-working, ability to negotiate, openness and social skills, which represent key determinant of individual behavior and success both at school and in business activities (Heckman and Kautz 2012). The question is therefore whether soft skills can be stimulated by, and personal enhancement can be pursued with, specific education programs. In this direction, the diffusion of collaborative practices and the focus on soft skills in entrepreneurship education have concerned all educational levels, even in university degrees.

Conceptually, entrepreneurship education can be interpreted as a specific tool for promoting the development of an entrepreneurial mindset and more specifically, the value of collaboration in the business activities (European Commission 2008). Indeed, understanding and embracing the role of collaborative practices is so relevant that nearly all entrepreneurship courses include team-based project work (Lackeus 2015). This method emphasizes the rewards of collaboration in obtaining a common goal and reflects a "gold" standard in teaching entrepreneurial mindset. A denser and more collaborative entrepreneurial network can generate positive spill-overs on the process of entrepreneurial human capital accumulation and hence, given the dynamic nature of entrepreneurial learning, represents a key element to boost entrepreneurship as a career option.

In light of these considerations, this book focuses the attention on the specific traits and the nature of entrepreneurial human capital, in particular by investigating to what extent it can be stimulated by entrepreneurship education through activities that combine collaborative practices and innovation. The book includes a

comprehensive and multidisciplinary collection of contributes—providing both theoretical reflections as well as empirical evidence—on how entrepreneurship education can be structured. It also contributes to the ongoing debate on whether and how entrepreneurial skills can be actually taught, pointing to the role of innovation and collaboration in the design of educational programs that have the purpose to spread entrepreneurial human capital.

The book is structured into two main parts. The first part sets the contextual background, highlighting the main features of recent structural changes in ICT and robotics that have deeply influenced the production process, focusing on their effects on work practices within the firm and, specifically, on entrepreneurial human capital. Furthermore, it presents some evidence on the relationship between the latter and some specific organizational outcomes. Finally, it points to the role of entrepreneurship education to foster both collaboration and creativity, looking at the definition and relationships of these concepts in the EU education policies.

The second part provides examples of how collaborative practices can be valuable to entrepreneurship research and practice. These practices represent inputs to the design and organization of entrepreneurship education across campuses, as well as illustrative cases for teaching purpose in innovation and entrepreneurship classes.

This book results from an articulated selection process and includes some of the contributions, especially those dealing with collaborative practices in entrepreneurship education, presented at the scientific workshop "Together. Collaborative practices in groups and organizations" held at the University of Bergamo on 18th and 19th of May 2016. Other chapters have been invited after a careful evaluation of their contribution to the discussion on the role of collaborative practices and innovation within the framework of entrepreneurship education. Each contribution has undergone a blind review process, involving internal and external referees.

1 Structural Changes and Entrepreneurial Human Capital

In the last decades, continuous advances in ICT technologies, computerization and robotics have caused significant changes within the workplace, enabling new forms of businesses and contributing to economic growth. As pointed out in the chapter by **Bosio and Cristini**, this new wave of technological progress caused significant changes on employment levels and composition within the firm and, ultimately, on the skills required in the production process. Most of the earliest literature has focused on either changes in employment or jobs, finding rather mixed results. Some studies point out that the new technologies have been progressively substituting for labor in the production process, causing a significant job destruction across a wide range of occupations (substitution theory; see Akst 2013 or Brynjolfsson and McAfee 2014). Other studies agree that automation substitutes for labor, but it can also complement it, also through positive indirect effects on productivity and earnings (compensation theory; see Autor 2015 or Acemoglu and Restrepo 2016). A recent strand of literature, also thanks to new datasets that allow to precisely

measure tasks within occupations, argue that the fraction of jobs that is likely to disappear in the next years due to the new technologies is rather low in OECD countries. However, at least one quarter of the existing jobs, especially among the low skilled ones, will experience a major change in their task contents (OECD 2017). In this respect, occupations are the best units of analysis and a "task approach" is the most suitable methodology to fully account for the effect of ICT and automation in the labor market. Using this approach, recent studies point to job polarization as a recurring empirical fact in most OECD countries: a relative decline in the demand for middle occupations, characterized by routine tasks that could be easily performed by the new machines, has been associated to a significant increase in labor demand for both high and low skilled occupations characterized by non-routine tasks (see Autor and Dorn 2013 for the USA; Goos et al. 2009 on Europe). Bosio and Cristini provide further evidence on job polarization in Europe, exploring differences across groups of countries. Their shift-share analysis shows that job polarization is a common phenomenon across Europe, with the occupational distribution shifting from routine to both abstract and manual jobs, even if the growth of manual occupations is still limited, especially in Continental and Mediterranean EU countries, compared to the USA. Furthermore, in Nordic countries the decline in routine occupations has been less pronounced than in other EU areas, while the UK has registered the greatest reallocation of employment shares towards non-routine occupations, equally distributed among abstract and manual ones. While acknowledging the role of automation in explaining these trends, Bosio and Cristini point to the role of differences in the institutional setting across countries, especially in labor and product market regulation, which can in turn influence entrepreneurial activity and dynamism, as additional factors that can explain heterogeneous trends in job polarization across countries.

The complementarity between new technologies and high skilled occupations suggests the existence of organizational complementarities, meaning that the adoption of ICT is more effective in organizations with more skilled people and which simultaneously implemented a significant organizational change, characterized by decentralized workplace organization (Bresnahan et al. 2002). Such type of work organization requires a higher worker engagement along many dimensions, including work autonomy, task discretion, involvement in decision making at the workplace or firm level and financial participation. **Bryson** provides a multidisciplinary overview on the history of employee engagement, investigating how the so-called "high-involvement", "high commitment" or "high performance" workplace practices (Lawler 1986; Appelbaum et al. 2000) can produce mutual gains in the modern workplace. These benefits take the form of higher labor productivity and profitability for the employers, while for employees they arise through higher job satisfaction due to engaging in enjoyable work, controlling their own working environment and feeling part of the enterprise. Notice that these practices may be the antecedents of intrapreneurship, since a more engaged worker is more likely to take some risk and undertake initiatives, often requiring creativity and innovation, which may end up in the creation of a profitable venture within the organization (Jong and Wennekers 2008). Empirical evidence, mainly on Britain, shows that human resource

management (HRM) practices promoting workers autonomy are not as widespread as economics and management theory predicted at the wake of the ICT revolution. Furthermore, while workers believe that having a paid job is important for their wellbeing, they declare negative feelings while at work, confirming the traditional economic assumption of disutility from work and casting doubts on whether and how workers are actually "engaged" in their jobs. Bryson provides also new evidence on the existence of mutual gains using the 2004 and 2011 waves of the Workplace Employment Relations Surveys. From the workers' side, he finds a U-shaped relationship between HRM intensity and various indicators of employee job attitudes, suggesting that adding further HRM practices can elicit employee engagement only at relatively high levels of HRM intensity. In this sense, there seems to be an optimal number of "high-involvement" HRM practices making the employees actually engaged in their work. These results also suggest that entrepreneurial human capital may play a role in promoting a mix of HRM practices that can actually make the employees engaged in the firm. From the employer's side, Bryson's estimates show that employee engagement (measured by an index capturing employee perceptions of how good managers are at seeking their views, responding to them and allowing them to influence decision-making) is the only employee attitude that is significantly associated, other things equal, with higher workplace performance, especially in terms of labor productivity. From a policy point of view, these results call for more governmental interventions in promoting greater employee engagement at the workplace, also in light of the underinvestment that firms are likely to do on it if they do not consider the social benefits of these practices.

A closer look to the role of entrepreneurial human capital in influencing economic growth is taken in the chapter by **Capelleras, Martin-Sanchez, Rialp and Shela**. They investigate the effect of entrepreneurs' exports orientation on growth aspiration taking into account entrepreneurs' level of human capital. Their analysis departs from the idea that entrepreneurs starting their export activities have to face organizational and environmental obstacles, also due to the lack of regional specific knowledge, that are not experienced by their host counterparts (Zaheer 1995; Johanson and Vahlne 2009). Consequently, entrepreneurs' may try to enter the unknown foreign market also going beyond prevailing norms and using their own judgmental sense to seize available opportunities (Wiltbank et al. 2006). Therefore, one would expect that the entrepreneurs' export orientation will have a positive impact on their aspirations to grow the new business. However, such relationship may depend on entrepreneurial human capital, since high skilled entrepreneurs (where skills can be proxied by either the level of education or work experience) will be more able to better identify profitable business opportunities in the host country compared to low skilled ones; this ultimately will motivate them to achieve higher growth aspirations. The original empirical analysis carried out by the authors is based on individual data from the Global Entrepreneurship Monitor (GEM) combined with country-level data from the World Development Indicators (WDI) dataset by the World Bank in 78 countries from 2003 to 2001. Estimates obtained with multi-level models show that on average entrepreneurs' export orientation does

not significantly affect growth aspirations. However, effect on aspirations is significantly higher for those entrepreneurs with higher levels of education and entrepreneurial experience. A straightforward policy implication of these results is that promoting higher education attainment would help the entrepreneurs to improve their cognitive abilities and awareness to create new opportunities.

If entrepreneurial human capital is an input factor of economic growth and education plays a role in creating it, entrepreneurship education should stand out as the preferred tool to teach and improve this specific form of human capital. The chapter by **Magni and Mazzini** introduces to the central topic of our analysis with a multidisciplinary overview, which spans from the idea of collaboration, entrepreneurship and management skills in the work of the ancient Greek thinkers Aristotle and Xenophon to the current European documents on entrepreneurship education. In a collaborative organization, resources are shared and mutual cooperation among its members creates a common identity. Hence, teamwork and networking are both strategic skills and work practices that should be promoted to grant organization's success. In this perspective, Aristotle's concept of *philìa* should be associated with a positive idea of entrepreneurship and the latter should build on the concepts of work ethics highlighted by Xenophon in his Socratic dialogue *Oeconomicus*. In light of these lessons from the ancient past, Magni and Mazzini review the most relevant European Union's policy documents on entrepreneurship education (European Commission 2003, 2006 and 2013) to verify to what extent the "classical" perspective still permeates the current definition of entrepreneurship and skills. Their analysis shows that the EU documents point to the need to foster individual entrepreneurial spirit both investing in entrepreneurship education and promoting at least one practical business experience within compulsory education. The development of the "sense of initiative", teamwork ability and creativity are in the same line with those proposed by Xenophon, but the European definition of skills is quite different. While in Xenophon's perspective skills are not something to be learned, but are an essential part of each person, in the European perspective skills are standardized competences, which can be classified in levels and to which all individuals should adapt, first during schools and subsequently at the workplace. Magni and Mazzini conclude that, in order to re-build a pedagogical perspective centered on each person rather than on "something" that should be learned, it is important to recover those prerequisites identified by Xenophon, which involve also human values that may be important for both organizational and social wellbeing.

2 Collaboration and Innovation in Entrepreneurship Education Practices

Several researchers have observed a growth of entrepreneurship education diffusion (Morris et al. 2013), which has occurred in a multitude of ways. Sustaining such growth is challenging, especially when universities need to increase

entrepreneurship education by reaching out different disciplines and divisions on a university campus. Due to the variability in program design and implementation, identifying what factors determine the long-term success or failure of entrepreneurship programs is not trivial. By drawing on service science theory, **Hoy and Pavlov** examine how entrepreneurship education programs may be designed, implemented and assessed. Such approach allows analyzing education practices by incorporating the common elements of service systems. The experience at Worcester Polytechnic Institute in the United States is offered as a case study. The chapter offers a methodological contribution to the entrepreneurship literature, but also a practical contribution since the framework proposed can support strategic planning by university leaders and program directors. According to the "entrepreneurial university" vision (Fayolle and Redford 2014; Minola et al. 2016), universities must become entrepreneurial in *all* their activities in order to survive in the competitive educational marketplace. As an aid for strategy, the authors organize all framework elements into a Service Science Canvas. Its constitutive elements are the following: Resources, Access rights, Entities, Stakeholders, Value Co-Creation, Networks, Ecology, Governance, Outcomes, and Measures. By in-depth analyzing the case of Worcester Polytechnic Institute, the author introduce Service Science Canvas as a means for analyzing *education as a service* with a comprehensive entrepreneurship education as an example.

In different realms of society, established practices are altered and new ones are created thanks to digitalization, with its technologies, processes and application George et al. (2016). Academic research in management makes no exception in this regard (Obschonka 2017; Obschonka et al. 2017). **Fini et al.** focus on how ICT technologies and data science protocols can benefit management research, and particularly the field of entrepreneurship. After outlining commonalities and trends in management and data science research, they present some practical examples arising from several collaborative projects; these span from university–industry collaborations and technology and innovation management, to scientometrics, and from strategy processes in the tourism sector to business performance analytics. Implications for using data science in entrepreneurship and management research are finally offered by the authors. Beyond such contributions, the chapter offers a valid set of example that can be used in classes, especially those that are problem or case-based.

The relationship between research and practice, and between researchers and practitioners in particular (Hodgkinson et al. 2001; Alferoff and Knights 2009), is key to make organizational research more and more responsive to all its potential stakeholders. In line with the tradition of action research (e.g. Cassell and Johnson 2006) and collaborative processes (Shani et al. 2008; James and Denyer 2009), collaboration is crucial in research (Shani and Coghlan 2014).

In this context, the contribution of **Cirella** aims to understand whether and how a collaborative research project offers long-term organizational impacts. A collaborative management research (CMR) process is utilized as case. It consists in a collective effort performed at the Polytechnic University of Milan (Italy) by three researchers in organizational behavior and human resources management, together with an Italian fashion company. Based on the follow-up illustration, derived by data

collection after the termination of the research collaboration, the chapter discusses the potential long-term relevance and impact of CMR by exploring its social nature. The chapter also offers case-based criteria for impactful collaborative research, such as co-determination. Finally, the chapter offers implications for collaborative research and soft skills, thus proving valuable contribution to practice, in particular to train graduate students.

Organizational design, business processes and the multiplicity and heterogeneity work-related skills have risen in the last decades. This has emphasized the important for collaboration in the management of firms, organization and even public institutions; this is further prompted by the progressive and overall drop of resources in socio-economic systems, which has encouraged the collective pursuing of the "common good" in many ways. **Grasseni et al.** report on an educational tool for stimulating collaborative behaviors and attitudes among individuals. It consists in a sociological-rooted educational game, called *Totem and Tribe* that activates cooperative learning (Mayer and Alexander 2016). The authors report on the conceptualization of the game around the emergence and the development of leadership processes within groups and the empirics resulting from its replication to a mixed sample of students and entrepreneurs from the Center for Young and Family Enterprise (CYFE). A survey was administered before and after the game (pre and post test); results indicate that, overall, the average attitude towards collaboration increases after the game and suggest a number of contingencies to this finding, such as mutual interaction, common goals, low hierarchy, and trust.

3 Conclusion

The present research collection prompted from the observation that collaboration and innovation are becoming crucial dimensions of any socio-economic endeavor (Dyer and Singh 1998; Heckman and Kautz 2012). This manifests in several dimensions of industrial dynamics, firm' strategies and individual job market trajectories (Hagerdoorn 2002; Ehrlich et al. 2017), and is emphasized by the pervasive importance of entrepreneurship—and particularly entrepreneurial human capital—at aggregate, organizational and individual level (Shane 2003).

Also, the editors experienced—through the crafting of this volume—that collaboration and innovation somehow represent essential traits of modern research practices. Scholars benefit from the integration of different methodological approaches on the one hand and connect different literatures and theoretical domains on the other, in order to provide broader and bolder contributions.

The book represents a contribution to a deeper understanding of both such aspects of collaboration. First, it documents the nature of job changing in the modern workplace, introduces the importance of entrepreneurial human capital and offers a number of original collaborative research and education practices in entrepreneurship. Second, it offers such contributions as result of a collaborative research project that has connected different areas in business, economics, engineering and sociology.

This research and editorial experience has led the editors to experience the most challenging dimensions of collaboration that usually pertain different phases of the research: at initial (e.g., literature problematization and scoping of research question), developmental (e.g., empirical research design, data elaboration and visualization, result presentation) and final stages (e.g., valorization, editorial collocation). Nevertheless, this journey has permitted to experience the collaboration as potentially beneficial endeavor, by indicating for example that different disciplines, when combined, can improve the understanding of complex phenomena, increase the theoretical contribution of empirical research, and better bridge research and practice. This is particularly true in the context of entrepreneurship, which has long been depicted as a multidisciplinary research domain (Acs and Audretsch 2006).

Future research could further develop this multidisciplinary and collaborative research in several ways, such as: addressing the role of technology pervasiveness and artificial intelligence in the process of shaping entrepreneurial human capital and emergence of entrepreneurial opportunities; the wide adoption of experiments as social science method; exploring other crucial context *within* the classic fields of entrepreneurship (such as the family embeddedness perspective on collaboration and innovation) and *outside* it (such as the surge of entrepreneurial firms and organizations in life science and health care industries); and, finally, studying how different higher education institution governance mechanisms could enhance the effectiveness of collaborative research, assess it and incentivize it. This could be done by further enlarging the set of disciplinary domains involved, by including for example medicine and biology, psychology, law studies, and information technologies.

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Part I
Structural Changes and Entrepreneurial Human Capital

Is the Nature of Jobs Changing? The Role of Technological Progress and Structural Change in the Labour Market

Giulio Bosio and Annalisa Cristini

Abstract We examine the process of radical transformation that during the last decades has changed labor markets in developed countries and, in particular, the nature of jobs. Indeed, the advances in ICT and robotics have generated the concern that automation could substitute people in a wide range of activities, therefore contributing to the potential increase in the fraction of jobs at risk in the next future. However, empirical evidence on labour demand in the majority of OECD countries emphasizes a process of labour market polarization that consists in the hollowing out of routine occupations accompanied by a quasi-simultaneous rise of non-routine occupations, both high skilled conceptual and manual low skilled ones. This process has been explained by the routinization hypothesis, whereby computer-based technologies allow machines to perform repetitive tasks and replace workers in routine jobs where such tasks are prevalent. In this perspective, structural and occupational changes are naturally interwined with technological change; their understanding can therefore help unravelling the features of new technologies and how they can influence demand for skills. In such a setting, entrepreneurship can play an important role as driver of innovation and employment growth.

Keywords Jobs · Automation · Routine-biased technological change · Structural change · Occupations · Entrepreneurial human capital

1 Automation, Technological Progress and Employment

It has been widely documented that during the last decades labour markets in developed countries have experienced a process of radical transformation that is still under way and has changed dramatically their structure as well as the nature of

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jobs. Indeed, advances in IC technologies, robotics and computerization have increasingly ushered a new age of automation, in which machines can substitute and/or complement people in a wide range of work activities. The extent of technology adoption within workplace have primarily enabled new forms of businesses and contributed to raise productivity and economic growth. These changes, by influencing employment conditions and wage policies, have also affected individual and household wellbeing, and likely exacerbated inequalitie. Hence, the understanding of the mechanisms driving these processess represents an important challenge for both scholars and policy makers.

While there is a large stream of studies exploring the potential impact of automation on the nature of future jobs (Manyika et al. 2016), there is still an ongoing disagreement on the sign of this relation.

On the one hand, the argument is that computer automation eliminates jobs at an increase rate and therefore generates a higher level of technological unemployment *(substitution theory)*. As debated in Frey and Osborne (2013), a consistent portion of employment could be at risk in the next years as new computer technologies will acquire growing relevance in the production process. The automation of activities previously performed by labor has fostered periodic concerns that new workplace technologies can make labor redundant, wiping out, a large number of jobs across a wide range of occupations (e.g. Askt 2013; Brynjolfsson and McAfee 2011). The consistent decline in the labour share identified technological changes as one of the main culprit of this evolution. The argument is that the fall in the price of capital as well as the explosion of the digital IT technologies has modified the capital-labor complementarity, determining a shift in the employment composition from labour-intensive to capital-intensive industries (Orak 2017).[1]

On the other hand, other studies (Acemoglu and Restrepo 2016; Bresnahan 1999) point out that automation in the last two centuries has not induced a long-run increase in the unemployment rate and not even made human labor obsolete (Autor 2015). On the contrary, computer technologies has specifically eliminated jobs in the middle-wage occupations characterized by repetitive and codifiable activites, i.e. the so called routine task. In addition, Autor et al. (2003) claimed that new workplace machines easily outperformed such job tasks which traditionally followed explicit rules and repetition of methodical procedure. Moreover, Autor (2015, p. 5) argued that "Automation does indeed substitutes for labor—as it is typically intended to do. However, automation also complements labor, raises output in ways that lead to higher demand for labor, and interacts with adjustments in labor supply". Notably, Autor argued that public opinion and policy makers tend to overestimate the capabilites of machine as substitutes for human labor and do not

[1]Obviously, other potential determinants explaining downward trend in the labour share have been explored in this line of literature. Among the others, institutional changes in the labour market and the relative weaking of workers' bargaining power have received particular attention.

take into account the positive indirect effects of automation on labour demand through a rise in productivity and earnings *(compensation theory)*. Following this reasoning, Bessen (2016) proposed two main reasons according to which automation process might positively influence labor demand for a specific occupation. Firstly, by reducing the cost per unit of product, the new technologies can positively influence demand, therefore boosting the relative labour demand. Secondly, robots and new technologies, by enhancing productivity in some jobs, can ease the substitution with other activities, raising employment in new and more productive jobs.

Reflecting on the potential employment impact of technological innovations in automation and machine learning, it is worthwhile to keep in mind that there are substantial differences between humans and machines. Traditionally, jobs characterized by creative, communicative and cognitive tasks were considered challenging to be automated, while they required less effort for humans. On the contrary, jobs relying on tasks characterized by arithmetic or repetitive set of rules are considered trivial to be substituted by machines (Feng and Graetz 2015). Against this vision, Brynjolfsson and McAfee (2011) sustained that the exponential growth of computing power over time facilitates technologies in solving obstacles and exploring new areas of application, previously performed by human laborers. In this direction, a widely cited stream of research has investigated to what extent recent advances in automation and robotics has reduced the likeliness of jobs, taking inspiration from Frey and Osborne (2013). Notably, the authors have originally claimed that 47% of jobs in the US labour market are susceptible to automation in the near future. A similar methodology has been adopted in Bowles (2014) and the results seem to indicate a threat even larger for European labour markets, with 45–60% of jobs at risk to be eliminated by the diffusion of new technologies and robotics in the next 2 decades. Hence, supporters of the substitution theory claimed that concerns about the potential impact of automation seem substantial and need to be take into account.

The debate on the employment impact of technology adoption is still open and there is no consensus with the statements about the share of jobs at risk to be substituted by machines. In this light, criticizing some assumptions on which the seminal work of Frey and Osborne (2013) is based, Arntz et al. (2016) suggested that on average, in the OECD countries, only 9% of job is automatable in the short-run. Overall, critics of the alarming estimates emphasize the importance to account for the heterogeneity across occupations rather than looking at the jobs as single and independent unit. An alternative way to estimate the impact of technology on future employment and quantify the number of jobs at risk of automation has been developed by the OECD. It exploits the task content of each individual job collected in the OECD Adult Skill Survey 2012–2015 (Programme for the International Assessment of Adult Competencies, PIAAC) which allows for a detailed breakdown of workers' task. Based on this approach and on data from OECD Employment Outlook (2017), Fig. 1 reports that the fraction of jobs at high risk of automation ranges for several OECD countries between 6% (Finland) and 13% (Greece). Conversely, a consistent fraction of jobs (around 25%, though the variation across

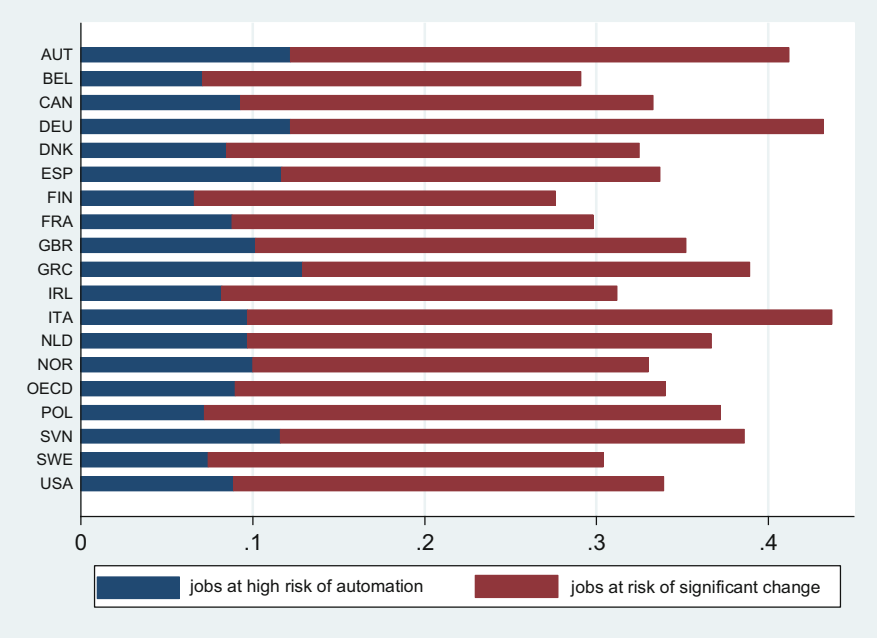

Fig. 1 Jobs at risk of automation in the OECD countries. Source: Employment Outlook 2017 (OECD) and based on the Survey of Adult Skill (PIAAC) 2012, 2015

countries is relevant) will experience a change in the majority of tasks they entail associated with the developments of new technology and robotics. In particular, this result matters for those people employed in low-skill occupations and from most disadvantaged socio-economic groups.

The rest of this chapter is structured as follows. In Sect. 2, we discuss the potential impact of different types of automation. More specifically, we start by briefly illustrating the new evidence on industrial robots in manufacturing industries and the recent debate on the role of robotics. Then, we concentrate on the diffusion of ICT technologies and digital revolution and the relative skill-biased labour demand. Lastly, we introduce the concept of labour market polarization and routine-biased technological change. Section 3 presents the interplay between routinization and structural change, with a focus on the role of occupations. In Sect. 4, we discuss the literature based on the task approach to labour market, while Sect. 5 provides empirical evidence on job polarization in Europe and a detailed decomposition analysis on the within and between components of this process. In Sect. 6, we introduce the relationship between technological innovation and entrepreneurship and finally, Sect. 7 concludes.

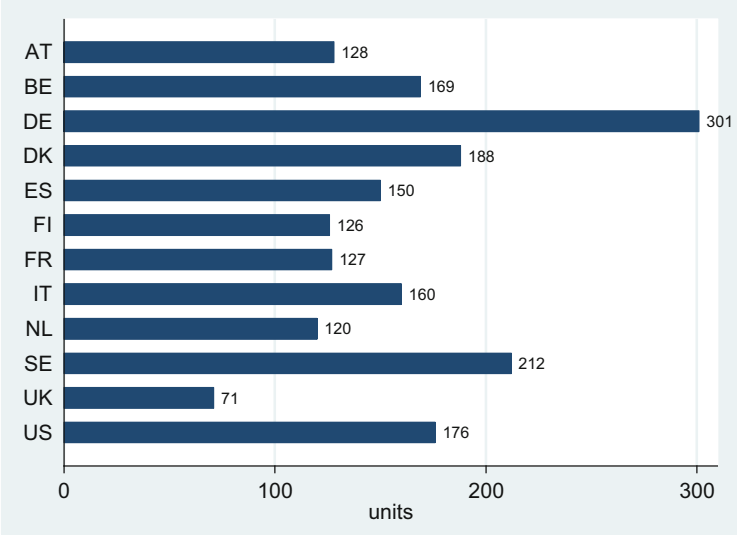

Fig. 2 The number of multipurpose industrial robots per 10,000 employees in manufacturing: 2015. Source: Elaboration on IFR data

2 The Industrial Robots

Given the growing concerns on the potential effects of automation on unemployment and inequality, it is surprising that the actual impact of robotics has been sparingly addressed. One exception is the work of Graetz and Michaels (2015) which analyzes how employment and productivity are influenced by robot density (i.e. the number of robots per employee). Using a panel of industries in several OECD countries for the period 1993–2007, they find a positive association between robot density and productivity, but the results concerning the employment impact of a higher use of robots indicate only a weak negative association for low-skilled jobs.[2] Other studies relying on robots data find that robotics do not necessarily imply a reduction in the employment prospects. In the same light, the International Federation of Robotics (IFR) have recently claimed that the spread in the use of robotics and in the automation process has the capability to improve the performance of US labour market (IFR 2017). The intuition is that the adoption of robots in the production processes at the industry-level can reduce the scope for off-shoring and ease the complementarities between technology and humans, avoiding outsourcing and improving the organization of work.

[2]These estimates appears particularly striking, considering the standard results in this stream of research that technological change is biased against middle-skilled workers or those in routine occupations (Acemoglu and Autor 2011; Autor 2014; Frey and Osborne 2013; Goos and Manning 2007; Goos et al. 2014; Michaels et al. 2014).

Cross-country differences in the speed of robotics' adoption into the production process can influence the rate at which automation will be able to potentially eliminate an increasing share of jobs. Figure 2 depicts the number of multipurpose industrial robots per 10,000 employees in the manufacturing industries in 2015 provided by the International Federation of Robotics (IFR).[3] We select a sample of developed economies which includes European countries as well as the US. The evidence indicates a significant heterogeneity in the diffusion of this type of robots in the production process of manufacturing industries across countries. In particular, Germany is the country with the highest penetration of industrial robots in the manufacturing, while on the opposite, the UK appears to be the less automated country.

3 ICT, Digital Revolution and Demand for Skills

Automation and robotics are not the only way through which new technologies can influence employment opportunities. The introduction of new products as well as technology-induced changes in the organization of work, all imply changes in the distribution of jobs across occupations and industries. More importantly, information and communication technology (ICT) and digitalisation are expected to produce radical changes not only in the production process and delivery of goods and services, but also in the procedures to start a new business, reducing administrative costs and facilitating outsourcing and the creation of more global value chains.

ICT and digital innovation primarily lead to lower unit costs of production; in a competitive market this translates into lower prices and, in turn, generates higher demand for products. Hence, this mechanism stimulates the creation of new employment and the effect is stronger the higher the degree of competition and the higher the price elasticity of final demand. Conversely, the diffusion of ICT in non-competitive settings could exacerbate the labour-saving bias of the new technology, thus leading to the possibility of technological unemployment. Moreover, this bias capital will favour jobs where skills are complementary to capital, which also facilitate a compositional shift in employment from labour-intensive to more capital-intensive industries.

Figure 3 reports the evolution in the ICT capital services per hour worked provided by EU-KLEMS for several OECD countries from 1995 to 2014. The findings suggest that ICT investments largely grew at an increasing rate until

[3]This paper draws on the definition of a robot proposed by the International Organization for Standardization (ISO), and confirmed by the International Federation of Robotics (IFR), as *"an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications*" (IFR 2017). While several aspects of this definition are relevant, it is clearly a robots' autonomy, or its capability to interpret its environment and adjust its actions accordingly, that distinguishes it from traditional capital or machines (IFR 2017).

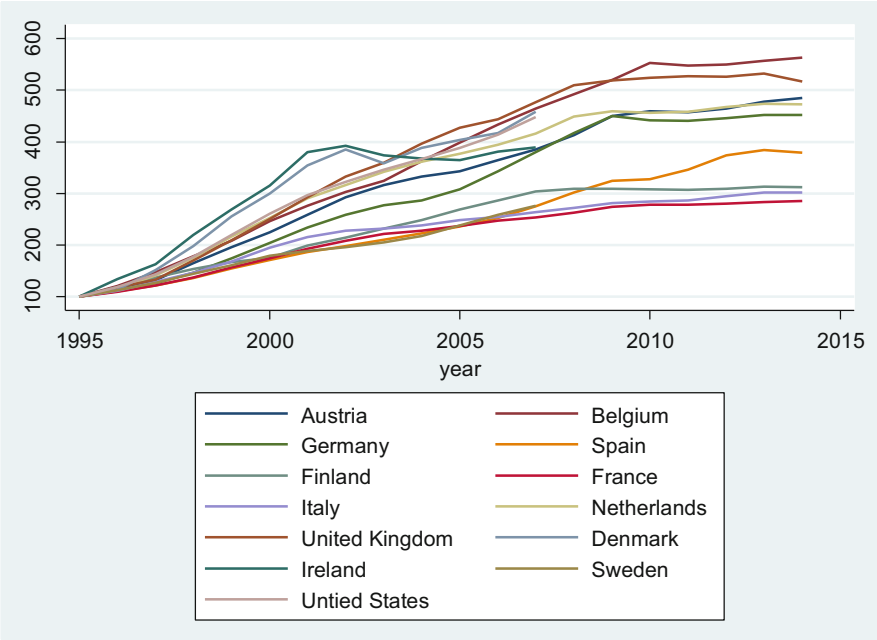

Fig. 3 The spread of ICT investment over time in the OECD countries. Source: EUKLEMS and World KLEMS, ICT capital services for hours worked, index (1995 = 100)

2007, while with the beginning of the Great Recession the rise in the growth rate slowed down in most countries. It could also be noted that the heterogeneity in the quantity of ICT capital services is still relevant and the gap in the path of ICT adoption across countries is consistent with different speed in the technological revolution. At the lower path, we find Finland, France and Italy that experienced a growth as much as 300% in these two decades, while, on the opposite, it is over 500% for Belgium and United Kingdom.[4]

Concerning the sign in the relationship between ICT and jobs, a recent report by OECD (2016) for the period 1992–2012 corroborated the insights from economic theory, emphasizing how, on average, ICT investments had only temporary impacts—positive or negative according to the specific period analyzed—on the labour demand and employment opportunities by skill while they enabled permanent effects on labour demand at the industry-level. Indeed, changes in the aggregate labour demand hide a process of reallocation across industries and in particular, increasing investments in ICT and digital economy negatively affect labour demand in manufacturing, transport and accomodation, as well as in the financial sectors. On the opposite, the relationship is positive, on average, in the public sector (government, health care, culture and recreation) and construction.

[4]For the period after 2007, the data are available only for a selected number of countries.

A stylized fact associated with the spread in ICT technologies since the 1980s has been the rise in the demand for highly educated workers in several OECD countries. Moreover, from the late 90s, Europe has experienced twice as large increases in graduation rate from tertiary education than in the US (Verdugo and Allègre 2017). This trend appears to be more relevant for countries in the Southern Europe and for women that have dramatically contributed to the recovery in labour market participation during the Great Recession. Notably, this is consistent with the concept of skill-biased technological change (SBTC) that has inspired a considerable attention in the economic literature. From the late70s and 80s, a clear demand shift in favour of college-educated workers has been detected in the evolution of labour demand.[5]

4 The Routine-Biased Technological Change

However, the STBC hypothesis did not fully match with the evidence, both in the US and European countries, of a consistent bias against middle-skill jobs relative to low- and high-skilled jobs (Autor et al. 2003, 2006; Goos et al. 2009; Spitz-Oener 2006). Starting from the work of Autor et al. (2003), a large body of economic literature has emphasized the role of occupations, sustaining that new technologies are complementary with human capital and, in particular, ICT substitutes for routine tasks and complements both abstract tasks. In this line, Michaels et al. (2014) analyzed whether ICT technologies represent a main source of job polarization, exploiting EU-KLEMS cross-industry data on a sample of OECD countries. Overall, they find that ICT-based explanation for labour market polarization is confirmed by the international data and that a faster growth in ICT investments at the industry-country level crucially increases demand for college-educated workers, relative to the middle ones, while for low-educated workers the estimates are not clear cut. The implicit assumptions on which this work relies is that there is a direct link between level of education and the task performed at work as well as between the diffusion of ICT technologies and computerization and the demand for middle (and low) skills. Following the same reasoning, Autor (2015) argued that "[cit.] changes in technology do alter the types of jobs available and what those jobs pay. In the last few decades, one noticeable change has been polarization of the labor market, in which wage gains went disproportionately to those at the top and at the bottom of the income and skill distribution, not to those in the middle.".

The phenomenon of job polarization refers to the increasing concentration of employment in the highest- and lowest-wage occupations, as jobs in middle-wage occupations disappear. Empirical studies (e.g. Acemoglu 1999; Autor et al.

[5]Traditionally, this shift has been explained by the skill-biased nature of technological progress, i.e. the fact that unskilled workers are more easily replaced by machines and susceptible to the risk of automation, while, on the opposite, skilled workers benefit by innovations and complement new ICT technologies.

2006; Goos and Manning 2007; Goos et al. 2009, 2014) have documented that employment structure is becoming concentrated at the tails of the occupational skill distribution. Consistently, this process has accelerated since the 1980s, as middle-skilled jobs tend to disappear. The economic literature has emphasized the role of demand shocks (and the importance of specific tasks) as the driving force and has identified three main mechanisms that could explain this trend (Kampelmann and Rycx 2011). The first one is the propensity to offshore labour services, i.e. the capability to relocate many middle-skilled production jobs to low-income countries (Blinder 2009). Second, the growing income inequality which may foster the demand for some low-paid service jobs (Autor and Dorn 2009). The third and more convincing explanation has been proposed by Autor et al. (2003). The idea is that this hollowing out of the middle is related to the disappearance of occupations focused on routine tasks, i.e. those activities that can be performed by following a well-defined set of procedures. Concretely, firms are able to substitute routine tasks for technology, a process driven by computerization. This hypothesis has become known as routinization, or routine-biased technical change (RBTC).

5 Routinization and Structural Change: The Role of Occupations

Until recently, little attention has been paid to occupations as a major unit of analysis to capture the potential employment impact of automation and advances in ICT even if there is a traditional stream in the economic literature claining that investments in occupation-specific skills reflect an important determinant of individual wages (Shaw 1984; Zangelidis 2008; Kambourov and Manovskii 2009). The underlying consideration is that workers develop occupation-specific human capital as they gain work experience and skill specificity increases the costs of occupational mobility. Practically, individual wages are affected by occupational experience more than either firm or industry tenure. Obviously, this situation has been challenged by the growing relevance of research of routinization and labour market polarization that put occupations at the center of the debate, since the task content of each job is primarily defined for each occupation.

In this light, structural and occupational changes are naturally interwined with technological change and occupations then identify a relevant path through which we can better grasp the features of new technologies and how they influence demand for skills.

Notably, routinization increases demand for high-skilled occupations, characterized by non-routine cognitive and analytical tasks as well as interpersonal work logics that are expected to be complementary to both automation and digital economies. Relying on the International Standard Classification of Occupations (ISCO88), in this group we can include managers, professionals, technicians and

associated professionals.[6] Conversely, ICT and routinization are considered substitutes for middle-skill occupations in which workers perform routine and codified tasks. Typical occupational profiles belonging to this group are clerical support workers, craft and related trades workers, plant and machine operators and assemblers. In a similar vein, routine-biased technological change is not expected to substitute manual jobs with machines, given that these works are not yet prone to ICT and robotics and are cheaply performed by humans (such as janitors, drivers and service occupations).

Concerning the interplay with the structural change, the industry dimension of routine-biased technological change is substantial, even if the majority of empirical studies on job (wage) polarization is based on an aggregate perspective. Indeed, routine-intensive occupations are largely concentrated in manufacturing and administrative services (e.g. support activities and trade), while abstract high-skilled occupations are widespread in several industries, but especially in financial sector, insurance and real estate services. They represent the top jobs in terms of wage profile, skills and qualification. For this reason, the intensity in job destruction associated with routinizazion and automation could consistently vary with industry.

Of course, manufacturing, transportation and specific segment of services share a consistent fraction of jobs replaceable by machines in the near future. Moreover, the share of these sectors is declining in developed OECD countries, as theorized in the framework of structural change, thus widening the potential challenges of RTBC in these economies. Consistently, the process of de-industrialization has further corroborated the shrinking of middle-skilled jobs in favour of a rising demand for non-routine occupations. Figure 4 reports the percentage change in total employment by industry for several OECD economies[7] in the period 1995–2015 and indicates that the process of de-industrialization is substantial, while the share of employment in service industries is rising (OECD 2017; Messina 2006).

In sum, occupational change and routinization are primarily examined using the "task approach", which also offers a novel perspective on the undergoing structural transformation in the labor market. Relying on the distinction between tasks—abstract, routine and manual—allows to better characterize the specificity of occupations and the content of jobs with respect to the traditional skill divide adopted in the SBTC, largely associated to specific educational levels. In this perspective, the task approach can facilitate the understanding of how structural change and occupational change interact in a context of growing routinization and technology adoption. Moreover, it also allows to verify whether the challenges of job polarization crucially rely on the industry composition of each economy and to what extent

[6]See Table 1 for a detailed classification at the two-digit ISCO88 classification codes, in which we follow Acemoglu and Autor (2011) and identify three main tasks, respectively abstract, routine and manual, including a set of occupations for each task.

[7]The countries included in the sample are: Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, the United Kingdom and the United States.

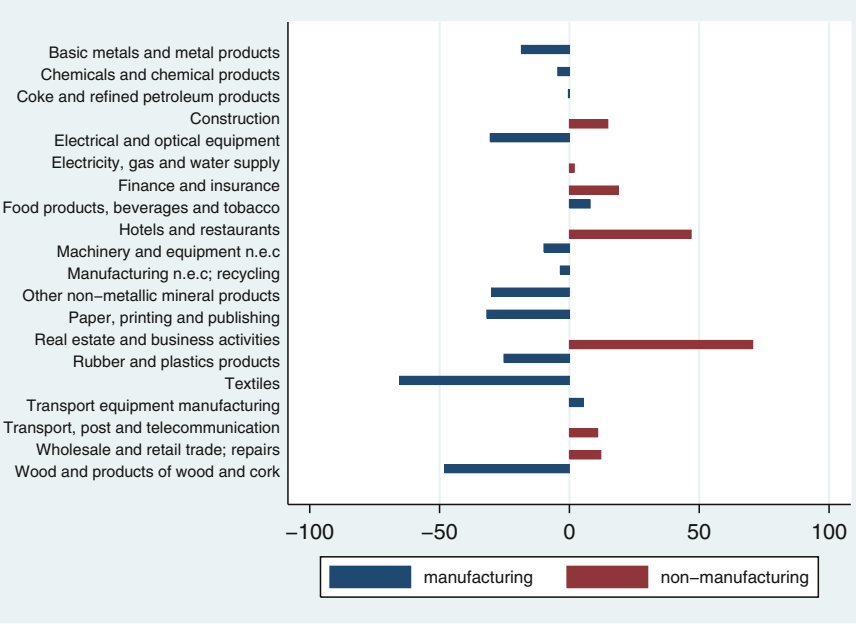

Fig. 4 The process of de-industrialization and the decline in manufacturing employment share for selected OECD countries, 1995–2015. Source: Employment Outlook OECD 2017 (OECD), based on European Labour Force Survey, labour force survey for Canada and United States

the process of de-industrialization characterizing developed economies in the last decades constitutes a crucial progress component.

6 The "Task" Approach to Labour Market

As discussed above, the so-called job polarization is a phenomenon consisting in the wane of routine occupations accompanied by a quasi-simultaneous rise of non-routine occupations, both high skilled conceptual and manual low skilled ones. Job polarization then implies that the change in the shares of occupations in employment, measured along a skill intensity meter between two points in time is typically U shaped. This reshuffling of occupations is well documented in Anglo-Saxon world, where it was first observed and recent evidence extends job polarization to some European countries as well (Goos et al. 2009, 2014).

The most accredited view relates job polarization to the diffusion of computer-based technology that allows machines to perform well-sequenced and repetitive tasks, thus replacing workers in so-called routine jobs. Once the declining price of computer-based technology is initiated, the emergence of job polarization rests essentially on the features of the production function, as far as the right tail of the

U-shaped distribution is concerned, while production function properties are necessary but not sufficient to explain the left tail of the U-shaped distribution. The increase of high-skill conceptual occupations is essentially related to the complementarity between high skilled labour and computer technology, a fact which is supported by the well-documented benefits of ICT on the productivity of cognitive jobs. If labour is paid according to its marginal productivity, this also implies the wage of high skilled labour increases. In contrast, routine work, which is assumed to be a substitute for computers, will experience a wage drop as the price of computers declines. Notice that this explanation is in line with the standard SBTC story that predicts a monotonic increase in the shares of high skill non-routine employment.

However, since computer-based technology cannot complement non-routine low-skill tasks, additional ingredients are called for in order to account for the rising share of occupations at the lower end of the intensity skill meter. Autor and Dorn (2013) show that a sufficient condition for the non-routine low-skill employment share to increase relative to the routine one, is that the elasticity of substitution between computer capital and routine labour in production is greater than the elasticity of substitution in consumption between goods and services. A sufficiently high elasticity between computer capital and routine labour implies that as computer prices decline the demand for routine workers also declines; the unskilled labour dismissed from routine tasks in the goods production then moves to the service sector to perform manual tasks, the demand of which is increasing relative to the demand for goods. This polarization in terms of employment is also reflected in a polarization in terms of wages since labour is assumed to flow consistently with wages.

On a similar vein, Weiss (2008) emphasizes that if the price of manual services rises in response to a rise of demand, then the ratio between manual and routine wages may rise even if the ratio of the corresponding marginal productivities does not.

Hence, while high skill labour is attracted by a wage premium, which reflects an increase in its marginal productivity, the wage premium of low skill manual jobs is ultimately determined by aggregate demand characteristics (e.g. the price elasticity of goods/services ratio, as in Autor and Dorn (2013) or the demand for personal services induced by a rise of high skilled occupations as in Weiss (2008) (see also Moretti (2010)). However, little is known about the mechanisms behind consumer preferences and computer-based technology on which the emergence of job polarization rests. In particular, it is unclear to what extent the complementarity between goods and services is able to capture the contribution of service occupations to observed employment trends. The closest related evidence comes from Moreno-Galbis and Sopraseuth (2014) who argued that population aging can account for the rise in the demand for personal services and, ultimately, the growing fraction of low-paid manual occupations. They corroborate this hypothesis showing how goods and personal services are complementary for older (while substitutable for young) and emphasizing the role of demographic trends.

Critically, RBTC in the canonical model is not defined as industry-specific and the nature of job polarization has been largely investigated as an aggregate

phenomenon, with some exception (Autor et al. 2003; Goos et al. 2014; Michaels et al. 2014). More recent literature (Albertini et al. 2017; Breemersch et al. 2017) has identified new perspectives to untangle sources and driving factors of job polarization across countries and across industries. In addition, theoretical models have been discussed to explore the effects on job polarization of interactions between institutional setting and the ongoing computer-based technical progress, concentrating in particular on labour and product market regulations.

Competition might enhance the demand for high-skilled cognitive tasks both directly and indirectly. In the first case, as suggested by Guadalupe (2007) and Boone (2000), a rise in the level of competition contemporaneously reduce profits for firms and the possibility to extract rents. If high-skill workers are able to produce at lower costs (i.e. if they are complementary to technology), then firms increase the demand for those workers, which implies a rise in the return to skills. Alternatively, competition might act indirectly on high-skill segment, by favouring innovation and investments in technology.

Messina (2006) proposes a theoretical framework to explain the differences across countries in the share of service industries. The main idea is that there exists a negative association between product market regulation (PMR) and employment in service occupations. This is consistent with the gap in the market size of service sector between the US and European economies during the 80s and 90s.[8] This approach crucially differs from most empirical previous studies on job polarization due to its focus on the relation between labour market dynamics response to task-biased technological change and the regulatory background against which computer-based technology occurs. One relevant exception is the work of Shim and Yang (2017). The authors claim that job polarization is more pronounced in some industries and that interindustry wage differentials are consistent with this evidence. Their results corroborate the idea that to reduce production costs high-wage industries are more likely to replace routine workers with ICT technology, therefore facing a quicker process of job polarization than low-wage industries. Consequently, as computerization reduces the price of ICT capital and erodes the wage paid to routine tasks, we observe asymmetric job polarization across industries.

Concerning labour market institutions, the hollowing out of routine jobs seemed to be associated with the diffusion of non-standard employment and, in particular, with the process of partial deregulation undertaken by European governments, oriented to ease employers constraints in the sole use of temporary employment, by reducing EPL on this type of contracts. This flexibility at the margin has been primarily introduced in mostly Continental and Mediterranean countries starting from the late 90s. In this light, the growing incidence of temporary contracts could partially explain why, despite similar underlying technology adoption in workplaces,

[8]Additionally, several studies indicates that product market regulation is detrimental for the investments in ICT technology that represents one of the main factors explaining employment polarization.

these countries in the pre-recession period did not experience a clear evidence in favour of polarization.

In a similar vein, other studies find some evidence that institutions can matter in shaping the evolution in labour demand. For instance, Causa et al. (2016) illustrate how stricter EPL as well as union bargaining power might slow down employment adjustments, protecting low- and middle-skilled workers and weaking the polarization of labour demand. On the opposite, firms might opt for more capital-intensive technologies (Cingano et al. 2016) that replace workers, in order to ease the constraints imposed by a stricter regulation. As expected, this behaviour might enhance the impact of new technologies on polarization trends.

Summarizing, job polarization is regarded as an empirical fact in the developed OECD countries. Disappearing routine, middle-skill jobs due to falling automation costs is the dominant explanation. Globalization and institutional settings are typically regarded as additional relevant factors to take into account.

7 Evidence on Job Polarization in Europe

In discussing empirical evidence on the employment impact of routinization, we primarily concentrate on the European labour market, even if it is worth noting that labour market polarization has been consistently documented for the majority of developed OECD economies. Following the traditional approach in the TBTC literature (Acemoglu and Autor 2011), we sort occupations into three main groups, depending on the prevalence of the corresponding task. Our schematic mapping is described in Table 1. Precisely, we exploit the original categorization introduced by Autor et al. (2003), which focused on the main three broad tasks, respectively abstract, routine and manual. In other words, Autor et al. (2003) selected information on job task requirements coming from the 1977 edition of the Dictionary of Occupational Titles (DOT) and calculated specific task-intensity means for each occupation. Using these indicators at the occupational level, Autor and Dorn (2013) defined an index of routine task-intensity (RTI) that is positively associated to the relevance of routine tasks in each occupations; RTI is therefore declining in the prominence of manual or abstract tasks. The main data source are the 1995–2010 waves of the European Labour Force Survey (ELFS), which contains several information on employment status, two-digit occupation (ISCO88) and one-digit industry codes (NACE 1.1. revision). In order to keep comparability with previous studies, we follow the same sample selection as in Goos et al. (2014), excluding some occupations and industries.[9]

[9]Concerning occupations, as common practice in this stream of research (e.g. Goos et al. 2014), we drop legislators and senior officials (ISCO 11), teaching professionals and associate (ISCO 23 and 33), skilled agricultural workers (ISCO 61) and agricultural, fishery and related laborers (ISCO 92). In a similar vein, concerning industries, we exclude agricultural, fishery and hunting (NACE A), fishing (NACE B), mining and quarrying (NACE C), public administration and defense (NACE L),

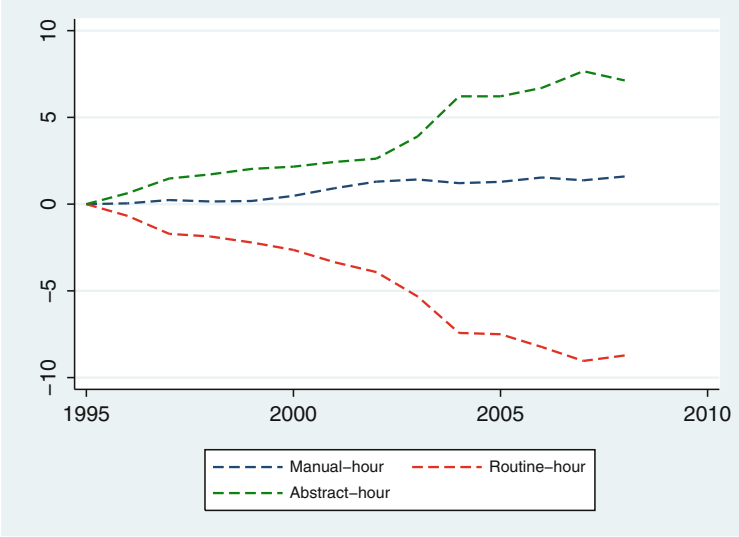

Fig. 5 Cumulative percentage point change of employment shares over tasks in Europe. Source: Own elaboration on European Labour Force Survey data

The process of job polarization appears to be a sort of gradual phenomenon, as it is shown by Fig. 5 that reports the cumulative change in the employment shares for each task from the base year (1995) onwards. However, after 2002–2003 we observe an acceleration in the polarization trend with a rapid growth of non-routine jobs, in particular high-skill abstract occupations, that counterbalanced the correspondent reduction in routine occupations. Notably, the changes in manual occupations are much less pronounced, partially reflecting the exclusion of public sector and private households with employed persons sector that could account for a consistent portion of these jobs.

As anticipated, the significant heterogeneities that characterize the existence and extent of job polarization across countries and industries (Goos et al. 2014; Shim and Yang 2017) could reflect differences in the institutional setting and welfare system as well as different characteristics of production function at the industry level (Autor et al. 2003). In order to provide a more disaggregate picture, we split European countries in four clusters that are identified on similarities in welfare systems and

education (NACE M), and extra-territorial organizations and bodies (NACE Q). Moreover, we also drop private households with employed persons industry (NACE industry P). Specific occupations and industries were dropped because they belong to public sector and are therefore subject to both different regulations and political contexts (e.g. NACE L, NACE M and NACE Q as well as ISCO 11, ISCO 23 and ISCO 33). Consistently, observations related to agricultural sectors (and occupations) were dropped because employment in these industries and occupations is commonly occurs in a small number of country-year cells, potentially introducing measurement error issues (ISCO 61 and ISCO 91 and by association NACE A, NACE B and NACE C).

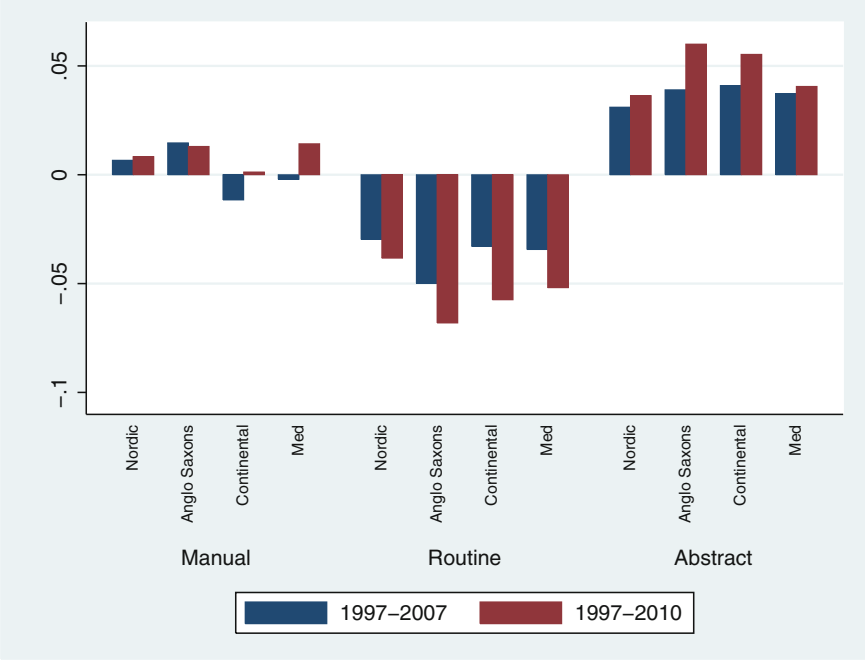

Fig. 6 Change in the employment share by tasks and country clusters. Source: Own elaboration on European Labour Force Survey (ELFS)

institutional contexts, according a standard classification. Specifically, we distinguish between Nordic, Anglo-Saxon, Continental and Mediterranean countries. In this direction, Fig. 6 depicts changes in percentage points for each task in the employment shares for selected four country clusters. We report changes for both 1997–2007 and the extended period 1997–2010 in order to check whether job polarization has been accelerated by Great Recession and to what extent heterogeneity across countries exacerbated.

Taking Anglo-Saxon countries as benchmark, results indicate that, until 2007, in the Continental and Mediterranean countries, the growth of manual and low-skill occupations was substantially null or even negative, thus excluding polarization, while Nordic countries experienced a similar path to Anglosaxon ones. When we include also 2008–2010 period the picture is substantially different and the trend is homogeneous across all clusters, with a consistent hollowing out of routine occupations and a correspondent growth in the non-routine occupations, even if for Continental countries the employment share of manual occupation remains negligible.

As shown in Fig. 6 and widely debated in a recent line of empirical research (OECD 2017; Verdugo and Allègre 2017; Eurofound 2008; Autor 2015), the Great Recession has substantially accelerated the process of job polarization. Hence, it is relevant to understand whether the patterns of employment changes in the task distribution are structurally different in expansions and recessions. According to

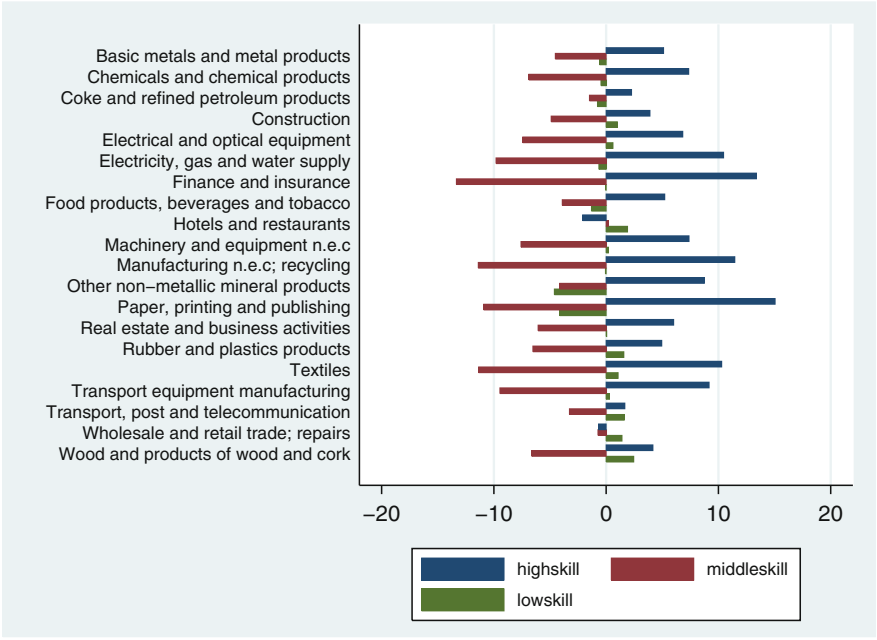

Fig. 7 The evolution of job polarization at industry-level for selected OECD countries, 1995–2015. Source: Employment Outlook OECD 2017 (OECD), based on European Labour Force Survey, labour force survey for Canada and United States

Jaimovich and Siu (2012), the business cycle component has driven the trend of labour market polarization and the hollowing out of routine occupations has largely characterized the last recession. In this light, the jobless recoveries experienced in the last years in Europe can be related to the speed of job polarization and the relative destruction of routine jobs and would deserve more attention. In the wake of this consideration, job polarization and structural change are related and the Great Recession represents an ideal candidate to investigate how sluggish labour mobility and asymmetric declining employment opportunities potentially influence long-run trends in the European labour market. Notably, the possibility to characterize the process by which routine jobs are destroyed can provide a guide to identify the policy implications of job polarization as well as to determine labour market perspectives faced by specific demographic groups.[10]

[10]Concerning this aspect, Cortes et al. (2014) recognized some important stylized facts capturing the hollowing out of routine employment and how the recession phase can accelerate the speed of polarization trends and the structural transformation of modern labour markets: precisely, a decline in the transition rates from unemployment (and non-participation) to routine jobs and a correspondent rise in the transition rates from routine occupations to unemployment or non-participation. In particular, the first mechanism seems to account for a consistent share of decline in routine employment both before and after the Great Recession.

Industries can reflect another relevant dimension to capture the heterogeneity in the degree of job polarization, as discussed in Shim and Yang (2017). Using data provided by OECD in the Employment Outlook 2017, Fig. 7 shows the 1995–2015 percentage point change in the employment shares by skill type within each industry at two-digit ISIC Rev. 3 classification for selected OECD countries.[11] Overall, the share of middle-skill jobs is declining in almost all sectors. This reduction has been entirely counterbalanced by the rise in the high-skill jobs, while the role of low-skill occupations is still negligible in the majority of selected industries. The profound reduction in the share of middle-skilled employment has been more marked in manufacturing and textile industries as well as in the financial services. Moreover, a limited number of industries experienced a positive shift in employment share towards the bottom of skill distribution (e.g. hotels and restaurants as well as wood and products of wood).

7.1 Within-Industry and Between-Industry Components of Job Polarization: A Shift-Share Analysis

In order to shed light on the mechanisms potentially explaining the different extent of job polarization at the country-industry level and to integrate this process with the debate on structural change,[12] we implement a standard shift-share analysis that quantifies the contributes of within-industry and between-industry components to the observed shifts in employment shares for each task. The overall change in employment share for each occupation, ΔE_{jit}, can be decomposed as:

$$\Delta E_{jit} = \sum_i \Delta\theta_{jit} E_i + \sum_i \theta_{ji} \Delta E_{it} \tag{1}$$

where θ_{jit} is the share of employment in occupation j and industry i on total employment in industry i, and E_{it} is the share of employment in industry i on total employment at time t.

The first term on the right hand side of Eq. (1) reflects the fraction of job polarization associated with changes in the employment share of each occupation driven by within-industry shifts. Overall, this component captures the extent to which changes in the composition of jobs are due to a reallocation of workers from routine to manual or abstract occupations, holding constant the relative size of each industry. Conversely, the second term measures the component of job

[11]The countries included are the same as in Fig. 4.

[12]In the literature, the structural change has been defined as the documented shifting away of employment from industries towards services as income increases. Concisely, the empirical evidence corroborates the idea that in the last decades employment shares of manufacturing sector has been declining and the mechanisms put forward to explain the process of structural transformation have often combined individual motivations with some specific features of technological progress.

Table 2 Shift-share analysis by task and countries

Component	Task	(1) All sample	(2) Nordic	(3) Anglosaxon	(4) Central Europe	(5) South Europe
Between	Manual	0.72	0.41	1.08	0.71	0.88
Within		0.16	0.69	2.05	−0.46	−0.24
Between	Routine	−1.82	−1.70	−2.23	−1.79	−1.83
Within		−3.61	−2.77	−4.15	−4.20	−3.72
Between	Abstract	1.10	1.31	1.14	1.09	0.96
Within		3.31	1.94	2.09	4.45	3.89

Source: Own elaboration on European Labour Force Survey (ELFS) data

polarization attributable to between-industry shifts, holding constant the occupational distribution of jobs within each sector. It implicitly reflects the process of structural change (Barany and Siegel 2018) and emphasizes how the reallocation of workers across sectors influences shifts in employment composition by task.

This approach closely relates to the shift-share decomposition proposed by Barany and Siegel (2018) and Acemoglu and Autor (2011) for the US, Goos et al. (2014) for European countries and Goos and Manning (2007) for the UK. In the literature, this procedure has consistently supported the conclusion that compositional changes in the employment structure within industries did not entirely explain polarization patterns both in the US and in Europe, since routinization has an important between-industry component as well.

Table 2 reports the results aggregated into the three main occupational groups (manual, routine and abstract occupations).[13] Countries are grouped into the four main clusters. The first corresponds to the Nordic countries (i.e. Denmark, Finland, Sweden and Norway), while the second includes Anglosaxon countries (i.e. UK). The third clusters concerns Continental countries (Austria, Belgium and Netherlands) and finally, Mediterranean countries represent the last group (i.e. France, Greece, Italy, Portugal and Spain).

Column (1) of Table 2 shows that, pooling all countries, there is evidence of employment polarization in the period 1997–2006, with the occupational distribution shifting from routine to both manual and abstract jobs (as in Fig. 1). This reshuffling of employment across different tasks has been largely directed towards abstract occupations, while the growth of manual occupations is still limited. Looking at the decomposition for each task, the within-industry component accounted for more than 70 (80)% in the changes of employment share for abstract (routine) occupations. On the opposite, employment shifts for manual occupations have been primarily due to the between-industry component. These results are consistent with those of Barany and Siegel (2018) for the US and Goos et al. (2014) for Europe, even if both papers found a larger effect of between-industry

[13]In order to have the same time interval for all countries, we restrict our sample to 1997–2006 in implementing the shift-share analysis.

component as driver of job polarization. In order to emphasize potential differences associated to specific institutional settings, in columns 2–5 we implement shift-share analysis separately for different country clusters. Column 2 denotes interesting peculiarities for Nordic countries. Indeed, the overall magnitude in employment shifts is lower with respect to other country clusters. In particular, the decline in routine occupations is less pronounced, while the increase in the employment share of manual occupations has been primarily related to the within-industry component. Similar changes have been reported for the Anglo-Saxon in column 3, where job polarization has led to a greater reallocation of employment shares towards non-routine occupations, equally distributed among abstract and manual. In addition, between-industry component accounted for about one third of total changes in all tasks, suggesting that employment shifts across industries still play a role in shaping polarization trend. Most interestingly, the decomposition results for Continental and Mediterranean clusters in columns 4 and 5 illustrate that employment shifts for manual occupations have accounted for a small fraction of job polarization, while the reshuffling from routine occupations is almost entirely captured by a correspondent rise in abstract occupations. Moreover, the low increase in manual occupations is the results of two opposite forces: a contribution of the between-industry component partially offset by a negative within component.[14]

In sum, the shift-share analysis documents that the reallocation of employment shares towards non-routine occupations in the period 1997–2006 corroborated the presence of job polarization in Europe. It also shows that a relevant amount of employment shifts is driven by the within-industry component. This emphasizes the conventional wisdom from the "routinization" literature that technological progress tend to be a driver of job polarization, leading to the substitution of routine jobs with computer and ICT capital. On the other hand, the between-industry component is still sizeable, especially for manual occupations. One might argue that this stilyzed fact is consistent with the contraction of manufacturing sector during last decades and the correspondent growth in service industries characterized by a larger share of non-routine jobs. Finally, the observed differences across countries suggests that different combinations of institutional settings might influence the extent of job polarization.

[14]We also replicate the shift-share analysis, by examining the breakdown for each occupation—country combination. Interestingly, the results indicate that there has been a lot of heterogeneity in the size of the disappearance of routine jobs across occupations and countries as well as in the contribution of both within- and between-industry components. Conversely, the increase in the employment share of workers in manual occupations is concentrated in some countries (e.g. Finland, France, Portugal, Spain and UK), while in the others, on average, a negative trend still persists. Concerning abstract occupations, the primary contributor to job polarization has been the within-industry employment shifts, with some exceptions (e.g. Finland, Netherlands, Portugal and Spain) characterized by a negative effect for this component.

8 Technological Progress, Innovation and Entrepreneurship

As one of the most commonly-identified drivers of labour market polarization, new technologies are advancing fast and nowadays increasingly permeate the workplaces and production processes. In particular, the growth of ICT, regardless of cross-country differences in the speed of technology diffusion, can be interpreted as the extent to which automation and digital economy can generate new business opportunities and demand for new products.

In parallel to the spread of ICT technologies, the role of entrepreneurship is acquiring a growing relevance both among academic scholars and policy makers. By developing product and process innovations and boosting new businesses, entrepreneurs are able to stimulate competition in the market as well as employment growth. For this reason, it is widely recognized that entrepreneurship can play a key role in economic developments and improve the ability of many countries to create jobs, especially after the Great Recession. The European Commission (European Commission 2008) has recently stressed that in order to foster the entrepreneurial dynamism, it is crucial to reinforce entrepreneurial culture in schools and universities. Through the Entrepreneurship 2020 Action Plan and the Rethinking Education Communication, the European Commission has emphasized the need to embed entrepreneurial learning in all sectors of education. In particular, the aim is to facilitate the diffusion of an entrepreneurial human capital, constituted by a set of specialized, high-level entrepreneurship specific skills and capabilities that help entrepreneur to negotiate, develop new products, create new processes and be characterized by a lower risk-aversion (Shane 2003).

In this context, the entrepreneurial dynamism of a country can potentially become a driver of automation and technological innovation. Following the Schumpeter's view, economic growth can be interpreted as the result of a creative destruction process, by which entrepreneurs entering the market drive innovations in computer technologies, pushing out obsolete and less productive firms (Geroski 1989). Hence, the market incentivizes the introduction of innovative workplace machines, allowing resources to be freed up for alternative, more productive scopes. Overall, the economic progress can be represented as a disrupting and not gradual process, where, sometimes, workers or even entire job tasks can be reduced or thrown out.

Taking inspiration from the case of the US labor market, Decker et al. (2014) discuss the role of entrepreneurship in job creation and in a similar vein, the role of entrepreneurship in stimulating employment growth has been a topic of much discussion (Acs 2006; Van Stel and Suddle 2008). On the one side, the intuition is that, according to Van Stel et al. (2005), entrepreneurs can be agents of innovation or enhance competition in an industry, which may drive productivity improvements, which in turn can positively affect employment growth (Acs 2006). A consistent stream of studies have claimed that entrepreneurship is positively correlated with employment growth, even if, until now, research has mainly focused on cross-country comparisons at the national level, or at the regional level within a single country (Baptista et al. 2008; Braunerhjelm and Borgman 2004).

Theoretically, it has been noted that there are several potential mechanisms[15] through which new firm formation can stimulate employment growth: (1) securing efficiency by contesting established market positions as (possible) new entrants force efficiency upon existing business, (2) accelerating structural change linked to Schumpeter's (1934) concept of creative destruction where industrial change occurs when new firms substitute for older firms; (3) amplified innovation, e.g., the creation of new markets; and (4) greater variety of goods and services as the products offered by the entrants may differ from those of older firms (Fritsch 2008). This provide strong theoretical underpinning for studying the role of the entrepreneurial process in driving employment growth also at a regional level. Regions with high levels of new firm formation should see a corresponding benefit of higher employment growth.

Indeed, the existing literature suggests that a positive effect on regional employment growth due to new firm formation and self-employment is evident in the United States (Acs and Armington 2004; Rupasingha and Goetz 2013), the UK (Ashcroft and Love 1996), Portugal (Baptista et al. 2008), and Sweden (Braunerhjelm and Borgman 2004). Some studies, however, have found that new firm formation can positively or negatively impact regional employment growth dependent upon the time period considered (Fritsch 1997), while other studies have failed to find a positive relationship in any time period (Audretsch and Fritsch 2002), which suggests that the effect of entrepreneurship on employment needs to be further investigated.

However, one must also consider the measurement of entrepreneurship. New firm creation is extensively used as a proxy for entrepreneurial activity (Acs and Armington 2004; Audretsch and Fritsch 2002). Baliamoune-Lutz (2015) illustrates how using firm births as a proxy for entrepreneurship is appealing as an entrepreneur will often have to set up a firm in order to exploit the profit-generating innovation that he/she has perceived. This suggests that the birth of new firms should be highly correlated with entrepreneurship. Concerning European countries, Doran et al. (2016) look at the effect of entrepreneurship on regional employment growth during the first years of Great Recession. Using a measure of new firm formation as a proxy for the relevance of entrepreneurial activity, the authors find that entrepreneurship positively affects the level of employment growth across European regions, therefore contributing to the occupational recovery in the post-crisis years.

9 Discussion and Conclusion

In this chapter, we reflect on the process of radical transformation that during the last decades has changed labor markets in developed countries and the nature of jobs. In particular, advances in ICT and robotics have generated the concern that automation

[15]This list of mechanisms linking entrepreneurship and employment growth extensively draw on the work of Fritsch (2008).

could eliminate jobs and substitute people in a wide range of activities, therefore contributing to the potential increase in the fraction of employment at risk in the near future. We examine alternative types of automation, concentrating on both the use of industrial robots and the diffusion of ICT technologies.

Empirical evidence on labour demand in the majority of OECD countries indicates a process of labour market polarization which finds a coherent explanation in the routinization hypothesis, whereby computer-based technologies allow machines to perform repetitive tasks thus replacing workers performing routine jobs. However, automation and advances in technologies are not the entire story; indeed, the debate on the employment impact of technology adoption is still open and there is an ongoing disagreement on whether the evolution of labour demand in the European labour markets has followed the scenario of a polarization of jobs, with the traditional disappearance of routine occupations or a progressive educational upgrading (Oesch and Rodriguez Menes 2011).

In this perspective, Eurofound (2008) argues that a considerable heterogeneity characterizes the patterns of changes in employment structure across European countries (Fernández-Macías 2012). In particular, empirical evidence clearly illustrates that the substantial diversity in the process of radical transformation of employment trends might be primarily related to different institutional settings. In other words, although advances in automation and ICT technologies could in principle similarly impact on the polarization of labour demand across the board, country-specific institutional aspects such as EPL, unemployment benefits, the degree of product market competition or collective bargaining system, could in fact smooth the demand for different types of skills or jobs and therefore strenghten the observed heterogeneity in the process of labour market polarization. Indeed, even if alternative labour and product market institutions do not directly modify the trend of employment polarization, they could alter the specific effects of new technologies on labour market outcomes and, in turn, the speed in the polarizaton of labor demand.

The Great Recession, however, acted as a counterbalancing and equalizing force. As shown in Jaimovich and Siu (2012), the Great Recession triggered a pervasive job polarization, with the disappearance of routine occupations and the decline in manufacturing employment concentrated in economic downturns. Hence, the extent of similarity or dissimilarity in the trends towards labour market polarization and de-industrialization across European countries is the results of institutions, business cycle and of their interplay.

In sum, though both empirical evidence and theoretical studies have no final answer to the net effect of technological innovations on employment, it is recognized that the current technological combination of ICT advances and robotics—while likely influencing structural and occupational changes as well as the nature of jobs—does not call for widespread concerns related to technological unemployment. Nonetheless, it is crucial to provide adequate measures that extend the benefits of new technologies to the overall society, rather than confined them to specific groups of occupations. In this light, the growing relevance that scholars and policy makers have recently attached to entrepreneurship clearly reflects the need to spread the

entrepreneurial learning in all sector of education, thus facilitating the diffusion of entrepreneurial human capital. Policy efforts should be concentrated on helping workers to gather the benefits of digital revolutions and to withstand the distruptive transformations caused by technological innovations. Most importantly, the ICT revolution requires the diffusion of adequate learning and training opportunities (OECD 2017) that enable displaced workers to develop those skills and capabilities needed to fulfill employers' requirements. In a complementary way, policy makers should embed basic ICT skills in the initial education, adapting school curricula and introducing work-based learning opportunities in order to equip young people with competences that make them complementary to automation and digital technology.

Appendix

Table 1 Task categorization of occupations—ISCO88 classification code

Abstract occupations	Routine occupations	Manual occupations
12 "Corporate managers"	41 "Office clerks"	51 "Personal and protective services workers"
13 "Managers of small enterprises"	42 "Customer services clerks"	83 "Drivers and mobile-plant operators"
21 "Physical, mathematical and engineering science professionals"	52 "Models, salespersons and demonstrators"	91 "Sales and services elementary occupations"
22 "Life science and health professionals"	71 "Extraction and building trades workers"	
24 "Other professionals"	72 "Metal, machinery and related trades workers"	
31 "Physical and engineering science associate professionals"	73 "Precision, handicraft, printing and related trades workers"	
32 "Life science and health associate professionals"	74 "Other craft and related trades workers"	
34 "Other associate professionals"	81 "Stationary-plant and related operators"	
	82 "Machine operators and assemblers"	
	93 "Labourers in mining, construction, manufacturing and transport"	

Note: The task classification is based on the logic proposed by Acemoglu and Autor (2011) and Autor and Dorn (2013), which provided a rationale to classify occupations in three broad categories

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Mutual Gains? The Role for Employee Engagement in the Modern Workplace

Alex Bryson

Abstract I examine the history of employee engagement and how it has been characterised by thinkers in sociology, psychology, management and economics. I suggest that, while employers may choose to invest in employee engagement, there are alternative management strategies that may be profit-maximising. I identify four elements of employee engagement—job 'flow', autonomous working, involvement in decision-making at workplace or firm level, and financial participation—and present empirical evidence on their incidence and employee perceptions of engagement, drawing primarily from evidence in Britain. I consider the evidence regarding the existence of mutual gains and present new evidence on the issue. I find a non-linear relationship between human resource management (HRM) intensity and various employee job attitudes. I also find the intensity of HRM use and employee engagement are independently associated with improvements in workplace performance. I consider the implications of the findings for policy and employment practice in the future.

Keywords Employee engagement · Productivity · Performance · Human resource management · Worker wellbeing

1 The History of Employee Engagement

For over two centuries debate concerning labour's role in capitalist production has been dominated by two competing paradigms. The first treats labour as a simple input to production, like capital and land, which can be bought and sold on the market and deployed like any other factor of production. The second starts from the

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premise that labour is 'different' or 'special' because it consists of human beings with desires and needs, some of which may conflict with those of capital owners. As such, relations of production are necessarily social relations, and relations between the representatives of capital and labour are human relations. Both paradigms preoccupied two of the founders of modern-day political economy, Karl Marx and Adam Smith. Both emphasised imperatives in the capitalist system to minimise the costs of production and maximise control over labour power through the organization of the production process and job redesign. Smith describes the destruction of craft skills in a pin-making factory in pursuit of profits, thus prefiguring Marx's description of the alienation workers feel through the division of labour underpinning the capitalist mode of production.[1] Yet, at the same time, both reflect on the tacit skills workers possess and the importance capital attaches to the extraction of the surplus value locked in the minds and abilities of labour.

There is, therefore, a conundrum employers face when deciding how to manage labour. Do they adopt a labour intensification strategy aimed at driving costs down and controlling labour, or do they adopt a work enrichment strategy founded on principles of employee engagement with a view to eliciting collaboration and co-operation with workers in expectation of what Tom Kochan and Paul Osterman (1994) have referred to as "mutual gains"?

From a theoretical perspective, it is plausible that multiple equilibria are possible since there may be more than one way to compete in the production of goods and services. Which option firms adopt is, arguably, a "strategic choice" (Child 2000), rather than something determined by technology and market competition. How much employers can adopt the labour intensification strategy is bounded by labour regulations on minimum wages, maximum hours and health and safety, while their ability to adopt labour enrichment/engagement will be bounded by the quality of labour and management skills. But at least, in principle, one can conceive of the degree of employee engagement being a product of decisions made by firms, sometimes in conjunction with labour and the state, as one means to maximise profits.

The "choice" perspective is not shared by all. Some maintain that the design of jobs and production processes is largely determined exogenously by technological developments. In the 1960s, Blauner (1966) and others expressed great optimism at the new opportunities to re-skill labour afforded by technological innovation. Labour process theorists, on the other hand, maintain there is a clear, unequivocal imperative

[1]Smith (1776) says "the man whose whole life is spent in performing a few simple operations, of which the effects are perhaps always the same, or very nearly the same, has no occasion to exert his understanding or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become. . .But in every improved and civilized society this is the state into which the labouring poor, that is, the great body of the people, must necessarily fall, unless government takes some pains to prevent it".

in a capitalist mode of production to design and re-design jobs in such a way as to deskill labour, thus driving down costs and limiting labour's bargaining power vis-à-vis employers. This position is exemplified in the classic work of Braverman (1974) whose book *Labour and Monopoly Capital* was a direct counter to what, at least in retrospect, appears to have been unbridled optimism regarding opportunities for job enrichment and employee engagement arising from technological advances.[2]

Others have emphasised heterogeneity in capitalist processes, with some industries and settings being conducive to fundamentally different forms of capital-labour relations in which owner-worker demarcations are often blurred. For instance, in their book *The Second Industrial Divide* Piore and Sabel (1984) describe high value-added firms producing niche products with highly skilled labour founded on familial ownership structures underpinned by collaborative social relations and political support, an arrangement they label "flexible specialization" that exists in places such as North-Eastern Italy. Others emphasize the potential of worker ownership to improve job quality and opportunities for employee decision-making, either through cooperatives, such as the ones existing in Mondragon in Spain, or through employee share ownership schemes that characterize large firms in some parts of the United States (Kruse et al. 2010). Some case studies indicate the two strategies of employee engagement and labour intensification can co-exist within the same firm or across the supply chain delivering a single product, the production of Apple's iPhone beginning with design in Silicon Valley and production by Foxconn in China being the exemplar.[3]

2 The Concept of Employee Engagement and the Employer Scorecard

The concept "employee engagement" is not easily defined and measured because it is a multi-faceted concept. There are, arguably, four components to it. In the moment, employees are commonly understood to be "engaged" in their work when they are immersed in it. For psychologists, this is the state of being in the "flow" or "the zone" (Csikszentmihályi 1990). Engagement of this type is linked to job satisfaction and wellbeing, in part because it often entails activity which is

[2]Blauner (1966) famously describes the degree of job autonomy and control afforded an operative in a continuous process plant by virtue of technological advances. Braverman (1974), on the other hand, maintains that the profit motive imbues capitalism with an imperative to deskill labour, even if new technologies offer alternative possibilities.

[3]Together with Google, Apple is often cited as the "poster child" for modern, innovative, and creative production in the IT world, whereas Foxconn is best known for the suicide rates among workers on the i-Phone production line https://www.theguardian.com/technology/2017/jun/18/foxconn-life-death-forbidden-city-longhua-suicide-apple-iphone-brian-merchant-one-device-extract

intrinsically rewarding, but also because it is characterised by a sense of personal control, or agency which, under the psychological models developed by Karasek (1979) and Karasek and Theorell (1990), are key facets of jobs which explain variance in worker stress and wellbeing.

A second element in job-oriented "engagement" extends beyond a point-in-time to on-going engagement, as indicated by the employee's opportunities for job-related autonomous decision-making, either as an individual or in a team setting. Job-related control and autonomy are core elements in Human Resource Management (HRM) which seeks to devolve responsibility and control to the employee as the best means of eliciting tacit skills and knowledge. When first proposed in the HR literature it was promoted as a counter to the command-and-control style of management underpinning Taylor's principles of scientific management which Ford and others adopted in the early part of the twentieth Century (Walton 1972, 1985).

A third aspect of employee engagement relates to employee involvement in decision-making above the job level—either at plant or firm level—through representation in governance structures (on the board, through a works council, or via union representation). This type of employee engagement provides employees with a "voice" at work capable of influencing corporate decision-making through processes of consultation or bargaining, relating to a variety of issues ranging from the location or expansion of a plant, through to a corporation's environmental footprint.

The fourth and final aspect of employee engagement is employees' financial participation in their firm. Profit-related pay and employee share ownership plans are two of the most common forms of what has come to be known as "shared capitalism" (Kruse et al. 2010), whereby employees' fortunes are tied to those of the firm, blurring the division between capital and labour. The common assumption is that employees are more likely to be engaged in all aspects of the firm when they are co-owners, even if their overall share of capital is small.

Having identified four components of employee engagement, what empirical evidence is there as to the degree to which employees feel engaged at work? We take each component in turn. Evidence on 'flow' is minimal, partly because few empirical studies proxy 'flow'. Perhaps the best evidence we have relates to employees' momentary wellbeing at work, as indicated by their happiness in the moment. Using data for the United Kingdom collected at random moments via a smartphone Bryson and MacKerron (2017) isolate the independent association between episodes of paid work and momentary happiness and anxiety.[4] They find that paid work is ranked lower than all but one of the other 39 activities people

[4]People who downloaded the Mappiness app receive randomly timed 'dings' on their phone to request that they complete a very short survey. They are asked to rate how happy they feel and how relaxed they are; whether they are alone and, if not, whom they are with; whether they are indoors, outdoors or in a vehicle; and whether they are at home, at work or elsewhere. Finally, they are asked what they were doing 'just now'.

engage (only being sick in bed scored worse). The effect is equivalent to a 7–8% reduction in happiness relative to circumstances in which someone is not working. Working continues to be negatively correlated with momentary happiness, even when it is combined with other activities that are pleasurable, and even if one conditions on feelings of stress. It is conceivable that individuals do not record their moments of greatest happiness when in the 'flow', leading to a potential attenuation of the positive effects of work on happiness, but this is unlikely to account for the size of the negative effect identified.[5] The study contains no detail on job quality or governance arrangements, so it is not possible to distinguish between different work settings, some of which may be more pleasurable than others. Instead, the study obtains the average effect of engaging in work versus not doing so. The implication is that the employee wellbeing arising from fulfilling and engaging work is not easily discernible.

Turning to employees' direct influence over the design and conduct of their own jobs, this appears limited, raising questions about the extent to which employees can be truly engaged in their jobs. The British Workplace Employment Relations Survey (WERS) indicates that around half of employees in Britain reported having "a lot" of influence over "how the work is done" and "the order in which tasks are done"; four-in-ten report "a lot" of influence over "the pace of work" and "the tasks done in the job"; while roughly one-in-three have "a lot" of influence over "start and finish times". Only 16% report "a lot" of influence over all five aspects of their job (van Wanrooy et al. 2013: 106). Although employees' perception of the influence they have over their jobs has risen marginally between 2004 and 2011, HR managers' perceptions of employee job influence shows no change since the late 1990s (van Wanrooy et al. 2013: 105; Wood and Bryson 2009: 162). Another national survey—the Skills and Employment Survey (SES)—indicates job-related influence in the 2000s is lower than it was in the 1990s (Felstead et al. 2015).

The much-vaunted autonomous team-working arrangements intended to devolve responsibility for work organization to groups of employees are not as widespread as earlier HRM proponents anticipated. By 2011, autonomous work teams operated in just over four-in-ten private sector workplaces in Britain and half of the private sector workplaces in France (Askenazy and Forth 2016: 147). In Britain, the share of employees covered by them has only risen marginally since the late 1990s (Bryson and Forth 2016).

If employers and employees can both benefit from employee engagement, why is it that job-related autonomy and control are not widespread? One possibility is that employees do not want employers to devolve responsibilities to them for designing and organizing their work. Additional responsibilities might be perceived as job demands which, as is well-established in the literature, generate job-related stress

[5]Furthermore, there is an earlier smaller study from the United States using the Day Reconstruction Method which obtains similar findings (Kahneman et al. 2004).

and anxiety, often with no additional financial compensation. There is some evidence, both from WERS (van Wanrooy et al. 2013: 102–103) and the European Social Survey (McManus and Perry 2012: 05–106), that job demands have been rising in Britain, as indicated by the percentages agreeing to the statement "My job requires that I work very hard" (Bryson and Forth 2016: 163). However, increasing job demands are pervasive and are not primarily driven by measures to increase worker job control. Furthermore, surveys in both the United States and Britain indicate that there is an "influence gap", with employees wanting *more* influence over their jobs, not less (Bryson and Freeman 2013).

Another possibility is that managers do not want to cede control to employees through work enrichment and engagement. This concern appears reasonable from a standard principal-agent perspective where the employer is concerned about shirking among employees afforded greater autonomy and control (Holmstrom and Milgrom 1991), or from a more radical Marxian perspective in which capital and labour have fundamentally different interests and the workplace is "contested terrain" (Edwards 1979). Control of workers through close supervision, pay incentives, and appraisal systems all grew in Britain in the late 1980s and early 1990s (Gallie et al. 2004), and appraisal systems became more widespread during the 2000s (Bryson and Forth 2016). White et al. (2004: 100) estimated that in 2002 ICT-based monitoring systems linked to individual performance appraisal were "already covering around half the [British] workforce and appear to be spreading rapidly". These trends are hard to reconcile with a shift towards job enrichment and employee engagement.

For employees to engage in decision-making at workplace or firm level they need to be able to express their opinions away from the production line or shop-floor in committees, boardrooms, town hall meetings and other fora. Workers' voice is often conveyed though their representatives. Workers' rights to workplace representation are written into international conventions and some are guaranteed by national or international law. Legal frameworks differ markedly across countries. In some, it is relatively easy for employees desirous of representation to trigger it, as in the case of union representation in France (Amossé and Forth 2016) and works councils' representation in Germany (Addison 2009). In other countries, such as the United States and the United Kingdom, the legislative framework makes it more difficult for workers to obtain representation, even if they have a strong desire for it, leading to a "representation gap" (Towers 1997; Freeman et al. 2007). Whether an employee can engage in decision-making at workplace or firm level varies markedly across European countries due to variance in the incidence of workplace representation (Forth et al. 2017).

To the extent that statute provides for worker representation, it is no longer a choice on the part of the employer to offer that representation to employees and the engagement that comes with it. In practice, worker representatives are present in only a minority of workplaces in most European countries (Forth et al. 2017: Figure 1). Similarly, while workers in some companies have rights to information,

consultation and representation at company level, guaranteed via an EU Directive, these representative structures tend to be confined to larger companies operating transnationally. There is substantial variance in workers' rights to board-level representation across Europe (Williamson 2013). It seems that where companies can choose to have workers on the board, they choose not to. Few, if any, firms in Britain have chosen to include worker representatives on their board, unless required to do so under EU law governing transnationals.[6]

Employers are often hostile or ambivalent to trade union representation, even when union representatives are present, and even in countries like France where the concept of dialogue between Social Partners has strong roots (Amossé and Forth 2016). Asked directly, employers usually prefer to consult directly with employees than via union representatives (Amossé and Forth 2016: 95–97). These employer preferences, coupled with the steep decline in the incidence of union representation and union membership in many parts of the world,[7] makes it increasingly difficult for workers to rely solely on union forms of representation to engage in decision-making at workplace or firm level. However, employers continue to value employees' input into decision-making processes. Despite the decline in union representation in British workplaces since the early 1980s, the percentage of workplaces (and employees) with no mechanisms for employees to express their voice has remained small and static at around one-fifth. This is due to a surge in direct forms of two-way communication between employees and employers such as team briefings and all staff workplace meetings (van Wanrooy et al. 2013: 18; Bryson and Forth 2016: 155; Bryson et al. 2013a, b) which are employer investments to procure employee "voice" without having to rely on third parties such as trade unions (Willman et al. 2014). Similar voice mechanisms exist in other countries such as France, although they are not as extensive (Amossé and Forth 2016: 80–85).

Employee evaluations of how good managers are at engaging them in decision-making raise doubts about the effectiveness of these management practices. In Britain in 2011, around half rated their managers as "good" or "very good" at seeking the views of employees or their representatives; fewer than half rated them as "good" or "very good" at responding to suggestions from employees or their representatives; and only one-third rated them "good" or "very good" at allowing employees or their representatives to influence decisions (van Wanrooy et al. 2013: 18). It is perhaps unsurprising, therefore, that only four-in-ten employees were either

[6] A lively debate is on-going. Mike Ashley, owner and CEO of Sports Direct, has proposed worker representation on its board but the proposal has been met by scepticism given the company's track record on worker rights https://www.theguardian.com/business/2017/mar/09/sports-direct-workers-representative-mike-ashley. The UK government are consulting over proposals for worker involvement in corporate governance https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/584013/corporate-governance-reform-green-paper.pdf

[7] Across all OECD countries average union density fell from 34.7% in 1960 to 16.7% in 2014 https://stats.oecd.org/Index.aspx?DataSetCode=UN_DEN#

"satisfied" or "very satisfied" with the amount of involvement in decision-making they had at the workplace (van Wanrooy et al. 2013: 74).

Financial participation in the firm offers employees opportunities to influence decision-making directly as financial stake-holders. Despite tax-breaks to induce firms to introduce all-employee share plans and profit-sharing in countries like Britain, and the requirement for larger firms to have financial participation schemes in France, only a minority of employees in these and other countries hold shares or receive income contingent on the firm's or workplace's performance (Bryson et al. 2013a, b). When they do, they rarely hold a significant financial stake in the firm, or seek to substantially alter corporate decision-making by exercising their voting rights in board-room decision-making.[8] That said, employees are more likely to express positive attitudes towards management and the running of the firm where the firm has financial participation schemes and members of all-employee share ownership plans are significantly more likely than other employees to say they feel like co-owners in the firm (Kruse et al. 2010). Shared capitalist payment methods are also independently associated with greater employee job satisfaction, even conditioning on wage levels (Bryson et al. 2016). This, together with the finding that in both Europe and the United States, employees in firms with financial participation schemes are more likely to be in jobs with high degrees of autonomy (Bryson et al. 2013a, b), suggests there may be a link between financial participation and greater employee engagement.

3 Are There Mutual Gains?

The main contention in Kochan and Osterman's (1994) book is that firms and their employees benefit from the introduction and maintenance of the right sorts of HRM practices, what are known as "high-involvement", "high commitment" or "high performance" workplace practices (Walton 1985; Lawler 1986; Appelbaum et al. 2000).[9] For firms, the benefits accrue through improvements in labour productivity and profitability, while for employees they arise through intrinsic rewards

[8]In an on-going study of employees in a multi-national firm with an all-employee share ownership plan I find that half the members and ex-members of the ESOP had never voted in the firm's annual general meeting and a further one-in-ten did not know whether they had or not. Of those who had voted, one-in-three followed others' recommendations when voting.

[9]The terms "high-involvement", "high commitment" and "engagement" have been used interchangeably in the literature. However, as we discuss in Section Two above, "high-involvement" management practices might reasonably be viewed as a subset of employee engagement practices—that part linked to decision-making at the job, workplace or firm-level. Commitment, on the other hand, as we discuss later, might be regarded as a job attitude which, alongside job satisfaction, can be an outcome from employee engagement.

related to engaging in enjoyable work, controlling their own working environment, having a "say" at work, and feeling part of the enterprise.

The literature on management practices has developed rapidly in the intervening quarter century, particularly in economics. "Management" is no longer viewed purely as the preserve of business school gurus and managerial scientists. Instead, it is recognised as a key input into the production process—a technology entering the production function alongside capital and labour (Bloom and Van Reenen 2012 (BVR forthwith)). However, those practices deemed critical in this framework are not necessarily those likely to elicit employee engagement. For BVR the core set of practices are target setting, monitoring, and incentives—arguably the pillars of the scientific management orientation propounded by Taylor and adopted by Ford. BVR find strong correlations between these practices and firm productivity and performance within and across countries (Bloom et al. 2014). Indeed, they argue differences in managerial practices account for a substantial part of the variance in productivity across firms within industries, thus helping to explain the huge heterogeneity in firm performance within industries emphasised by Syverson (2011) and others. BVR maintain these practices are not simply correlated with better performance, rather they have a causal impact on productivity and performance (Bloom et al. 2017).

The implication of BVR's work is that there is sub-optimal use of these practices among firms in general, and that more intensive adoption of them would lead to improvements in productivity and performance. This is a controversial stance. Others argue that what works for some firms may not work for others, either because HRM's success is contingent on firms' competitive strategies, or because they are contingent on the other policies and practices deployed at the firm—what are referred to as external and internal fit respectively (Milgrom and Roberts 1995; Huselid 1995; Becker and Huselid 1998).[10] The implications are that firms may need to experiment with various practices before identifying what works for them, while the internal fit perspective suggests the precise *configuration* of HRM practices is likely to matter.

Notwithstanding this objection, if the sub-set of practices emphasised by BVR are so successful, one might question the value of engaging employees through a more extensive set of practices, even if they do benefit employees. The core HRM practices highlighted in the early high-performance management literature were those that transformed job and work organization through the devolution of control to workers, offering the autonomy required to optimise their own working arrangements (Lawler 1986; Walton 1985). It is commonly assumed that initial and on-going training is necessary to underpin the transition to such a system and maintain it in the face of worker turnover and modifications to

[10]The forerunner to the 'fit' perspective is the resource based view (RBV) of the firm which emphasises the need for firms to manage human, physical and organizational resources to succeed (Saridakis et al. 2017: 88–89).

production. Additional support is thought to be desirable, through supervisory oversight, appraisal and incentivisation (Forth and Millward 2004; Appelbaum et al. 2000). This is a fundamentally different perspective on what might "work" when compared to BVR's conception, stemming largely from the assumption that performance improvements brought about by transforming HRM occur because they engage employees in their jobs and decision-making more generally at the workplace.

Although there is debate about the optimal configuration of HRM practices and whether the returns to such practices are homogeneous across firms, there is increasing evidence to suggest that firms can and often do increase productivity via investments in HRM. There are studies in addition to BVR's to suggest this is the case, and many of these include a more complete set of HRM practices than those used by BVR, including those that have the potential to raise employee engagement (see reviews by Wood and Bryson 2009; Bloom and Van Reenen 2016; Saridakis et al. 2017). Less is known about *how* HRM improves productivity but some studies suggest performance benefits accrue through employee engagement and through improvements in workers' well-being. One study has identified a causal linkage between individual worker happiness and individual productivity (Oswald et al. 2015). A couple of studies suggest this link also exists at organizational level (Bryson et al. 2017b; Böckerman and Ilmakunnas 2012). It is possible that HRM may benefit firms by increasing worker wellbeing through practices designed to engage employees. The literature on links between HRM practices and employee wellbeing is mixed, but recent evidence suggests that what matters is the intensity with which the HRM system is implemented by management: "shallow" HRM can actually reduce employees' intrinsic job satisfaction and organizational commitment, but more intensive HRM use is positively associated with both (White and Bryson 2013).

In the remainder of this section, we present new evidence on the presence or otherwise of mutual gains. We do so using linked employer-employee data that is representative of all workplaces in Britain in 2004 and 2011, but we confine our attention to the private sector since most of the theory and evidence presented earlier focuses attention on the market-oriented economy. The analyses we perform are relatively simple but are sufficient to identify independent associations between HR practices, employee engagement and workplace performance. The sampling methodology and the survey weights used in the analysis mean we can extrapolate from these results to employees and workplaces in the population of private sector workplaces in Britain with at least five employees. First, we undertake employee-level analyses to establish what relationship there might be between workplace HRM practices[11] and five aspects of what might be loosely be termed "employee engagement", namely intrinsic job satisfaction; job-related contentment; organizational commitment; perceived job autonomy; and employee ratings of how good

[11]The HRM domains are described in detail in Appendix (Table 4).

management are at involving employees in decision-making. Second, we examine the correlates of workplace performance focusing primarily on the role of HRM practices, on the one hand, and employee expressions of "engagement" on the other. A nice feature of our data is that employee perceptions are taken from employees, while the data on managerial practices are collected from the HR managers in their workplaces. This means we avoid common methods variance and related potential biases that might occur if we were to rely on the same respondent to provide information on both the performance of the workplace and employee engagement.

Table 1 shows the conditional association between HRM domains and employee job evaluations. Although the eight HRM domains are jointly statistically significant for all five employee engagement outcomes[12] only training is positively and significantly associated with any of the outcome measures, and even here only in two cases (organizational commitment and the managerial scorecard for engagement). Two of the domains emphasized by BVR (incentives and targets) are negatively associated with job satisfaction and organizational commitment (with targets also associated with lower perceptions of manager's ability to engage employees).

By summing the HRM scores for all eight domains a somewhat different picture emerges. The association between HRM intensity and the five engagement measures is non-linear, following a u-shaped pattern (Table 2). As employers add HR practices at low levels of intensity, job satisfaction, job contentment and job autonomy tend to fall, but the squared termed is positive—significantly so in the case of job contentment and on the margins of significance for intrinsic job satisfaction. A similar pattern is apparent for organizational commitment, although both terms are only statistically significant at a 90% confidence interval. The implication is that the returns to HRM intensity rise after a certain point, that is, once HRM is deployed intensively, just as White and Bryson (2013) observed in relation to job satisfaction and organizational commitment.

What is the association between workplace performance and employee measures of engagement, variously defined, and HRM practices? Table 3 presents results from workplace-level analyses for private sector workplaces pooled from WERS surveys in 2004 and 2011. The performance measure, obtained from managerial responses, is described in footnote 1 to the table. The models contain an extensive set of controls described in footnote 4. The employee attitudes are those analysed in Table 1, but now they are aggregated to the mean for each workplace and introduced together to see whether they explain any of the variance in workplace performance. They are jointly statistically significant in all the models presented.[13] However, only one of the measures—employees' perceptions of how good managers are at engaging them in terms of seeking their opinions, responding to suggestions and allowing employees to influence decision-making—is positively and statistically significant.

[12]The p values for the joint significance tests range from 0.00 in the case of job autonomy to 0.03 for managerial employee engagement.

[13]P values for their joint significance range from 0.016 to 0.022.

Table 1 Conditional association between HRM domains and employee job evaluations

	Intrinsic job satisfaction	Job contentment	Organizational commitment	Job autonomy	Managerial scorecard for engagement
Incentives	−0.102 (2.76)**	−0.022 (0.68)	−0.076 (2.22)*	−0.059 (1.45)	0.007 (0.16)
Record keeping	0.012 (0.29)	−0.048 (1.37)	−0.030 (0.92)	−0.019 (0.44)	−0.059 (1.24)
Targets	−0.104 (2.23)*	−0.021 (0.59)	−0.084 (2.12)*	−0.092 (1.83)	−0.134 (2.37)*
Participation	0.000 (0.00)	0.020 (0.62)	0.055 (1.52)	−0.017 (0.38)	0.092 (1.71)
Selection	−0.036 (1.00)	0.026 (0.89)	0.028 (0.85)	−0.120 (2.85)**	−0.004 (0.08)
Team-working	0.018 (0.56)	0.022 (0.79)	−0.009 (0.31)	0.069 (1.88)	0.010 (0.22)
Training	0.052 (1.40)	−0.049 (1.47)	0.069 (2.04)*	0.022 (0.51)	0.102 (2.04)*
TQM	0.005 (0.12)	−0.060 (1.93)	0.034 (0.94)	0.040 (0.93)	−0.003 (0.05)
Constant	2.606 (8.36)**	1.557 (6.11)**	2.064 (7.87)**	10.535 (30.00)**	0.825 (2.39)*
R^2	0.10	0.11	0.12	0.16	0.10
N	25,714	25,931	25,254	25,557	23,743

(1) The dependent variables are the following. Intrinsic job satisfaction: an additive scale running from −8 to +8 based on responses to "how satisfied are you with the following aspects of your job. . .sense of achievement; scope for initiative; the amount of influence over your job; the amount of involvement in decision-making at this workplace". Responses are recorded on a 5-point Likert scale from "very satisfied" (+2) to "very dissatisfied" (−2). Job contentment: and additive scale running from −6 to +6 based on responses to "Thinking of the past few weeks, how much of the time has your job made you feel. . .tense; worried; uneasy" with responses coded "all the time" (−2) to "never" (+2). Organizational commitment: an additive scale running from −6 to +6 based on responses to "to what extent do you agree or disagree with the following statements about working here. . .I feel loyal to my organization; I share many of the values of my organization; I am proud to tell people who I work for". Responses are recorded on a 5-point Likert scale from "very satisfied" (+2) to "very dissatisfied" (−2). Job autonomy: an additive scale running from 0 to 15 based on responses to "In general how much influence do you have over the tasks you do in your job; the pace at which you work; how you do your work; the order in which you carry out tasks; the time you start or finish your working day" with responses coded "a lot (3) to "none2 (0). Managerial score card for engagement: an additive scale running from −6 to +6 based on employee responses to "how good would you say managers at this workplace are at seeking the views of employees or employee representatives; responding to suggestions from employees or employee representatives; allowing employees or employee representatives to influence final decisions" with responses coded "very poor" (−2) to "very good" (+2). (2) A full description of the eight HRM domains is provided in Appendix (Table 4). Each is entered as a z-score into the model. (3) Controls: *Demographics*: gender; age (six dummies); race; married; disability; highest qualification (eight dummies); union member. *Job*: tenure (five dummies); contract type (three dummies); usual hours (five dummies); log hourly pay. *Workplace*: single-establishment organization; number of employees; region (11 dummies); establishment aged over 25 years; % age 16–21; % age 50+; age diversity; proportion female; gender diversity; proportion non-white; proportion part-time; union density; % manager; % professionals; % associate professionals; and a year dummy. (4) T-statistics in parentheses. Statistical significance * $p < 0.05$; ** $p < 0.01$

Table 2 Conditional association between HRM scores and employee job evaluations

	Intrinsic job satisfaction	Job contentment	Organizational commitment	Job autonomy	Managerial scorecard for engagement
HRM score	−0.049 (2.23)*	−0.054 (3.22)**	−0.037 (1.83)	−0.051 (2.09)*	−0.044 (1.48)
HRM squared	0.001 (1.71)	0.001 (2.57)*	0.001 (1.75)	0.001 (1.47)	0.001 (1.46)
Constant	3.426 (7.43)**	2.402 (6.98)**	2.452 (6.27)**	11.421 (22.87)**	1.226 (2.20)*
R^2	0.10	0.11	0.11	0.15	0.10
N	25,714	25,931	25,254	25,557	23,743

See Table 1 for notes

It remains so in all models. Although the HRM domains are also jointly statistically significant, none of the domains is statistically significant individually, whether one conditions on mean employee attitudes or not (models (3) and (4)). However, workplace performance is higher where HRM intensity is greater, a relationship that is linear (models (5) and (6)).

To explore the mechanisms that may link employee engagement to workplace performance we reran the same models on the three components to the workplace performance additive scale, namely labour productivity, financial performance and the quality of service and output. These models indicate that perceptions of how good managers are at employee engagement were linked to labour productivity and not to financial performance or quality of service or output.[14] This was also the case with the HRM additive score capturing HRM intensity.

4 Conclusions and Implications

In this chapter, I have examined the history of employee engagement and how it has been characterised by thinkers in sociology, psychology, management and economics. There are only a small number of instances in which employees have rights to information, consultation or representation under the law and, although there are common rules governing health and safety at work requiring employers to meet minimum labour standards, employers have a great deal of discretion as to the extent to which they choose to invest in employee engagement. Since there are alternative management strategies that may be profit-maximising it is uncertain, a priori, how much they will invest in employee engagement.

[14]Mean employee perceptions of employers' ability to engage employees was statistically significant in all the labour productivity models and in none of the models for financial performance or quality.

Table 3 Workplace performance

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Mean employee attitudes						
Satisfaction	0.050 (0.82)	0.086 (1.47)		0.086 (1.49)	0.084 (1.44)	0.082 (1.42)
Contentment	−0.064 (1.47)	−0.030 (0.56)		−0.013 (0.24)	−0.018 (0.34)	−0.015 (0.28)
Commitment	0.058 (0.87)	0.019 (0.33)		0.031 (0.54)	0.032 (0.55)	0.031 (0.54)
Autonomy	0.003 (0.09)	−0.048 (1.38)		−0.043 (1.19)	−0.043 (1.21)	−0.041 (1.15)
Engagement	0.114 (3.04)**	0.133 (2.67)**		0.123 (2.47)*	0.119 (2.39)*	0.120 (2.41)*
HRM domains						
Incentives			0.049 (0.65)	0.073 (1.00)		
Record keeping			0.015 (0.25)	0.019 (0.32)		
Targets			0.069 (0.86)	0.062 (0.78)		
Participation			0.056 (0.66)	0.082 (0.98)		
Selection			−0.054 (0.82)	−0.069 (1.05)		
Team-working			−0.031 (0.59)	−0.023 (0.45)		
Training			0.128 (1.70)	0.110 (1.47)		
TQM			0.030 (0.38)	0.018 (0.23)		
HRM score					0.022 (3.22)**	0.051 (1.72)
HRM score squared						−0.001 (1.02)
Constant	4.801 (14.02)**	3.348 (3.95)**	1.910 (2.79)**	3.446 (4.08)**	2.804 (3.25)**	2.513 (2.78)**
Controls	No	Yes	Yes	Yes	Yes	Yes
R^2	0.05	0.15	0.15	0.16	0.16	0.16
N	1781	1781	1787	1781	1781	1781

Notes: (1) Dependent variable: an additive scale combining managers' responses to three questions: "Compared to other workplaces in the same industry how would you assess your workplace's. . .financial performance; labour productivity; quality of product or service". Responses are recorded on a 5-point Likert scale from "a lot better than average" to "a lot below average". The "a lot below average" and "below average" codes are collapsed and scales scored from 0 to 3 where 3 = "a lot above average". Summing them gives a scale of 0 ('below average' performance on all three items) to 9 (performance 'a lot better than average' on all three items). (2) Employee attitudes: those described in footnote 1 to Table 1, aggregated to workplace-level means. (3) A full description of the eight HRM domains is provided in Appendix (Table 4). Each is entered as a z-score into the model. (4) Controls: *Employee data aggregated to workplace means*: log hourly pay; tenure (five dummies); contract type (three dummies); usual hours (five dummies); job demands additive scale consisting of two items based on how strongly employees agreed with the following statements: "My job requires that I work very hard" and "I never seem to have enough time to get my work done" (the two items are summed with the scale running from zero ("strongly disagree" on both items) to eight ("strongly agree" to both items)); single-item job security index running from (0.4) based on agreement with the statement "I feel my job is secure in this workplace" where 4 indicates strong agreement. *Workplace*: single-establishment organization; number of employees; region (11 dummies); establishment aged over 25 years; % age 16–21; % age 50+; age diversity; proportion female; gender diversity; proportion non-white; proportion part-time; union density; % manager; % professionals; % associate professionals; and a year dummy. (5) T-statistics in parentheses. Statistical significance * $p < 0.05$; ** $p < 0.01$

I identify four elements of employee engagement—job 'flow', autonomous working, involvement in decision-making at workplace or firm level, and financial participation—and present empirical evidence on their incidence and employee perceptions of engagement, drawing primarily from evidence in Britain.[15] There is only minimal evidence regarding employee feelings of being in the 'flow'. However, in the moment individuals are far less happy engaged in work than they are engaged in all other activities, apart from being sick in bed. Thus, while there is clear evidence that paid work is important to people, that it affects evaluations of their lives and own self-worth, and that they feel much worse if they are deprived of it, *in the moment* it has the flavour of something that they'd rather not be doing. This disutility from work raises questions about the extent to which they are 'engaged' in it. Autonomous working is not uncommon, though only a small minority of employees have autonomy over most aspects of their work, and the HR practices that some thought would promote that autonomy are not as widespread as some early HRM proponents anticipated. The same might be said for the incidence of employee "voice" mechanisms and financial participation.

I present new evidence regarding the existence of "mutual gains" using the Workplace Employment Relations Surveys for 2004 and 2011. There are few independent associations between domains of HRM and employee job attitudes. However, there is an association between the intensity with which HRM is deployed and some of these attitudes. That relationship is u-shaped, so that increasing HRM use at low levels can be disadvantageous in terms of its associations with how employees feel at work. However, at higher levels of HRM intensity adding further HRM practices can elicit employee engagement. This finding suggests employers need to be wary about how much HRM they are implementing. An earlier study focusing solely on satisfaction and commitment which found similar results suggested that HRM may be a signalling device to employees, with low-intensity HRM signalling a half-hearted attempt to engage employees, as opposed to a more fulsome HRM regime capable of signalling the employer's serious attempt to engage employees (White and Bryson 2013).

The acid test, from an employer perspective, is whether these investments can 'pay off' in terms of workplace performance. To assess this, we introduced mean employee attitude scores and HRM practices into models estimating employer perceptions of their own workplace's performance. I control for a wide variety of potential confounders to isolate the independent association between employee engagement measures, HRM and performance. What stands out from this analysis is that employee engagement—as measured by an additive index capturing employee perceptions of how good managers are at seeking their views, responding

[15]One needs to be cautious when extrapolating from Britain, or indeed, any single country when considering the incidence and correlates of employee engagement because cross-country studies indicate that HRM practices and job quality can vary quite markedly across as well as within European countries (Bryson et al. 2017a, b, c; Green and Mostafa 2012).

to them and allowing them to influence decision-making—was the only employee attitude that was robustly associated with higher workplace performance. Specific HRM practices tended not to be, though HRM intensity was positive and statistically significant. Further analyses indicated that these positive associations between workplace performance, engagement and HRM intensity were driven by the links between engagement, HRM and labour productivity specifically, and not financial performance or quality of output or service.

Since labour productivity is usually cited as the primary mechanism by which engagement and HRM practices should influence workplace performance, the findings presented here are consistent with the HRM literature discussed earlier. However, our analyses are not sufficient to identify a causal relationship between engagement, HRM and workplace performance. The literature in general has made little headway in this respect, largely because it is difficult to discount potential confounding factors without randomly assigning workplace practices that might affect employee engagement. There is one study, conducted in China, which randomly assigned homeworking among tele-workers to the benefit of workers, whose work satisfaction improved, and the firm, which saw an increase in productivity (Bloom et al. 2015). However, such evidence is rare. Furthermore, if the success or otherwise of various practices is contingent on the firm's other practices, or the market environment, we cannot be sure whether "what works" in one setting will work in others, or on other occasions. The implication is that firms might do well to consider experimenting with practices, and evaluate the outcomes rigorously, perhaps on a continuous basis.

In the absence of more evidence about the value of employee engagement and the role HRM practices can play in fostering it and improving performance, it seems firms will focus on the costliness of such investments, making it unlikely that firms will independently switch to greater employee engagement. Since governments often view employee engagement as a good, and sometimes show signs of legislating in support of more employee engagement,[16] there may be value in policy makers considering what role they can play in promoting greater employee engagement in workplaces than currently exists.

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[16]See, for example, the UK government's response to a consultation regarding worker representation in corporate governance https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/640631/corporate-governance-reform-government-response.pdf

Appendix

Table 4 Management practices

HRM domain	HRM measures for each domain	KR20
Incentives (0.4)	Any performance pay; managers appraised; 100% non-managers appraised; non-manager appraisal linked to pay	0.22
Records (0.9)	Sales, costs, profits, labour costs, productivity, quality, turnover, absence, training	0.71
Targets (0.11)	Volume, costs, profits, ULCs, productivity, quality, turnover absence, training, job sat, client sat	0.79
Teams (0.4)	100% largest non-managerial occupation in teams; teams depend on each other to perform work; team responsible for products and services; team jointly decides how to do the work	0.59
Training (0.5)	80% largest non-managerial occupation had on-job training lasts 12 months; workplace has strategic plan with employee focus; investors in people award; standard induction programme for new staff in largest non-managerial occupation; number of different types of training provided is above population median	0.45
TQM (0.3)	Quality circles; benchmarking; formal strategic plan for improving quality	0.24
Participation (0.5)	Formal survey of employee views in last 2 years; management-employee consultation committee; workforce meetings with time for questions; team briefings with time for questions; employee involvement initiative introduced in last 2 years	0.38
Selection (0.7)	References used in recruitment; recruitment criteria include skills; recruitment criteria include motivation; recruitment criteria include qualifications; recruitment criteria include experience; recruitment includes personality or aptitude test; recruitment includes competence or performance test	0.31

Note: KR20 is the Kuder-Richardson coefficient of reliability used for dichotomous items

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Entrepreneurs' Export Orientation and Growth Aspirations: The Moderating Role of Individual Human Capital

Joan-Lluís Capelleras, Victor Martin-Sanchez, Josep Rialp, and Waleed Shleha

Abstract We investigate the effect of entrepreneurs' export orientation on growth aspirations, contingent on their level of human capital. We argue that the higher the entrepreneurs' export orientation, the higher their growth aspirations. Importantly, we also suggest that these aspirations will vary depending on two endowments of individual human capital. To test our hypotheses, we employ a multilevel model analysis, using a combined dataset drawn from the Global Entrepreneurship Monitor (GEM) and the World Bank in 78 countries. The results show that entrepreneurs' export orientation does not significantly affect growth aspirations. However, we find that its effect on aspirations is significantly higher for those entrepreneurs holding greater levels of both higher education and entrepreneurial experience. Implications from these findings are discussed.

Keywords Entrepreneurs' export orientation · Human capital · Growth aspirations · Multilevel · GEM

1 Introduction

Entrepreneurial growth aspirations have been considered as the entrepreneurs' goals for the growth trajectory they would like the new venture to follow (Dutta and Thornhill 2008) and tend to reflect their respective beliefs about the potential of the venture (Levie and Autio 2013). Empirical evidence shows that growth aspirations have a positive impact on subsequent firm growth and may contribute to job creation

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and economic development (Wiklund and Shepherd 2003; Stam and Wennberg 2009; Hermans et al. 2015). Consequently, there has been an increasing interest in the antecedents of such aspirations. Prior work in this area has shown that both entrepreneurs' background and environmental conditions affect the formation of growth aspirations (Autio and Acs 2010; Autio et al. 2013; Estrin et al. 2013; Capelleras et al. 2016, 2018; Giotopoulos et al. 2016).

However, relatively little is known about the impact of entrepreneurs' international orientation on their growth aspirations. Although starting an international activity is considered an important way for entrepreneurs to boost their venture growth prospects, the growth aspirations of international oriented entrepreneurs are relatively unexplored (Hermans et al. 2015), particularly those using the most common mode of entry i.e. exporting (Zahra et al. 1997; Hessels and van Stel 2011; Jaffe and Pasternak 1994; Filipescu et al. 2013). Previous studies have pointed to a positive effect of growth aspirations on the decision to export, since ambitious entrepreneurs tend to start their export activities to expand their businesses in international markets (Madsen and Servais 1997; Ibeh 2003; Andersson and Wictor 2003; Sommer and Haug 2011). Yet, entrepreneurs starting their international operations are exposed to entry barriers, which ultimately may become obstacles that are not confronted in their home markets (Mudambi and Zahra 2007). This exposure may subsequently affect their aspirations to grow. Therefore, prior work suggests a positive impact of growth aspirations on starting export activity (Sommer and Haug 2011) but exploring whether being an export oriented entrepreneur triggers aspirations is a gap in the literature that requires additional research (Levie and Autio 2013; Hermans et al. 2015). Accordingly, the first objective of this study is to investigate whether the export orientation of entrepreneurs affects their growth aspirations.

Nevertheless, prior research has also shown that the entrepreneur's human capital endowments are important to explain the formation of their growth aspirations (Autio and Acs 2010; Capelleras et al. 2018) and are likely to shape their decisions during the development of international activities (Ibeh 2003; Andersson and Wictor 2003). Indeed, entrepreneurs accumulate knowledge and skills through investments in human capital in the form of education, training and experience (Becker 1964), which are likely to affect their growth aspirations. At the same time, human capital attributes may facilitate their entry into the international markets, because entrepreneurs may transfer and adapt their prior knowledge to better recognize potential growth opportunities in foreign markets (Sharma and Blomstermo 2003; Perks and Hughes 2008). Overall, however, little is known about the moderating role of human capital on the relationship between export orientation and growth aspirations. Therefore, the second objective of this research is to examine whether individual human capital attributes, specifically higher education and entrepreneurial experience, moderate the impact of export orientation on growth aspirations.

In a nutshell, this study seeks to increase our knowledge about the determinants of growth aspirations by investigating the direct effect of entrepreneurs' export orientation and the moderating role of individual human capital (i.e. higher education and entrepreneurial experience). Our empirical analysis is based on a sample of 11,659 early-stage entrepreneurs (started a firm in the past 42 months) among 78 countries.

The data set we employ combines individual-level information obtained from the Global Entrepreneurship Monitor (GEM) project together with country-level information gathered from the World Bank during the time period 2003–2011. To test our prediction, we use multilevel analysis.

This chapter is structured as follows. In the next section, we present the theoretical framework and develop three testable hypotheses. Then we explain the data, variables and methods. After presenting the results, we discuss the findings, limitations and future research lines.

2 Theory and Hypotheses

2.1 Entrepreneurs' Export Orientation and Growth Aspirations

Entrepreneurs who start an international activity seek to create value for their new ventures and strive to achieve growth globally. They endeavor to operate across national borders and focus on the advantageous relationship between their businesses and the environments in which they operate (Wright and Ricks 1994; McDougall and Oviatt 1996, 2000). In such international environments, entrepreneurs try to achieve a competitive advantage to overcome their liability of foreignness and liability of newness (Mudambi and Zahra 2007; Zaheer 1995). As a result, entrepreneurs select one or more international entry modes (i.e. exports, licensing agreements, acquisitions, FDI, among others) to better identify and exploit potential business opportunities in the pursuit of competitive advantage. In this study, we focus on the entrepreneurs' export orientation because export activities are considered the first step in a firm's internationalization process (Johanson and Vahlne 1977). In fact, exporting is the most common mode of foreign operations for new ventures, where they can achieve growth and tap into new knowledge (Zahra et al. 1997; Yeoh 2004). Moreover, export activities do not require major capital investments (Hessels and van Stel 2011) and have lower commercial and financial risk in comparison with other international ones (Jaffe and Pasternak 1994; Filipescu et al. 2013).

However, entrepreneurs starting their export activities may come up against different barriers such as the liability of being foreign and that of unfamiliarity (Mudambi and Zahra 2007; Zaheer 1995). Export oriented entrepreneurs encounter organizational and environmental obstacles that are not experienced by their host counterparts (Zaheer 1995; Johanson and Vahlne 2009). In other words, they may lack resources and the information necessary to understand and systematically analyze the new markets (Zahra et al. 2005), which are not predictable according to environmental differences and geographical distances (Johanson and Vahlne 2009). These differences and distances broaden the impact of uncertainty that entrepreneurs face in international markets (Butler et al. 2010). This may reduce their growth aspirations.

Nevertheless, uncertainty is embedded into entrepreneurial action. In this sense, those entrepreneurs who are able to successfully cope with such levels of uncertainty will get new combinations of products or services that will ultimately allow them to grow (McMullen and Shepherd 2006; Schumpeter 1934). In this vein, the main challenge of entrepreneurs when it comes the time to look for potential business opportunities abroad is to put together and make sense of unconnected information from the environment through their cognitive mechanisms (Mitchell et al. 2002; Baron and Ensley 2006). In other words, entrepreneurs who are exposed to international markets are threatened by both uncertain and non-static environments associated to the lack of regional specific knowledge (Mudambi and Zahra 2007; Johanson and Vahlne 2009). Consequently, entrepreneurs' interactions with the market are based on their own judgmental sense that throughout subjective evaluations would make sense of the different components into newly constructed means-ends frameworks (Wiltbank et al. 2006). These entrepreneurs may then use their cognitive mechanism to maximize their utility out of a given business opportunity and ultimately create their own novel contributions (Zahra et al. 2005). Hence, exposure to new environments via export activities may encourage entrepreneurs to go beyond prevailing norms and think more intuitively to seize available opportunities and use all means at hand to accomplish a variety of current and future missions with an unrestricted surge of growth aspirations (Dutta and Thornhill 2008). Therefore, one would expect that the entrepreneurs' export orientation will have a positive impact on their aspiration to grow the new business. Thus, we formulate our first hypothesis.

Hypothesis 1 The higher the entrepreneurs' export orientation, the higher their growth aspirations.

2.2 The Moderating Role of Individual Human Capital: Higher Education and Entrepreneurial Experience

So far, we have discussed about the influence of entrepreneurs' export orientation on growth aspirations. Now, we argue that such aspirations are likely to be moderated by their education level and entrepreneurial experience. Entrepreneurs use their cognitive abilities to recognize and exploit business opportunities, which depend on how they leverage their mental frameworks to piece together diverse and unconnected information (Mitchell et al. 2002; Shepherd and DeTienne 2005). This cognitive mechanism is associated with the skills that entrepreneurs develop through their investments in education and experience (Davidsson and Honig 2003; Baron 2006; Haynie et al. 2012). In other words, entrepreneurs' human capital investments will influence the cognitive mechanism that has to do with the way individuals perceive and evaluate information from the environment (Becker 1964; Schultz 1959). Therefore, holding higher levels of education and entrepreneurial experience will boost the confidence of entrepreneurs, which ultimately will mean that export oriented entrepreneurs will be more likely to show higher aspirations to

grow their businesses than the rest of entrepreneurs (Zahra et al. 2005; Krueger and Dickson 1994).

In the case of formal education, those entrepreneurs who invest more in higher education attempt to receive a compensation for their investments (Becker 1964). In line with this tendency towards compensation, entrepreneurs who invested more in their human capital set out to grow their businesses to recoup what they invested in their prior education (Cassar 2006). Previous studies have shown that more educated entrepreneurs tend to hold higher growth aspirations to compensate their higher opportunity cost (Autio and Acs 2010; Capelleras et al. 2018). Here we argue that the impact of the entrepreneurs' export orientation on growth aspirations will be contingent on their previous investments in education.

More specifically, we suggest that entrepreneurs holding higher levels of education are expected to display higher growth aspirations when they are exposed to international markets for several reasons. First, entrepreneurs with higher levels of education possess more knowledge and ability to recognize, process, and analyze the procured information (Capelleras and Greene 2008). These educated entrepreneurs will have higher self confidence in their capabilities to create new ideas (Bandura 1978) and ultimately grow their businesses both at home and abroad. More educated entrepreneurs will further develop their mental schemas, in which they boost their entrepreneurial capacity to understand changes in the environment, and link multivariate information (Shane and Venkataraman 2000; Baron 2006; Baron and Ensley 2006). With this comprehensive understanding, entrepreneurs may reallocate the available resources to undertake the proper actions towards potential opportunities (Sarasvathy 2001) and transform them into useful advantages to achieve their current and future aspirations in domestic and foreign markets.

Secondly, more educated entrepreneurs will spot potential opportunities better than less educated ones, due to an easier identification of the useful knowledge (Arenius and De Clercq 2005). Higher education facilitates the connection with knowledgeable individuals, so entrepreneurs can have access to valuable network connections (Capelleras et al. 2011). Therefore, education will broaden the entrepreneurs' connections and, thus, the likelihood of boosting their ability to access necessary information and recognize potential opportunities (Drucker 1995; Arenius and De Clercq 2005). Additionally, higher education will provide entrepreneurs with a broader knowledge base, where they can maximize the ability of linking this knowledge to the potential opportunities (Cohen and Levinthal 1990). More educated entrepreneurs may draw on their knowledge base to complement the required information to resemble the different pieces of potential opportunity in the new international environment (Arenius and De Clercq 2005).

The previous discussion acknowledges the key influence of higher education level on growth aspirations for those entrepreneurs with an export orientation. In other words, we expect that higher levels of education of export oriented entrepreneurs will increase their capabilities to better identify profitable business opportunities in the host country, which ultimately will motivate them to achieve higher growth aspirations. The following hypothesis summarizes our expectation.

Hypothesis 2a The positive relationship between entrepreneurs' export orientation and growth aspirations is strengthened if entrepreneurs have higher levels of education.

Similarly, entrepreneurs with entrepreneurial experience may deal more efficiently with uncertain and new environments. Prior experience will allow them to have a greater mental database, and better retrieval processing in their mental schemas (Dew et al. 2009). This may boost their propensity to use analogical reasoning to solve one problem they face in the exporting market. Expert entrepreneurs will tend to solve one problem considering the whole possible aspects that could be related to this problem. In other words, entrepreneurs consolidate their cumulative knowledge through experience to obtain a more holistic approach in their thinking (Dew et al. 2009). Therefore, they process their cognition with unrestricted procedures in their approaches to problem-solving and decision-making (Dutta and Thornhill 2008).

Besides the uncertainty that entrepreneurs face in the exporting markets, they will confront the competition challenge with their local counterparts (Zahra et al. 2005; Johanson and Vahlne 2009). Their local competitors have priority in the market thanks to their local networks and sufficient knowledge of the market (Zaheer and Mosakowski 1997). These encounters exhort expert entrepreneurs to go beyond existing norms and frameworks to create their opportunities and compete in the new market (Dutta and Thornhill 2008). In line with creating such opportunities, entrepreneurial experience helps to recognize and create potential opportunities that entrepreneurs may pursue in international markets. That is because prior experience is likely to enhance the entrepreneur's self confidence in their numerous capabilities that they already have from experience in their local market, thus improving the recognition of certain opportunities that could foster entrepreneurial growth aspirations (Krueger et al. 2000).

Thirdly, experience indirectly influences entrepreneurial intentions (Krueger 1993), whereby experience helps entrepreneurs in perceiving potential opportunities in the surrounding environment (Baron 2006). Entrepreneurs with prior entrepreneurial experience identify opportunities by using their cognitive abilities to perceive connections between unrelated incidents, and thus to connect unrelated constituents of a certain opportunity (Baron and Ensley 2006). After discovering the opportunity in such an uncertain environment, entrepreneurs will tend to make better decisions and carry out knowledgeable actions, thanks to their experience in owning or managing a former business (Unger et al. 2009). To sum up, entrepreneurs with previous experience deal more efficiently with the uncertainty in international markets, and they tend to compete better with their local counterparts by defining the best opportunities in that market. That will enhance their self confidence in their capabilities to perform better in the exporting markets (Zahra et al. 2005), and they may tend to make desirable decisions to grow their business through the international markets (Krueger 1993; Unger et al. 2009). In line with the previous discussion, we formulate the following hypothesis.

Hypothesis 2b The positive relationship between entrepreneurs' export orientation and growth aspirations is strengthened if entrepreneurs have entrepreneurial experience.

Figure 1 presents our model and the main hypotheses.

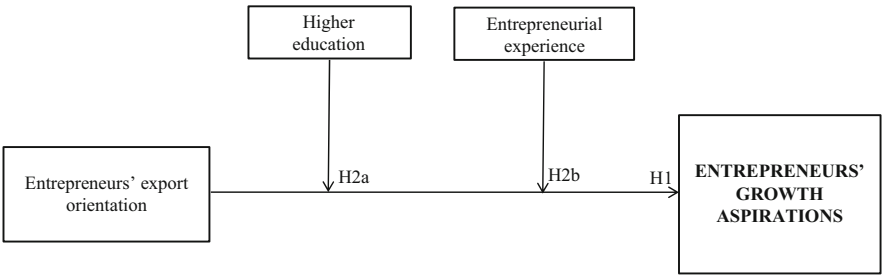

Fig. 1 Conceptual framework and hypotheses

3 Methodology

3.1 Data and Sample

To test our hypotheses, we employ two levels of analysis— individual and country levels. More specifically, our empirical model combines unique annual harmonized primary data on early-stage individual entrepreneurial activity in 78 countries. Our analysis covers the years 2003–2011. We must note at this point that we use cross-sectional data to test our hypotheses. Thus, the present study might suffer from an endogeneity problem. Following Stuetzer et al. (2014) and Estrin et al. (2016), we partly alleviate this issue by using time-lagged country-level predictors. However, we cannot empirically model the relation of personal and regional characteristics and entrepreneurs' growth aspirations as cause and effect.

Individual observations are obtained from the Adult Population Survey (APS) of the Global Entrepreneurship Monitor (GEM) project. The APS is designed to obtain a representative sample of the general population aged 18–64. The APS includes different blocks of questions aimed at different types of respondents. To accomplish the purpose of this paper we focus on early-stage entrepreneurs that are those who own and manage a business that is less than 42 months old (Reynolds et al. 2005; Giotopoulos et al. 2016). By using this category, growth aspirations are obtained from firms that are at their initial stages of development (Douglas 2013; Estrin et al. 2013). After omitting observations for which there were any missing values and non-valid answers, we are left with a final sample of 11,659 entrepreneurs.

Country level variables were collected from the World Development Indicators (WDI) dataset provided by the World Bank. We have confidence that the variables gathered from WDI, dataset carefully capture the regional characteristics in our study. Table 1 provides detail of the sample, number of observations and total entrepreneurial activity (TEA) per country, respectively.

Table 1 Countries in the sample, adult-population prevalence of nascent and new entrepreneurs (unweighted)

Country	Observations	% of TEA entrepreneurs	Country	Observations	% of TEA entrepreneurs
Algeria	5427	12.25	Malaysia	8070	6.64
Angola	3685	28.49	Mexico	11,747	9.16
Argentina	18,080	13.20	Montenegro	2000	14.75
Australia	13,186	8.60	Morocco	1500	15.80
Austria	4199	4.29	Netherlands (The)	31,181	4.38
Bangladesh	2000	11.90	New Zealand	4945	12.78
Barbados	2928	6.15	Nigeria	2080	37.26
Belgium	23,977	3.40	Norway	19,014	6.18
Bolivia	5524	34.97	Pakistan	4009	8.83
Bosnia & Hercegovina	8305	6.02	Panama	4001	5.25
Brazil	20,000	13.38	Peru	14,195	28.62
Canada	2000	15.20	Philippines (The)	2000	19.30
Chile	31,394	15.12	Poland	4001	9.52
China	19,756	17.07	Portugal	7036	6.61
Colombia	29,562	19.96	Puerto Rico	1998	2.80
Costa Rica	2003	13.58	Romania	10,608	3.91
Cote D'Azore	1010	3.37	Russia	16,424	3.96
Croatia	18,012	5.24	Serbia	6797	5.08
Czech Republic	4006	7.29	China	2000	4.65
Denmark	26,024	4.96	Singapore	15,747	5.72
The Dominican Republic	6107	17.32	Slovakia	2000	14.40
Ecuador	8429	19.98	Slovenia	24,129	4.28
Egypt	5405	10.23	South Africa	25,892	5.69
Finland	18,057	5.24	South Korea	8002	7.82
France	17,948	3.59	Spain	198,205	5.62
Germany	46,278	5.32	Sweden	40,323	3.32
Ghana	2447	35.27	Switzerland	15,633	5.64
Greece	18,008	6.96	Syria	2002	8.19
Guatemala	6873	16.57	Taiwan	4013	8.22
Hong Kong	8062	4.25	Thailand	8000	17.02
Hungary	17,759	5.79	Tongo	1184	17.48
Iceland	16,026	10.66	Trinidad and Tobago	4024	17.37
India	5693	11.38	Tunisia	4001	7.67
Indonesia	12,488	6.69	Turkey	12,019	7.13
Iran	13,185	11.66	Uganda	7402	31.17
Ireland	15,996	6.91	United Arab Emirates	9266	7.96

(continued)

Table 1 (continued)

Country	Observations	% of TEA entrepreneurs	Country	Observations	% of TEA entrepreneurs
Israel	10,062	5.31	United Kingdom	185,084	4.38
Italy	19,948	3.24	United States	38,598	8.28
Jamaica	14,613	16.64	Uruguay	12,133	10.27
Japan	17,388	3.30	Vauatu	1182	53.72
Jordan	4006	14.60	Venezuela	7487	21.92
Kazakhstan	2000	9.15	West Bank of Palestine	4072	9.65
Kingdom of Saudi Arabia	4000	7.30	Yemen	2065	24.65
Latvia	13,937	7.66	Zambia	2039	34.58
Lebanon	2000	14.35			
Lithuania	2003	10.78			
Macedonia	4002	9.50	**Total**	**1,341,906**	**8.12**

3.2 Variables Measurement

Dependent Variable In keeping with our conceptual model, the dependent variable is *entrepreneurs' growth aspirations.* Following previous studies (e.g. Estrin et al. 2013), we calculate entrepreneurs' growth aspirations as the difference between (the natural logarithms of) the entrepreneurs expected number of employees in the next five years and the actual number of employees, exclusive of owners, at the firm's inception.

Individual-Level Predictor To test the first hypothesis, we use *entrepreneurs' export orientation*, which is based on a categorical variable included in the GEM survey that asks the entrepreneurs to report the proportion (i.e. percentage intensity) of customers who normally live outside the entrepreneur's home country. Consistent with extant work on export-oriented new ventures (e.g. De Clercq et al. 2008; Hessels and van Stel 2011; Terjesen and Hessels 2009; Li et al. 2017), the original variable has been transformed to a binary variable with two levels taking value 1 if the percentage of the customers living abroad is more than 25% and 0 otherwise.

Cross-Level Interactions Our model predicts that *higher education* will positively moderate the effect of the entrepreneurs' export orientation and growth aspirations, we capture this effect by using a binary variable taking value 1 if the entrepreneur holds a post-secondary degree (i.e. university level) and 0 otherwise (Autio and Acs 2010). We also hypothesize that *entrepreneurial experience* will positively moderate the effect of the entrepreneurs' export orientation of new ventures on entrepreneurs' growth aspirations; entrepreneurial experience is captured by asking whether the individual is the owner or manager of another established existing firm. Answers are represented in a binary variable which holds the value 1 if yes and 0 otherwise (Estrin et al. 2013). Therefore, to test hypotheses 2a and 2b, we create the following

two cross-level interaction variables: *entrepreneurs' export orientation* × *higher education, and entrepreneurs' export orientation* × *entrepreneurial experience*.

Individual-Level Controls We include *age* and the *gender* (1 male and 0 female) of the entrepreneur. *Perceived founding opportunities* is a dummy variable captured by asking the individuals if they see good opportunities for starting a business in the next six months (1 = yes). *Perceived entrepreneurial skills* is the perceived self-ability whether individuals possess the knowledge, skills, and experience required to start a new business (Autio et al. 2013). It is captured using dummy variables (1 = yes). Additionally, we control the *exit experience* from any entrepreneurial activity (Autio and Pathak 2010): an individual's exit experience is captured by asking whether the individual had -in the past 12 months- sold, shut down, discontinued or quit a business owned and managed (1 = yes). We also control for the *current employment level*, anticipating that a higher number of initial number of employees will negatively influence entrepreneurs' growth aspirations (Estrin et al. 2013).

Country-Level Controls Because we are using international data in our analysis, we control the country's *GDP/h* (the logarithm of the GDP per capita), as well as *GDP change* during the previous years, *population size* (the logarithm of the country population), and *population growth* (Levie and Autio 2008; Autio and Acs 2010). Finally, we control by the country's level of development by considering a set of three variables: *high competitive country, medium competitive country and low competitive country*. We exclude one (here, *low competitive country)* as a reference category. This classification is obtained using the Global Competitiveness Index (GCI). This is a highly comprehensive index for measuring national competitiveness, which accounts for the macroeconomic and microeconomic foundations of the national competitiveness. GCI is built upon twelve pillars of competitiveness to be aggregated into three key analysis factors to get closer to the actual area in which a particular country needs to improve (Sala-i-Martin 2007). Moreover, The New GCI model (Porter 2008) uses social infrastructure and political institutions (SIPI) as a proxy for overall stage of economic development. However, in the current study, regarding the stage of development in the new GCI model, countries are grouped into three groups. The countries falling into the top rank for each of the SIPI are assigned to the high stage of development group. Countries that fall into the top rank for the overall SIPI index or its human capacity component but rank lower on other SIPI components are assigned to the middle group. The remaining countries are assigned to the low stage of development group (Porter 2008).

In addition, we include time dummies to enable controlling for the *years* of the pool—while excluding one (here, 2003) as a reference category. Table 2 provides detailed definitions and descriptive statistics for individual-level variables and regional-level ones, respectively.

Table 2 Description of variables

Variable	Description	Source
Dependent variable		
Entrepreneurs' growth aspirations (Ln)	Difference between (the natural logarithms of) the entrepreneurs expected number of employees in the next five years and the actual number of employees, exclusive of owners, at the firm's inception	GEM APS 2003–2011
Individual-level controls		
Age	Current age of participants in years	GEM APS 2003–2011
Gender	Dummy: 1 = male, 0 = female	GEM APS 2003–2011
Perceived entrepreneurial skills	Dummy: 1 = participants believed whether they have the knowledge, skills and experience required to start-up, 0 = otherwise	GEM APS 2003–2011
Perceived founding opportunities	Dummy: 1 = participants were asked whether in the next six month there will be good opportunities for starting a business in the area where they live, 0 = otherwise	GEM APS 2003–2011
Exit experience	Dummy: 1 = participants were asked whether they had—in the last 12 months- sold, shut down, discontinued or quit a business owned and managed, 0 = otherwise	GEM APS 2003–2011
Current employment level	Current number of employees (not counting the owners)	GEM APS 2003–2011
Entrepreneurial experience	Dummy: 1 = current owner/manager of another established existing business, 0 = otherwise	GEM APS 2003–2011
Higher education	Dummy: 1 = respondents have post-secondary education, 0 = otherwise	GEM APS 2003–2011
Individual-level predictor		
Entrepreneurs' export orientation	Dummy: 1 = percentage of customers living abroad is higher than 25%, 0 = otherwise	GEM APS 2003–2011
Country-level controls		
GDP/h (t−1)	GDP per capital in USD (lagged 1 year). Logarithm transformation has been applied for distribution purposes	WDI 2003–2011
GDP change	Percentage of change during the previous year in annual GDP per capita	WDI 2003–2011
Population size (t−1)	Annual population size (lagged 1 year) in millions. Logarithm transformation has been applied for presentation purposes	WDI 2003–2011
Population growth	Percentage of growth in annual population size	WDI 2003–2011
Level of development	Three binary variables that measure the level of country's development. High competitive country, medium competitive country or low competitive country (the latter one omitted as a reference category)	GCI 2003–2011

Notes: GEM APS. Global Entrepreneurship Monitor (GEM), Adult Population Survey (APS). http://www.gemconsortium.org/; WDI. World Development Indicators (WDI) by World Bank. http://databank.worldbank.org/data/home.aspx; GCI. Global Competitiveness Index by World Economic Forum. https://www.weforum.org/

3.3 Methodological Approach[1]

Our data set has a pooled cross-sectional time-series structure whereby individuals are hierarchically grouped by country. Because we are using two levels of analysis, data are analyzed using hierarchical linear modeling methods (Autio and Wennberg 2010; Estrin and Mickiewicz 2011; Autio et al. 2013; Estrin et al. 2013; Bosma and Sternberg 2014; Stuetzer et al. 2014). We do not employ standard multivariate methods because they would preclude us to assume the independence of observations (Hofmann et al. 2000; Autio and Wennberg 2010). In other words, those methods require viewing individuals as acting homogenously but would not account for how the environment affects their decisions (Autio and Wennberg 2010).[2]

To estimate the direct effect of the entrepreneurs' export orientation on growth aspirations, as well as the moderating effect of higher education and entrepreneurial experience, we use a multilevel random effects specification (Autio et al. 2013; Estrin et al. 2013). Random effects analysis allows regression coefficients and intercepts to vary across countries (Aguinis et al. 2011). In studies with more than one level of analysis, researchers have agreed that lower-level entities (e.g. individuals) are nested within higher-level ones (e.g. countries) (Aguinis et al. 2013). This perspective has the advantage of facilitating multilevel analysis of cross-level interactions (Hundt and Sternberg 2014). In that sense, a multilevel random effects specification is more accurate than the multivariate methods (e.g. moderated multiple regressions) normally used in the management literature to estimate interaction effects (Aguinis et al. 2005).

We adopt a three-step strategy for testing the direct effect of the entrepreneurs' export orientation—and the moderating effect of human capital—on growth aspirations. First, we estimate the "null model" (model 0 in Table 4) where either predictors nor controls are included in our specifications. We observe significant country-level variance, which require the use of multilevel techniques. Second, we devise a model with individual and country-level control variables (model 1 in Table 4). Next, we add individual predictors (model 2 in Table 4). Finally, we add cross-level interactions to estimate the moderating effects (models 3, 4, and 5 in Table 4). The model we use to estimate both the direct effect of entrepreneurs' export orientation and the moderating effect of human capital (i.e. higher education and entrepreneurial experience) on growth aspirations takes the following

[1]Capelleras and Martin-Sanchez are using the same methodological approach in this book chapter as the one they used in previous and recent research published at *Small Business Economics*—Capelleras et al. (2018) (see full citation details on the references list).

[2]An alternative methodological approach to control for the effect of heterogeneity across groups is to estimate linear regression models taking into consideration the clustering of standard errors at the province level. It is worth noting that results using this alternative approach are fully consistent with the ones reported here.

form (Snijders and Bosker 2004; Autio and Acs 2010; Autio et al. 2013; Stuetzer et al. 2014).

Individual-level component

$$\log(\pi_{ij})_t = \beta_{0j} + \beta_{pj}\{\text{individual-level predictors}_t\} + \beta_{cj}\{\text{individual-level controls}_t\} + r_{ij}. \quad (1)$$

Country-level component

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\{\text{country-level controls}_t\} + \mu_{0j}, \quad (2)$$

$$\beta_{cj} = \gamma_{p0} + \gamma_{p1}\{\text{country-level predictor}_t\} + \gamma_{p2}\{\text{country-level controls}_t\} + \mu_{pj}. \quad (3)$$

In this model, π_{ij} is a continuous measure of the growth aspirations chosen by individual *i* in country *j*. As we use the logarithm to normalize this measure, then β_{0j} is the coefficient for the effect of each individual—hierarchically nested in a specific country—on growth aspirations. β_{pj} and β_{cj} are the coefficients for the individual-level variables in the model 2. The term γ_{00} is the mean of all intercepts (sometimes called the "constant"; Autio and Wennberg 2010) across countries, and γ_{p0} is the mean of all slopes across countries. We use γ_{01} to signify the coefficients for country-level variables in the model 2; similarly, γ_{p1} and γ_{p2} are coefficients for the cross-level variables in models 3, 4 and 5. Individual and country-level residuals capture the setup's random aspect; we use r_{ij} for the individual-level residuals and μ_{0j} and μ_{pj} for country-level ones. In other words: the variation in μ_{0j} and μ_{pj} quantify the degree of heterogeneity in intercepts across countries, and the variation in r_{ij} quantifies the within-group variance (Aguinis et al. 2013). In sum, regional characteristics could affect individual-level regressions because of variation, at the individual level, in the intercepts and/or slopes across countries.

In addition, we estimate the variance inflation factors (VIF) for all our independent variables. All VIF values were within acceptable limits indicating that multicollinearity was not an issue in our analyses. All variables showed values below the strictest standard of 5 (Studenmund 1997). Specifically, values ranged from 1 to 2.03. In addition, tolerance values are all above 0.1 (including the variable with the higher VIF), which further indicates that our variables do not suffer from multicollinearity (Autio et al. 2013). Finally, we control self-selection and endogeneity concerns in the selected data. To eliminate both self-selection bias and endogeneity, we follow the Simultaneous-equation Model technique in which the self-equation and endogeneity models predate the 2SLS estimation and introduce the Inverse Mills Ratio (IMR) for the main multilevel estimations.

4 Results

4.1 Descriptive Results

Table 3 provides descriptive statistics and correlation matrix. 24% of the entrepreneurs have more than 25% of their customers abroad. The average age of the respondents in the sample of early-stage entrepreneurs is around 37.5 years and 58% of them are male. The current level of employment generated is almost five employees at inception. Furthermore, 60% of entrepreneurs perceive good opportunities in the area where they live to start a new business in the next six months. 85% of the entrepreneurs declare that they possess the knowledge, skills, and experience required to start a new business. In terms of human capital attributes, 40% of the respondents hold a higher education degree and 4% of the respondents' report experience as owner-manager of another established existing firm. With regards to the country level variables, the annual GDP change is 10.64% and the annual population growth in the period of this analysis is 0.35%. The table further shows bivariate correlations of the variables. Growth aspirations are negatively related to the entrepreneurs' export orientation while they are positively related to entrepreneurs' higher education and entrepreneurial experience.

4.2 Multilevel Model Results

Table 4 reports results from multilevel random intercept models predicting entrepreneurs' growth aspirations. As indicated, model 1 provides results for the individual and country-level control variables. Model 2 incorporates the effects of the individual predictor (i.e. the entrepreneurs' export orientation). Then, model 3 and 4 add the interactions between the human capital (i.e. higher education and entrepreneurial experience) and the entrepreneurs' export orientation, respectively and model 5 incorporates both. To test our hypotheses, we focus mainly on the model 5 (most general specifications). However, it is worth noting that results of the other models (i.e. model 3 and 4) are in line with those observed in such general model.

We do not find support for hypothesis 1 where we predict that entrepreneurs' export orientation is positively related to growth aspirations. However, in support of hypotheses 2a and 2b, in all models, education and entrepreneurial experience positively moderate the relationship between the entrepreneurs' export orientation and growth aspirations. Model 3 supports hypothesis 2a as the positive effect of the export orientation will be greater and significant for entrepreneurs with higher education. This result is also observed in the full model 5. In this line, with hypothesis 2b, in model 4 we find that the positive effect of the entrepreneurs' export orientation will be greater and significant for those with prior entrepreneurial experience, a result that holds consistent in model 5.

Table 3 Descriptive statistics and correlation matrix

Variable	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Entrepreneurs' growth aspirations (Ln)	0.72	0.7	1.000															
(2) Age	37.58	11.33	**−0.067**	1.000														
(3) Gender	0.58	0.49	**0.036**	−0.007	1.000													
(4) Perceived entrepreneurial skills	0.85	0.34	**0.063**	**0.024**	**0.063**	1.000												
(5) Perceived founding opportunities	0.60	0.48	**0.102**	**−0.065**	0.012	**0.109**	1.000											
(6) Exit experience	0.10	0.30	**0.019**	**−0.010**	**0.011**	**0.038**	**0.026**	1.000										
(7) Current employment level	4.95	30.85	**−0.134**	0.006	**0.039**	0.002	0.000	0.013	1.000									
(8) Entrepreneurial experience	0.04	0.21	0.013	**0.078**	**0.043**	**0.046**	0.010	**0.033**	0.010	1.000								
(9) Higher education	0.40	0.49	**0.037**	**0.031**	**0.033**	**0.062**	**−0.015**	**−0.027**	**0.046**	**0.023**	1.000							
(10) Entrepreneurs' export orientation	0.24	0.43	−0.010	0.005	**0.038**	−0.009	**−0.028**	−0.001	**0.053**	0.000	**0.034**	1.000						
(11) GDP/h (1000s of USD)	18.76	17.57	**−0.057**	**0.187**	**0.056**	**0.040**	**−0.088**	**−0.096**	**0.022**	**0.015**	**0.232**	**0.025**	1.000					
(12) GDP change, %	10.64	10.97	**0.024**	**−0.058**	**−0.025**	**−0.027**	**0.124**	**0.035**	0.003	0.002	**−0.053**	−0.002	**−0.338**	1.000				
(13) Population size, millions	92.73	243.42	**−0.024**	**−0.028**	−0.005	**−0.085**	**−0.022**	**0.019**	**0.036**	**−0.025**	**−0.017**	**−0.010**	**−0.143**	**0.110**	1.000			
(14) Population growth, %	0.35	0.78	0.002	−0.006	0.006	**0.028**	**0.015**	**0.045**	0.004	**0.023**	−0.000	**−0.027**	**0.012**	**0.064**	**−0.036**	1.000		
(15) High competitive country	0.18	0.38	0.001	**−0.133**	**−0.024**	**−0.020**	**0.078**	**0.082**	**−0.034**	0.007	**−0.190**	−0.003	**−0.424**	**0.041**	**−0.029**	−0.000	1.000	
(16) Medium competitive country	0.39	0.48	**0.071**	**−0.074**	**−0.039**	**−0.032**	**0.049**	**0.041**	0.004	**−0.043**	**−0.063**	−0.001	**−0.555**	**0.229**	**0.163**	**−0.126**	**−0.380**	1.000

Note: Correlation coefficients displayed in bold are significant at the 0.1%

Table 4 Multilevel random intercept model predicting entrepreneurs' growth aspirations

	Model 0	Model 1	Model 2	Model 4	Model 3	Model 5
Individual-level controls						
Age		−0.0037***	−0.0037***	−0.0037***	−0.0037***	−0.0037***
		(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Gender		0.0266	0.0265	0.0296	0.0275	0.0306
		(0.0223)	(0.0223)	(0.0223)	(0.0223)	(0.0223)
Perceived entrepreneurial skills		0.0807***	0.0807***	0.0817***	0.0808***	0.0817***
		(0.0205)	(0.0205)	(0.0205)	(0.0205)	(0.0205)
Perceived founding opportunities		0.1020***	0.1020***	0.1020***	0.1017***	0.1017***
		(0.0135)	(0.0135)	(0.0135)	(0.0135)	(0.0135)
Exit experience		−0.0038	−0.0040	0.0014	−0.0026	0.0028
		(0.0325)	(0.0325)	(0.0325)	(0.0325)	(0.0325)
Current employment level		−0.0044***	−0.0044***	−0.0043***	−0.0043***	−0.0043***
		(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Entrepreneurial experience		−0.0136	−0.0140	−0.0074	−0.0471	−0.0398
		(0.0575)	(0.0575)	(0.0576)	(0.0606)	(0.0606)
Higher education		0.0287	0.0286	0.0108	0.0290	0.0113
		(0.0207)	(0.0207)	(0.0213)	(0.0207)	(0.0213)
Country-level controls						
GDP/c (ln)		−0.0218	−0.0216	−0.0196	−0.0210	−0.0189
		(0.0339)	(0.0339)	(0.0339)	(0.0339)	(0.0339)
GDP change		−0.0001	−0.0002	−0.0003	−0.0002	−0.0003
		(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Population size (ln)		0.0454**	0.0455**	0.0429**	0.0449**	0.0423**
		(0.0209)	(0.0209)	(0.0210)	(0.0209)	(0.0210)
Population growth		−0.0614**	−0.0615**	−0.0593**	−0.0608**	−0.0587**
		(0.0205)	(0.0205)	(0.0205)	(0.0205)	(0.0205)
High competitive country		−0.0445	−0.0439	−0.0376	−0.0421	−0.0359
		(0.1103)	(0.1103)	(0.1105)	(0.1104)	(0.1105)
Medium competitive country		0.0271	0.0275	0.0317	0.0287	0.0329
		(0.0768)	(0.0760)	(0.0770)	(0.0769)	(0.0770)

Individual-level predictor						
Entrepreneurs' export orientation (H1)			0.0066	−0.0419*	0.0000	−0.0481**
			(0.0167)	(0.0221)	(0.0171)	(0.0224)
Cross-level interaction						
Entrepreneurs' export orientation* Higher education (H2a)				0.1109**		0.1101**
				(0.0331)		(0.0331)
Entrepreneurs' export orientation* Entrepreneurial experience (H2b)					0.1318*	0.1284**
					(0.0756)	(0.0755)
Self-selection control variable		0.0105	0.0106	0.0096	0.0101	0.0092
		(0.0136)	(0.0136)	(0.0136)	(0.0136)	(0.0136)
Endogeneity control variable		1.6095**	1.6072**	1.4923**	1.5806**	1.4672**
		(0.6524)	(0.6524)	(0.6531)	(0.6526)	(0.6533)
Random effects parameters						
Intercept	0.7114***	−0.0652	−0.0694	−0.0279	−0.0608	−0.0198
	(0.0159)	(0.4952	(0.4955)	(0.4960)	(0.4957)	(0.4962)
Variance of random intercept	0.0185**	0.0239**	0.0239**	0.0240**	0.0240**	0.0241**
	(0.0034)	(0.0055	(0.0055)	(0.0055)	(0.0055)	(0.0055)
Variance of overall residual	0.4808	0.4587	0.4587	0.4583	0.4586	0.4582
	(0.0039)	(0.0060	(0.0060)	(0.0060)	(0.0060)	(0.0060)
Intra-class correlation	0.0015	0.0027	0.0027	0.0027	0.0027	0.0027
Years fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N of observations	29,625	11,659	11,659	11,659	11,659	11,659
N of groups (countries)	88	78	78	78	78	78
Wald chi-squared	–	451.63***	451.75***	463.33***	454.87***	466.29***
Log-likelihood	−31288.572	−12134.509	−12137.602	−12134.5	−12137.744	−12134.719
Degrees of freedom	0	24	25	26	26	27
AIC[a]	62,577.144	24,317.018	24,325.204	24,321	24,327.488	24,323.438

Notes: Reported values are non-standardized β coefficients. Robust standard errors are given in parentheses

[a]AIC is Akaike's information criterion = 2 *k* – 2 x (log likelihood), where *k* indicates the degrees of freedom

*$p < 0.10$, **$p < 0.05$, ***$p < 0.001$; two-tailed significance

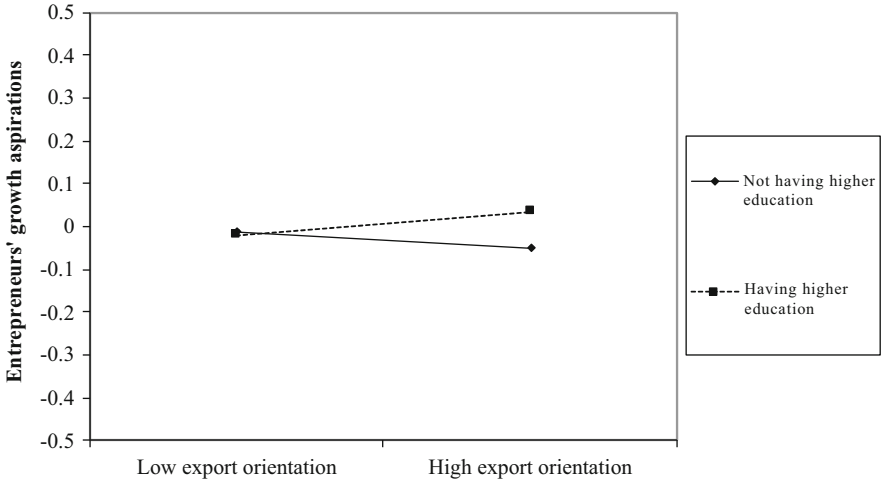

Fig. 2 Moderating effect of higher education on the relationship between entrepreneurs' export orientation and growth aspirations

To better gauge the net effects of higher education and prior entrepreneurial experience as moderators in the main relationship between the entrepreneurs' export orientation and growth aspirations, we next present the corresponding interaction plots. Figures 1, 2 and 3 depict the interaction effects of higher education and (respectively) prior entrepreneurial experience on growth aspirations. Observe that, consistently with our prediction, the relationship between higher education and growth aspirations changes with the export orientation. In Fig. 2 growth aspirations of entrepreneurs with higher education is higher when the entrepreneurs' export orientation is higher as well. In the same direction, in Fig. 3 we can see that growth aspirations of entrepreneurs with prior entrepreneurial experience are also higher when the entrepreneurs' export orientation is higher too.

We find several control variables to be statistically significant. Not surprisingly, entrepreneurs who are younger, those that see good opportunities for starting a business in the area where they live, and those who believe they have the knowledge, experience and skills to start-up a new venture have higher growth aspirations. Also, those businesses with higher levels of employment at inception will tend to have lower growth aspirations (Estrin et al. 2013). As per country level, population size is positively related to entrepreneurs' growth aspirations. Contrary, population growth is negatively related to the growth aspirations of entrepreneurs.

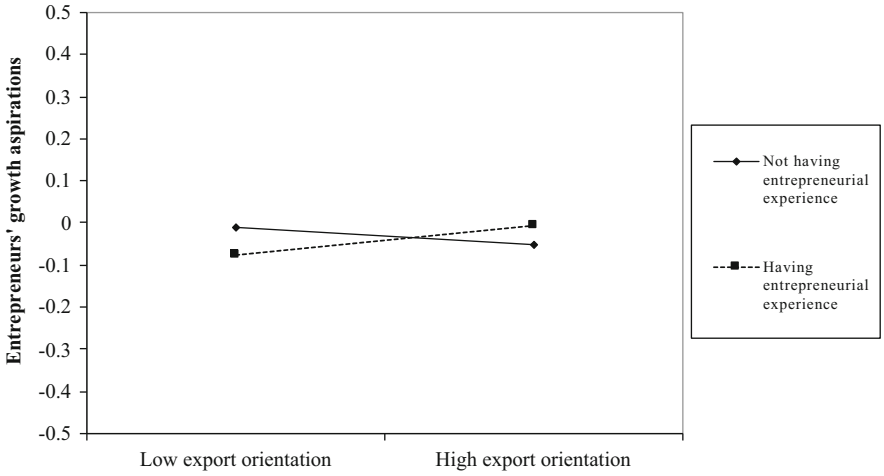

Fig. 3 Moderating effect of entrepreneurial experience on the relationship between entrepreneurs' export orientation and growth aspirations

4.3 Robustness Tests

The new venture growth literature shows that entrepreneurs' growth aspirations are more likely to influence the internationalization process (Sommer and Haug 2011; Levie and Autio 2013). According to Autio et al. (1997) growth aspirations are positively associated with average absolute annual international sales growth. Therefore, a reverse causality or simultaneity can arise between entrepreneurs' export orientation and growth aspirations. Consequently, one of the endogeneity conditions is accomplished in this model (Wooldridge 2002; Deaton 1997). Additionally, because entrepreneurs' growth aspirations are observed for those individuals who are involved in total entrepreneurial activities, it could be that self-selection to entrepreneurship has biased our findings (Autio and Acs 2010). Moreover, another condition of endogeneity is accomplished in this model (Wooldridge 2002; Deaton 1997).

Failure to control the potentially endogenous character of the entrepreneurs' export orientation dummy variable may lead to biased results. We address the endogeneity concern by estimating a maximum likelihood treatment effect model. We use this model because we have a continuous dependent variable (i.e. entrepreneurial growth aspirations) and a binary independent variable (i.e. entrepreneurs' export orientation), where the treatment effect model considers the impact of an endogenously-chosen binary treatment on another endogenous continuous variable, conditional on two sets of independent variables (Garcés-Galdeano et al. 2016). To meet the exclusion restriction necessary for identification, one variable not included in the multilevel regression is added to the selection equation in the treatment model (Wooldridge 2002). This variable considers whether the new venture is in the manufacturing

industry, which is used as an instrumental variable in the selection model. Export is more efficient in manufacturing firms than service firms (Sousa et al. 2008). Statistically, this variable was correlated with the entrepreneurs' export orientation and uncorrelated with the residuals of the growth aspirations equation, and it doesn't directly explain these aspirations. Therefore, the manufacturing industry variable accomplishes the conditions of the instrumental variable (Wooldridge 2002).

Another potential source of bias is the possible interdependence of entrepreneurial growth aspirations and the decision to become an entrepreneur. We address this concern by introducing into the employment growth aspirations equation (the second-stage "outcome" equation) the inverse Mills ratio (IMR), derived from modeling the choice to become a nascent entrepreneur (the first-stage "selection" equation). To determine the first stage of the Heckman selection model, we follow Estrin et al. (2013) by choosing a variable that is correlated with the first-stage dependent variable (entrepreneurial entry) but not correlated with the second-stage one (growth aspirations). Specifically, we use a variable that captures the entrepreneur's social capital and is based on GEM data indicating whether the individual in question personally knows another entrepreneur who has initiated a start-up venture within the last two years. Accordingly, we add into the selection equation the variable *knowing an entrepreneur,* which is related with the individual entry decision to entrepreneurship, but not to entrepreneurial growth aspirations.

5 Discussion

In this study, we have investigated the impact of the entrepreneurs' export orientation on growth aspirations and the moderating role of their education and experience, using considerations from human capital theory (Becker 1964). In contrast to our expectation, we have found that their export orientation is not significantly related to growth aspirations. This finding might be explained by the difficulties that entrepreneurs face in international markets (Butler et al. 2010), which provide them with a more realistic view about the future growth possibilities of their new ventures. Foreign entrepreneurs encounter organizational and environmental obstacles that are not experienced by their local counterparts (Zaheer 1995; Johanson and Vahlne 2009) and this might reduce their ambitions to grow.

However, our research provides evidence that the relationship between the entrepreneurs' export orientation and growth aspirations is shaped by their level of education. Indeed, higher education has a positive moderating effect on this relationship. One interpretation of this finding is that highly educated individuals use their knowledge and skills to create their own opportunities in the export markets. Through formal education individuals acquire knowledge and skills that allow them to gather, process, and analyze relevant information, which helps them to better recognize opportunities to be exploited. Highly educated individuals also have access to a large and resource-rich network of contacts (Capelleras et al. 2010) that favors their awareness of changes in the environment. Thus, higher education

may provide entrepreneurs with higher accessibility to the necessary resources to grow and this will strengthen their aspirations once they enter in the export markets.

Furthermore, the study shows that the effect of the entrepreneurs' export orientation on aspirations leans also on entrepreneurial experience. The finding here is that entrepreneurial experience has a significant positive moderating effect in the relationship between entrepreneurs' export orientation and growth aspirations. One possible explanation for this result is that expert entrepreneurs in their local markets, at some level, are restricted to the borders, which may make them more factual about growth aspirations. Meanwhile, when the same expert entrepreneurs initiate international activities (i.e. exporting), they have no limits to curb their ambitions, and their horizons may be broadened as much as they can to carve out new opportunities in new markets. They make use of all their expertise from the local market to intuitively link any similar dots and create opportunities in the new markets to seek new international entries and subsequently grow their businesses.

The research has some practical implications. Entrepreneurs might develop export strategies to have a better understanding of the environment of foreign and local markets simultaneously. Promoting higher education attainment and maximizing the beneficial utility of prior entrepreneurial experience would help them to improve their cognitive abilities and awareness to create new opportunities. They will then be able to transform these opportunities into beneficial resources, not only in their new markets, but in the local existing markets. At the policy makers' level, understanding the relationship between exporting, individual human capital, and growth aspirations will assist them in establishing effective policies to promote and support export activities in new ventures.

This study has some limitations, which simultaneously provide avenues for further research. First, the way that the GEM project measures exports, from our perspective, does not totally capture the actual entrepreneurs' export orientation of new ventures. We believe that more precise results could be obtained with the traditional measure of export intensity (foreign sales divided by total sales). Furthermore, future studies in this area should take into consideration other entry modes to the international markets to support the role of internationalization in growth aspirations. Moreover, future research should also consider additional human capital attributes of entrepreneurs. In particular, it would be interesting to study the moderating role of prior international experience in the relationship between environmental conditions and growth aspirations. Since we use the expected number of employees as a proxy to measure the entrepreneurs' growth aspirations, it would also be more informative in further research to use the same proxy but in local and foreign expected number of employees.

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Collaboration and Entrepreneurship Education: Requirements and Perspective

Francesco Magni and Alessandra Mazzini

Abstract In a collaborative economy, resources are shared and meeting with others produces a collective capital that generates a value. This creates a social exchange space, where members establish a communal identity through their mutual cooperation. For this reason, networking, working in groups and community actions are methods that must be dealt with strategic skills. However, neither the technology nor the technique are enough to make people work together. Therefore, in relation to contemporary theories of human cooperation Aristotle's concept of *philìa* becomes important in the modern political context and collaboration and entrepreneurship are really successful only if the debate on competencies is preceded by some prerequisites, which are a *conditio sine qua non* for ensuring the effectiveness of the technical skills themselves. The road had already been marked in the fourth century BC by the Greek historian Xenophon in his Socratic dialogue *Oeconomicus*, which strongly draws the essential antecedence of ethics in every speech about management. But how much of this "classical" perspective remained—in terms of awareness and effective use—related to the word "competence"? In 2006 the European Commission started a discussion about the increase of entrepreneurial spirit and several governments aim even more at fostering self-employment and job creation by investing in entrepreneurial education not only at the secondary education level, but also at the higher education level. Therefore, recovering those prerequisites, identified by Xenophon and which involve a sphere of values, allows to embrace and revive a pedagogical perspective centered on the human person.

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1 From *philìa* to *societas*: The Central Role of the Person

In the course of history two conceptions of human being confronted each other.

The first is the Aristotelian-Thomist one and according to this concept human beings have a natural *ligatio* and a natural desire for *philìa* (*NE* VIII, 1155a, 23),[1] a sort of attitude, which is not only important for the private life, but, as a «civic friendship» (Cooper 1977), which introduces community links and thus the social bond. In fact, from *philìa* derives, by *phronesis*, a rational and moral *ob-ligatio* to build civil society and institutions that are necessary to regulate common life in the *pòlis*. In this sense *philìa* is also required for the flourishing of the *pòlis,* as a sort of cement of the State and it provides a firmer and more stable bond between the citizens. In its widest sense it is a social "sympathy" which has, as a constitutive aspect, the mutuality and the reciprocity between people (Ricoeur 1990: 214–215). Latins called it *amicitia*, friendship. In the Christian tradition the concept took the name of brotherhood (or brotherly love or fraternity). In other words, from *philìa* springs the *societas*, which is the expression of the voluntary, free and responsible choice of human being, without constraints, to choose his own members. So, in society, individual freedom establishes community freedom.

In fact, as Aristotle observed, each human being is a «ζῷον πολιτικόν» (*Pol.* I, 2, 1253a), a "political and social animal", brought by nature to live in a civilized community and with the tendency to come together with other human beings to form a *pòlis*. Only through the *pòlis* a human being can fully flourish and fulfill his full potential. These forms of interaction institute the social bond for which is necessary that in any community exist certain norms of behavior which structure the relationships between the individual and the group.

In contrast, modernity inaugurated a different conception of human being and civil society. Human beings are no longer seen as relational people animated by *philìa*, but they are «ungrateful, fickle, dissimulating [. . .] greedy for gain» (Machiavelli 1513/1991). As Machiavelli and Hobbes have pointed out, human beings are moved by mutual fear, advantage, violence on others, rivalry and enmity. So with the beginning of modernity the vision of man is no longer the classical one (positive, confident of going towards the good) but negative and pessimistic. There is therefore in this conception a total mistrust in the human and *ligatio* is replaced by the concept of *homo homini lupus*.

The end of trust in *philìa* between people and therefore in freedom and responsibility of humans corresponds to the necessity of a Leviathan State (Hobbes 1651a, b/2011). It is the depositary of every liberty that the individual surrender to him and of the various social formations. This State regulates the human's responsibilities

[1] Abbreviations: Aristotle, *NE* (Nicomachean Ethics), *Pol* (Politics); Xenophon, *Oec* (Oeconomicus).

with a regulatory and managerial function of every personal and social activity, choosing good equally for all, in the same way without considering the uniqueness of each person (Bertagna 2017).

Therefore, following what Rousseau points out, the protagonist of this conception of the human is not "the individual", understood as an absolute whole, but "the citizen", a relative individual, a fractional unit dependent on a denominator, whose value is only in relation to the totality of which he is only a part and a piece (Rousseau 1762/2016).

In the Aristotelian-Thomist conception of human beings the protagonist is an absolute whole (unitary, free and responsible), unique and unrepeatable, a relational being, an autonomous integrality and an end in himself. If relational *philìa* is a virtue that allows one to progress from the self to oneself through the reciprocity with others that teaches that the other person is simply another like oneself, the person constructs himself and others. This is a kind of pedagogy that looks at the personal, unique, and substantial identity expressed, differently, in each of us. In fact, the educational idea at the base of this paradigm is structured around the concept of "person" understood in its integrity, unitarity and totality. The referring perspective is the pedagogical one, which, on the contrary of that one of other human sciences, brings with them "something more" that also calls into question the ethical dimension of the person.

Unlike educational sciences (psychology, anatomy, anthropology, sociology, etc.) pedagogy is a discipline that goes beyond the "theoretical logic" and the epistemic knowledge of the experience. The word "pedagogy" derives from the Greek *pâis*, *paidós*, a subject in growth, and from *agogé*, a transport, a relational, physical and emotional movement induced from "music" in the person or *agein*, to lead, that means to lead, to guide in an active way. The aim of pedagogy is, therefore, the fulfillment of oneself. It aims, in fact, "to give meaning" to the educational experience of the subject in growth, mobilizing educational sciences, but, while educational sciences are limited to consider what happened in the past, pedagogy goes beyond and considers the person in its wholeness of spiritual, moral, psychological, social and cultural aspects that make it unique and unrepeatable.

2 *philìa*, the Key of Business and Collaboration

Aristotle demonstrated how the concept of *philìa* could describe a broader spectrum of relationships than "friendship" does: in fact, many human relationships are structurally based on the *philìa* (Hughes 2001: 168). Business is one of those, as clearly illustrated by Luigino Bruni, who wrote that the vast majority of civil and economic life is explained by the intertwining of *eros* and *philìa*, passions which move needs, consumption, but also dynamics in organizations and entrepreneurs

(Bruni 2010). In other words, there can be no business without trust, connection and sharing.

In the last few years the way business has been conducted historically has faced a spiral of a transformational process: it is a technological revolution that is going to alter the way you live, work, and relate to one another; it involves also an increasingly complex, dynamic and "virtual" organization of production.

Because of this emerging economic and technological phenomenon vastly spreading worldwide, firstly it will be more and more necessary to put "the individual" back in the center and no longer "the citizen", and to develop the polycentrism and a plurality of voices enhanced by personalized theories and practices. So it will be necessary to create links and connections animated by *philìa* between all the parties involved in the social processes. In this arising transformation work and wealth do not come primarily from competition, but from cooperation and mutual benefit research. In other words they come from collaboration.

It is now widely recognized that the dynamics of collaboration are breaking up and are leading to a rethinking of the traditional business models. In a collaborative economy resources are shared and the meeting with the other creates a common capital that generates value. This creates a social exchange space, where members establish, through their mutual cooperation, a communal identity.

For this reason, networking and work in groups are methods that must be dealt with strategic skills.

However, neither the technology nor the technique are enough to make people work together. Collaboration and the end result of a shared work are really successful only if the debate on competencies is preceded by some "prerequisites", which are a precondition for ensuring an effective competence—even technical—of the person in the performance and in dealing with a specific job.

Some authors have distinguished the so-called "hard skills", «task-oriented competencies learned through education and/or training» (James and James 2004: 39–41), and the "soft skills", linked to «personal behavioral attributes, values, or traits, including ethics, communication, leadership, interpersonal, and teamwork skills» (Sisson and Adams 2013: 132). Soft skills are aspects of attitude and emotions that are demonstrated through effective communication and interaction.

In the dominant political, social and media mainstream, in education and in workforce settings cognitive abilities are the ones that exclusively matter and the most determinant of educational and work outcomes. Consequently, other variables, such as personality, has been considered unrelated to education and work and unimportant. However, in doing so the person is not considered in its totality, as a whole, as a combination of all the human components: such as rationality, feelings, practical abilities, but only partially. It is thus accomplished a subdivision of a person in many aspects. But you cannot divide what is united from the beginning.

Against this lack of significance, the dynamics of collaboration are bringing back an increased awareness of the importance of "soft skills", such as motivation, work

ethic, teamwork, organization, in the belief that «they play a role that is as important or even more important in determining success in school and in the workplace» (Kyllonen 2013: 18).

But, can soft skills be taught? Can personality enhancements be induced through specific interventions? Some studies of early-childhood intervention programs (Barnett 2011: 975–978) are questioning this aspect and are showing «that effective programs that are already in place, from preschool to the workplace, can develop and increase soft skills» (Kyllonen 2013: 19).

3 The Lesson of Xenophon

Actually, the road had already been marked in the fourth century BC by Xenophon (c. 430 B.C.–c. 355 B.C.) in his *Oeconomicus,* a Socratic dialogue principally about household management and agriculture (For a study on economy in classical Greece, see Kanyiannis 1992: 67–74; for a study on education in ancient times see Marrou 2016).

It has to be noted that «the *oikos* of Xenophon's time bears little resemblance to a conventional modern family—a married couple with children in a home setting. Affluent *oikoi* could include from several hundred to several thousand slaves and two housing facilities, one in the city and the other in the countryside, kept for farming operations. The family head, the *oikos* centre, was surrounded by his slaves, plus his own children as well as orphans of deceased kinsmen and subservient women. Taking into account the fact that newlyweds quite frequently lived with the husband's parents, the ancient *oikos* consisted of a few generations of parents and children» (Pichugina and Bezrogov 2017: 279).

From the conversation between Socrates and the entrepreneur Critobulus, basics also for contemporary management culture and, therefore, for economy itself emerge. In the second part of the dialogue Socrates tells Critobulus, his main interlocutor, about a conversation he had with the rich and noble Ischomachus.

Critobulus asks Socrates to help him perfect himself:

> Pray select the branches of knowledge that seem the noblest and would be most suitable for me to cultivate: show me these, and those who practice them; and give me from your own knowledge any help you can towards learning them (*Oec*, IV, 1).

In other words, as recently pointed out by some authors (Pichugina and Bezrogov 2017), Critobulus is asking Socrates: "Show me the example I can follow to become a mentor for myself".

Socrates tells that he asks Ischomachus about his collaborators and he begins to list the qualities of a good co-worker. And in a totally unexpected way for a modern reader, Socrates does not start from a long list of technical skills, but firstly he introduces the principle of loyalty:

> Then the first requirement will be that he should be loyal to you and yours, if he is to represent you in your absence. For if a steward is not loyal, what is the good of any knowledge he may possess? (*Oec*, XII, 5)

Without honesty there cannot be collaboration and a good collaborator is essential for the success of business. Ischomachus says: «for the man has to be capable of taking charge in my absence; so why he need know anything but what I know myself?» (*Ivi*, XII, 4). A collaborator must be able to replace the chief in his absence, so Socrates highlights that to achieve this aim, first of all a relationship made of mutual loyalty, of trust and so of *philìa* must be established. The ability, described by Xenophon, to replace the head, and to understand what must be done, when it must be done, refers to the category of sympathy, which involves putting oneself in the position of another so as to feel what the other person feels. This is a competence which is firstly learned through the ludic dimension. In fact, through the mediation of game, children discover the world, enter into relationships with others and acquire autonomy, self-control, responsibility and above all collaborative skills. The game thus becomes a way of constructing personal identity and it is a moment that allows the child to acquire self-control, self-confidence, values and a responsible behavior, which translates into compliance with a shared system of rules, promoting positive attitudes in children and sensitizing them towards the world around.

In doing so Xenophon indicates as the first and most important co-worker's feature a soft skill, one of those prerequisites which precede the technical competencies. The main factor for the wealth of a firm becomes the intangible abilities, skills or knowledge of the human beings. But loyalty can be taught? Socrates and Ischomachus agree in saying that a co-worker can be trained and educated to loyalty, which can be transmitted to a collaborator «by rewarding him» (*Oec*, XII, 6), by sharing all good things within the community of collaborators. Thus Socrates establishes that an entrepreneur has to train his employees, collaborators and bailiffs, himself.

The collaborator must then be selected for his willingness "to be careful" (*Ivi*, XII, 9), an ethical and technical criteria, which recalls the entrepreneurship, the ability to act independently and proactive. How does the entrepreneur teach them to be careful in the affairs he wants them to superintend? Ischomachus gives the answer:

> By a very simple plan, Socrates. Whenever I notice that they are careful, I commend them and try to show them honour; but when they appear careless, I try to say and do the sort of things that will sting them (*Ivi*, XII, 16).

So saying Xenophon shows another important prerequisite that the entrepreneur and therefore the collaborator have to have: the collaborator who knows how to replace the entrepreneur must know how to praise and reprimands the others. He has to express warm approval and admiration for those who work hardly, but he has also to rebuke and express sharp disapproval or criticism.

Moreover,

> if you want to make men fit to take charge, you must supervise their work and examine it, and be ready to reward work well carried through, and not shrink from punishing carelessness as it deserves (*Ivi*, XII, 19).

In other words, the collaboration is effective if loafers are treated differently from those who put effort: the co-worker must be able to distinguish between those who are negligent and who works hard. In fact the work commitment is related to the ability of the subject to apply to the task assigned, with a sense of sacrifice and tension to the result. Therefore it expresses the ability to comply with the requirements and objectives that are assigned in the workplace.

Through a long ethical, social and educational apprenticeship collaborator also learns the ability to command («I think he must learn to rule the labourers» says Ischomachus, *ivi*, XIII, 3).

Some authors (Humphreys 2002: 136–146; Humphreys et al. 2011: 183–207; Prastacos et al. 2012: 299–302) pointed out that Xenophon himself was an exceptional leader: in his early years, in fact, he was a disciple of Socrates, but his life took an abrupt change when he decided to accompany the Greek army under Cyrus the Younger. When Cyrus was killed in battle, the troops selected Xenophon as their leader, even though he held no command and had never been a soldier previously, for leading the Greek soldiers safely in their hostile retreat along the Tigris River.

Probably also starting from his personal experience, Xenophon describe leadership as the ability to watch over, to supervise and take control of situations. It's the control, the ability to develop standards to measure the results of the work of people. Collaborators with control skills are able to identify and establish appropriate organizational and working procedures and keep informed the others about the status of work progress. Having control of situations also means being able to identify what are the strengths and weaknesses of each in a sort of relational sensitivity.

> Those of an ambitious disposition are also spurred on by praise, some natures being hungry for praise as others for meat and drink (*Oec*, XIII, 9).

This capability calls into question the emotional intelligence, which is the ability to perceive, use, understand and control the skills and the emotional state of others in order to adopt effective behaviors and to organize work. This prerequisite is built on empathy and social orientation, which is based on knowing how to correctly interpret the organizational climate.

In addition to these features, treating the context of the work organization Socrates indicates another important prerequisite: do not steal (*Ivi*, XIV, 2) which recalls the first principle of loyalty. So, this social model, far from being ideological and naive, forcefully recalls the necessary antecedence of ethics in every speech about management.

Only at this point Xenophon calls into question the technical competence, because the collaborator «has still to understand what he has to do, and when and how to do it» (*Ivi*, XIII, 2):

> Well, I won't go on to ask whether anything more is wanting to your man, after you have implanted in him a desire for your prosperity and have made him also careful to see that you achieve it, and have obtained for him, besides, the knowledge needful to ensure that every piece of work done shall add to the profits, and, further, have made him capable of ruling, and when, besides all this, he takes as much delight in producing heavy crops for you in due season as you would take if you did the work yourself. For it seems to me that a man like that would make a very valuable bailiff (*Ivi*, XV, 1).

4 From Xenophon to European Documents

Therefore, according to Xenophon, a good collaborator/entrepreneur, must "be loyal"; must "know how to get busy"; must "praise and blame, recognizing everyone what is due"; he must "give generously", sharing with co-workers the goods and the goals achieved. Furthermore, an entrepreneur must have leadership qualities, owning the ability to "look beyond" the contingency, facing so the unknown and unexplored land borders, in order to anticipate possible future trends and developments: «to have this knowledge, Ischomachus says, is to be endowed with the virtue of high-mindedness. For the Socratic manager, this is the crowning virtue that completes the requisite qualities of loyalty, self-control, diligence, industry, piety, honesty, and justice» (Bragues 2007).

But what we mean today when we talk about good collaborator/entrepreneur? Are the categories and qualities identified by Xenophon still valid today or is it there a need for others? How much of this "classical" perspective remained—in terms of awareness and effective use—related to the word "competence"?

A good starting point for answering these questions can be provided by a brief analysis of the European documents that face, with growing interest, the theme of entrepreneurship development.

In fact, in 2006 the European Commission started a discussion about how to increase the entrepreneurial spirit (European Commission 2006; Commission of the European Communities 2003). Today this perspective appears established and recognized in several EU official documents (European Commission 2009; European Council 2012): as the EU strategy "*Rethinking education*" underlines, «by 2020, 20% more jobs will require higher level skills» and education needs to «encourage the transversal skills needed to ensure young people are able to be self-entrepreneurial and to adjust to the increasingly inevitable changes in the labour market during their career» (European Parliament 2012: 2).

For these reasons, in 2013 the European Commission promoted an "*Entrepreneurship 2020 action plan*" aims to "*reigniting the entrepreneurial spirit in Europe*", starting from the statement that «to bring Europe back to growth and higher levels of employment, Europe needs more Entrepreneurs» (European Commission 2013: 3).

And to achieve this goal, education is a key factor:

> investing in entrepreneurship education is one of the highest return investments Europe can make. Surveys suggest that between 15% and 20% of students who participate in a minicompany program in secondary school will later start their own company a figure that is about three to five times that for the general population. Whether or not they go on to found businesses or social enterprises, young people who benefit from entrepreneurial learning, develop business knowledge and essential skills and attitudes including creativity, initiative, tenacity, teamwork, understanding of risk and a sense of responsibility. This is the entrepreneurial mind-set that helps entrepreneurs transform ideas into action and also significantly increases employability (*Ivi*: 5–6; Jenner 2012).

In this process, an important role is entrusted to Member States: in the recent years several governments «have successfully introduced national strategies for entrepreneurship education or made entrepreneurial learning a mandatory part of

curricula» (European Commission 2013: 6), with the aim to foster even more «self-employment and job creation by investing in entrepreneurial education» (Kucel et al. 2016: 73; OECD 2015).

Moreover, to bring education to life through practical experiential learning models and experience of real-world entrepreneurs, Member States should

> foster entrepreneurial skills through new and creative ways of teaching and learning from primary school onwards, alongside a focus from secondary to higher education on the opportunity of business creation as a career destination. Real world experience, through problem-based learning and enterprise links, should be embedded across all disciplines and tailored to all levels of education. All young people should benefit from at least one practical entrepreneurial experience before leaving compulsory education (European Parliament 2012: 4).

What emerges from European policy documents is therefore a request of a larger interpenetration between entrepreneurship and education, also claiming also that «all young people should benefit from at least one practical business experience before to finish compulsory education» (*Ibid*).

The phenomenon, which will become increasingly important (European Commission/EACEA/Eurydice 2016), is still fairly new if you considering that until 2012 only six Member States had adopted a specific strategy for entrepreneurship education (Eurydice 2012).

If on the one hand the development of the "sense of initiative", the "teamwork ability", the "tenacity" and "creativity" are in the same line with which is proposed by Xenophon; on the other these skills in EU documents seem to be divided from the person who, in practice, will have to implement and exercise them.

In the European perspective, skills are likely to become "standardized", accompanied by uniform and indistinct levels, to which all co-workers/entrepreneur should adapt. A very different approach from the one marked by Xenophon, who spoke about a person as a complete unit aware of "what to do, when and how" (*Oec*, XIII, 2) while acting.

In fact, while it is true that in the common language (also in the European documents) it is now prevailing «the idea that competence means "something" to be learned; an "object" previously established and "other" compared to the person who must then meet and assume» (Bertagna 2010: 7), this does not mean that it is really so.

The perspective here proposed is, following in the footsteps of the "classic" authors mentioned above, to see the competence as the «way of being an "autonomous person", free and responsible in addressing the problems of their personal and social human life ("someone in action")» (*Ivi*: 12–13). This way, it could be possible to move from a "paradigm of the object" to a "paradigm of the person" (*Ivi*: 16), in the comprehension of this term as much used as misunderstood.

Therefore, if the competence is not an *object*, measurable and "transferable" in mechanical and automatic way through standardized procedures (everything would be really much easier!), but rather a *person*—in its uniqueness and wholeness—who becomes competent, then will be important the *exemplum* that the student will have in front of himself.

In fact, it has been said that to every true education is central not «what we are talking about, but . . . the one who speaks» (Hadot 1998: 30). In this sense, the lesson of Xenophon, where it rises within the dialogue form the figure of Socrates, seems rather emblematic.

Moreover, looking at the etymological root of the word, a further confirmation can be found: the term competence, in fact, comes from the Latin *cum* (with) jointed together with the verb *pĕtere* (head towards, look). This *cum* means first of all a relational and social perspective, that «implies a move of someone to something, but a move that cannot be lonely, but requires cooperation, solidarity, companionship» (Bertagna 2004: 41).

Every competence has always itself a cross-reference to «a social dimension (the competent moving forward of someone requires cooperation and solidarity with others), and to an operating mode (to carry on a number of aspects and/or activities at the same time), to a personal educational quality (who is competent is able to optimize the totality of his person, in all its constituent aspects, cognitive, emotional, motor, social, etc.)» (Sandrone 2013: 80). So, summing up, one could say that it is competent

> who solves in the best way a problem, a task or project, mobilizing all components of his person, valuing the "right" partnerships with others, taking into account the theoretical, technical and practical-moral complexity of the situation to deal with within the given context, and, finally, the judgment of an expert who has already been recognized as competent in the same field of action (*Ibid*).

So, if competence is this, the attention (even in developing the entrepreneurial sense) must be turned not firstly to the *objects* (structures, curricula, etc.), but to the *subject-person*, the only true protagonist who holds the educational stage.

Only in this way, the education system can be for every single person—unique and unrepeatable—avoiding the illusion of «being able to match the individual uniqueness of people with educational, organizational and learning that are uniform, standardized and standardizing for all» (Bertagna 2017). And this is even more true today in a global scenario where the trend towards a system of socio-educational services characterized by «diversity, flexibility and freedom of choice» (Hopkins 2013: 64) seems to be affirmed.

How then boost collaboration with others? How to inspire and develop the entrepreneurial spirit? Which *exemplum* find and follow? Here emerges the theme of the business and *entrepreneurship education*: in fact, what better *exemplum* than enterprise, namely the activity that requires constant collaboration with others, to be performed at your own risk and in view of good for themselves and for society, to encourage the development of these personal skills?

The perspective of the educational value of the business company (Bertagna 2011, 2012: 9–129), until a few years ago—at least in Italy—opposed for ideological reasons, has found increasing support in recent years, taking also in consideration the European documents, which ask more and more interaction between the world of education and the world of entrepreneurship.

5 Perspectives from Italy

As seen before, the promotion of collaboration and creativity skills within the entrepreneurship education is increasingly important not only at secondary level (Sahlberg and Oldroyd 2010: 284) but also during higher education (*Ex multis*, Russell et al. 2008: 123–138; Gibb et al. 2009; Gibb 2013: 9–45; Fayolle and Redford 2014; Bienkowska et al. 2016: 56–72): as pointed out by some authors, it is necessary to intervene, even at the university level in the *curriculum*, to inspire young generations that willingness to collaboration and business cooperation (Plewa et al. 2015: 35–53).

While the conceptual definition of *entrepreneurship education* is still in the making (Fayolle 2013: 692–701; Komarkova et al. 2015; Attali and Yemini 2016), it is possible, like the international literature pointed out, to explain and develop this term at least in three ways:

> education *about* entrepreneurship investigates entrepreneurship as a societal phenomenon, education *for* entrepreneurship is about the acquisition of skills and knowledge of relevance when starting up a new enterprise, and education *through* entrepreneurship uses the entrepreneurial process as a tool to achieve a particular set of learning objectives (Johansen and Schanke 2013: 357).

Entrepreneurship education can be seen primarily as a possibility of guidance to bring together the business world and schools and universities: previously Rousseau noted that «when I see young people who limit themselves to purely speculative studies and then, without any experience, they suddenly are thrown into the world and in business, I find that in this way you strike not only the reason but also the nature, and I wonder no more that so few people know how to behave well» (Rousseau 1762/2017: 393). But how to carry out this mutual dissemination?

In 2002, for the secondary school level, only Finland had within its *curricula* the explicit prevision of entrepreneurship education as teaching subject (European Commission 2002); 5 years later, in 2007, the goal of development of the sense of enterprise was added in the *curricula* of five other countries (Cyprus, Ireland, Poland, Spain and the UK) and their number has gradually increased in recent years (Kyrö 2015: 602).

Furthermore, since 2006 within the European Qualifications Framework it is added the "sense of initiative and entrepreneurship", key competence for the established perspective of the *lifelong learning*. This competence is defined as

> an individual's ability to turn ideas into action. It includes creativity, innovation and risk-taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports individuals, not only in their everyday lives at home and in society, but also in the workplace in being aware of the context of their work and being able to seize opportunities, and is a foundation for more specific skills and knowledge needed by those establishing or contributing to social or commercial activity. This should include awareness of ethical values and promote good governance (European Parliament 2006; Moreover, «Individuals should also be aware of the ethical position of enterprises, and how they can be a force for good, for example through fair trade or through social enterprise», in order to be able to «work both as an individual and collaboratively in teams. (. . .) An entrepreneurial attitude is characterised by initiative, pro-activity, independence and innovation in personal and social

> life, as much as at work. It also includes motivation and determination to meet objectives, whether personal goals, or aims held in common with others, including at work»; European Commission 2012a, b).

In Italy, at ISCED 1 and 2, *entrepreneurship education* (defined as a "sense of initiative and entrepreneurship" (MIUR 2012) is a cross-curricular competence: it is introduced at the end of the fifth grade of primary education and at the end of the third grade of lower secondary education. This "sense of initiative and entrepreneurship" seems to be very similar to the development of the willingness "to be careful" (*Oec* XII, 9) and "get busy" already reported by Xenophon.

At ISCED 3 and IVET, the same "sense of initiative and entrepreneurship" is included in the specific content of a subject called *"Law and Economics"*: this aspect is nevertheless not very effective, both for the small number of pupils involved and for the uselessness of a provision that is likely to remain "only on paper", whereas it has been undertaken and carried out with courage and determination by the teachers themselves and students.

It is no coincidence, in fact, that «most entrepreneurial programmes are designed as extra-curricular activities both at the primary and secondary levels of education» (Leffler 2009: 105) and even where entrepreneurship education was explicitly included in the compulsory education *curriculum*, this solution would be vain without an appropriate incentive and support (European Commission 2004: 7), necessary for a real and mutual dissemination between the world of entrepreneurship and education.

So, if the inclusion of a teaching activity explicitly dedicated to entrepreneurship education within the compulsory school curriculum does not seem the best option to be pursued, a better way could be find into the work-based learning ("*Alternanza scuola-lavoro*"), which could be «a privileged path to direct experience with entrepreneurship» (ISFOL 2013): 31).

As it is known, the recent law No. 107/2015 introduced some hours of work-based learning ("*Alternanza scuola-lavoro*" at least 400 h in technical and vocational institutes and at least 200 h in other high schools, during the last 3 years of studies) as a *compulsory* part of the *curriculum* (Bertagna 2006).[2]

This prevision, although delayed and limited, it is considered—even by European institutions—«a step in the right direction» (European Commission 2016: 77): in fact,

> At least, it will ensure that an entire generation of students will know and will deal with, as do other young peers from the European Union and the OECD member States, observative experience and/or active labor. And perhaps they could discover that, if you are well guided by experts who "know" and "do well what they do, knowing it", any job, first observed and then practiced in a critical e reflective way, is an authentic gold mine (Bertagna 2016a: 3).

Certainly, also the hours of work-based learning, to avoid being reduced to a mere formal-bureaucratic fulfillment, standardized for all, have to embrace a precise

[2]The law No. 107/2015 introduced some hours of work-based learning as a *compulsory* part of the *curriculum*. The law No. 53/2003 and the Legislative Decree 15 aprile 2005, n. 77, introduced for the first time this *opportunity*.

anthropological option, avoiding any reductionism on the human person (Bertagna 2016b: 117–142). Moreover, it will also be necessary to proceed with a reform of the Italian educational system, able to overcome the current rigid, bureaucratic and centralized system.

This reflection and research field appear more and more important also for the construction of «teaching and learning paths able to enhance and promote at the same time the excellence of everyone, without exception, and of each person» (Bertagna 2015: 3).

As it has been noted, in fact,

> future-oriented pedagogies involve large measures of collaborative and creative problem-focused learning to release wide-ranging talents for innovation and to liberate teachers and learners from bureaucratic constraints, (. . .). Indeed, a broader and less constricted curriculum and system of assessment are needed to facilitate reformed methods of teaching. (. . .) Smarter pedagogies and a more adequate organization of schools and teaching will bring significant improvements to knowledge, skills and competences that are needed for raising national economic competitiveness and increasing ecological sustainability. Specially well-developed teaching methods include cooperative learning, problem-based learning and creative problem-solving and seeking separate pedagogies for these two global challenges is unnecessary (Sahlberg and Oldroyd 2010: 296).

Following the same trend, *creativity* could be seen as the «mindset that better than others allows you to prosper in future seasons» (Rossi 2016: 24), so that Sir Ken Robinson has argued that creativity today has become as important as literacy and it should therefore be given similar status (Robinson 2001; 2009): in fact, in the creative person

> can be seen a protagonist subjectivity, not consumed, entrepreneur and not passive, owner of the power of intelligent initiative, unique, independent, committed to change concepts and perceptions and to generate new concepts and perceptions as well as to develop alternative views of reality (Rossi 2016: 24).

Creativity, collaboration, entrepreneurship: all elements hardly measurable and circumscribable (where do they start? Where do they end? Where do they take place?), but which are becoming increasingly critical to meet the challenges of today global world.

Before the *glocal* perspective and our "liquid" and complex society (Bauman 2014, 2015; Bauman and Bordoni 2015), the dynamics of cooperation and entrepreneurship education play a central role: recovering those prerequisites that involve a sphere of values, without giving up either to quantitative technicality and not to mere *téchne*, allows to embrace and revive a pedagogical perspective centered on the human person—unique and unrepeatable—in its full and complete entirety.

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Part II
Collaboration and Innovation in Entrepreneurship Education Practices

Entrepreneurship Education as a Service

Oleg V. Pavlov and Frank Hoy

Abstract This chapter addresses the extension of entrepreneurship education across disciplines and divisions on a university campus. We draw on service science theory to examine how such academic programs may be designed, implemented and assessed. The experience at Worcester Polytechnic Institute in the United States serves as a case study, which we review using the Service Science Canvas, a tool for analysis that incorporates the common elements of service systems. Besides making a methodological contribution to the entrepreneurship literature, the framework developed in this chapter can be used for strategic planning by university leaders and program directors.

Keywords Entrepreneurship education · Service systems · Service science · Academic program management · Higher education · Canvas

1 Introduction

According to Morris and Liguori (2016, p. xiv), "the emergence of entrepreneurship within universities over the past 30 years has been breathtaking." The timeline laid out by Katz in 2003 demonstrated that institutions of higher education have accepted entrepreneurship as a distinct discipline only recently, yet its adoption has been explosive. The spread of entrepreneurship education from four universities in 1968 (Vesper 1993) to over three thousand in the United States alone (Morris and Liguori 2016) has occurred in a multitude of ways. Yet, patterns do emerge. Early champions were lone faculty members with entrepreneurial interests or experience who offered single courses and individual backers—often successful entrepreneurial

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alumni—who funded educational initiatives (Morris et al. 2013; Morris and Liguori 2016). Over time, multiple courses emerged, then concentrations and majors, eventually leading to extensions beyond business schools and even campus-wide programs (Morris et al. 2013, 2014).

Most recently, attention has been given to the "entrepreneurial university" (Fayolle and Redford 2014; Foss and Gibson 2015; Phan 2016; Slaughter and Leslie 1997) and even to entrepreneurial ecosystems (Fetters et al. 2010) that extend university-based entrepreneurship programs into broader community and regional development initiatives. These developments have led to predictions that university DNA will be infused with entrepreneurship (Christensen and Eyring 2011). According to this vision, universities must become entrepreneurial in all their activities in order to survive in the competitive educational marketplace. Additionally, entrepreneurship is becoming part of educational and research activities on campuses in support of university efforts to commercialize their intellectual property (Phan 2016) and in response to the evolving needs of the labor market (Fetters et al. 2010; Welsh 2014; Graham 2014).

Employers are placing demands on universities, seeking T-shaped professionals with the depth of knowledge in at least one discipline and with the breadth of knowledge that allows them to innovate and acquire new knowledge as needed (Murphy et al. 2011; Barile et al. 2012). Responding to this demand, many schools are attempting to instill in their graduates the entrepreneurial mindset. Basic knowledge of entrepreneurship will become more relevant in the future as automation erodes job security (Brynjolfsson and McAfee 2014) and societies move toward "gig economies" (Mulcahy 2017).

While demand for entrepreneurship education is strong, its provision is less certain. Literature provides many cases of successful and not-so-successful academic entrepreneurship initiatives (Morris et al. 2013, Morris and Liguori 2016; Kyrö and Carrier 2005; Welsh 2014). Due to the variability in program design and implementation, identifying what factors determine the long-term success or failure of entrepreneurship programs is not trivial. Reviews have determined that institutions typically lack a unifying framework for building cross-campus and collaborative entrepreneurship programs (Fayolle and Redford 2014; Rae and Wang 2015; Rothaermel et al. 2007; Vanevenhoven and Drago 2015). Some efforts at creating such frameworks have been made, but there is little evidence that they are widely accepted (Vorley and Nelles 2008; Morris et al. 2013; Welsh 2014). There is still a recognized need for better theories that explain entrepreneurship education (Roberts et al. 2014).

This chapter addresses this need by offering a framework for creating sustainable cross-campus entrepreneurship programs. Our analysis draws on service science, which is a general theory of service production and delivery. As complex institutions (Christensen and Eyring 2011), colleges and universities are seen as service systems, which are part of the global educational ecology that delivers value by generating and transferring knowledge (Maglio et al. 2006; Spohrer et al. 2007; Lella et al. 2012; Spohrer et al. 2013). As an aid for analysis, we organize all framework elements into a one-page Service Science Canvas. Our intent is that the convenience of the Service Science Canvas may help university leadership and management with the design and assessment of cross-campus programs in entrepreneurship education.

2 Entrepreneurship Education

The first documented entrepreneurship course in the United States was taught at Harvard in 1947 (Katz 2003; Roberts et al. 2014). By 2008, there were more than 5000 courses throughout the country, and by 2013 over 400,000 students were taking courses from nearly 9000 instructors (Torrance et al. 2013). Entrepreneurship education has become a truly global phenomenon (Rice et al. 2014; Graham 2014; Lackéus 2015).

Early courses in entrepreneurship focused predominantly on new venture creation. Educators and scholars soon recognized that entrepreneurship encompassed more than the steps for starting a business. Subject matter expanded to include: opportunity seeking, assessment, and selection; obtaining seed and early-stage capital; forming venture teams; corporate venturing and intrapreneurship; family business; managing rapid growth; exit strategies; technology commercialization; and much more. The expansion clearly demonstrated the interdisciplinary nature of entrepreneurship education.

As the adoption of entrepreneurship education expanded, approaches among institutions of higher education varied widely (Erkkilä 2000). At many schools, a single course is all that is available. Others have multiple courses, sometimes enough to suffice for a minor or major degree option. Many universities are spreading entrepreneurship education beyond business schools. This process, however, has been found to be difficult (Baptista and Naia 2015; Nelson and Lumsdaine 2008; Morris et al. 2014; Roberts et al. 2014).

Challenges include resistance from administrators, faculty, alumni and staff (Morris et al. 2014; Fetters et al. 2010). University stakeholders may view entrepreneurial aspirations of a university as interfering with its fundamental academic mission (Lucas 2006; Kaplin and Lee 2007). A common fear is that university-industry alliances may stifle the free flow of information and encourage research that focuses more on commercial feasibility rather than academic scholarship (Fetters et al. 2010). Without university support, entrepreneurship programs often struggle due to poor coordination among participants and inadequate resources (Morris et al. 2014; Fetters et al. 2010). Successful entrepreneurship education requires a rich ecosystem and a network of stakeholders and resources for supporting budding entrepreneurs (Fetters et al. 2010; Graham 2014). Stakeholder involvement goes beyond the internal administrators, faculty, staff, and students, and calls for attention to the needs and relationships with public and private sector entities served by the university.

Identification of frameworks that support the long-term success of academic entrepreneurship is an active research subject (Roberts et al. 2014). Morris et al. (2013) proposed thirteen building blocks beginning with identifying an academic champion and proceeding to metrics and outcomes. The building blocks are focused internally to the organization. Welsh (2014) offered a twenty-one step model for cross-campus entrepreneurship, again predominantly internally-focused, although step number nineteen calls for working with the community (represented as business

and neighborhood leaders and elected officials). An "entrepreneurial architecture" approach was devised by Vorley and Nelles (2008) and extended by Foss and Gibson (2015). Entrepreneurial architecture consists of five dimensions—structures, systems, leadership, strategies, and culture—oriented in some combination to fulfill a university's mission to adapt to its socio-economic environment, specifically addressing commercial engagement. Perhaps the best known model for integrating universities with their external environments is the Triple Helix, consisting of university-industry-government relations (Etzkowitz and Leydesdorff 2000). It is normally applied to examine systems of innovation. The model encourages universities to engage in teaching, research and knowledge transfer in order to impact communities beyond the campus. Although specific disciplines were not defined with the Triple Helix, entrepreneurship education is one that could be and is being implemented across departments and divisions within universities.

This chapter extends entrepreneurship literature by positioning entrepreneurship education as a service. We rely on service science theory, which is explained in the next section, to examine entrepreneurship programs within the broad context of literature on service provision, which subsumes provision of educational services. We build on earlier literature that suggests that the service science approach can be used to analyze the production and delivery of educational services (Maglio et al. 2006; Spohrer et al. 2007, 2013; Larson 2009; Lella et al. 2012).

3 Service Science Theory

Service science is a theory that defines service systems and studies their evolution, design and management (Spohrer et al. 2007; Maglio and Spohrer 2008). Central to service science is the study of value co-creation phenomena (Spohrer 2009; Vargo and Akaka 2009). The theory was developed in response to the concern that the service sector of economies has been understudied relative to other sectors despite the fact that services account for most of the world's economy. Service is defined as "the application of competencies for the benefit of another" (Spohrer et al. 2007: 72). The service system is the foundational concept; it is an abstraction that represents a dynamic network of resources for producing and delivering value to stakeholders (Spohrer et al. 2007). Firms, business units, cities, government agencies, and nations are examples of service systems. Service science theory describes service systems in terms of ten elements that are described below (Spohrer et al. 2007).

Resources

A resource is anything that can be used in service production. People, technology, information and organizations are resources (Spohrer et al. 2007; Chen et al. 2008, p. 122). In market economies, financial resources are used to gain access to physical, human or intellectual resources.

Access Rights
Resource availability is determined by access rights (Spohrer et al. 2008). The service science approach differentiates four fundamental access rights: leased, owned, shared, and privileged. A rented car is an example of a leased resource. Private property is owned. Shared access rights direct the use of transportation in air and on roads. Knowledge is a resource with privileged access rights.

Entities
Service systems consist of entities, which are resource configurations capable of value creation (Spohrer et al. 2008; Spohrer and Kwan 2009). Entities are dynamic—they emerge and disappear. Entities can be formal or informal (Maglio et al. 2009). Examples include academic departments, practice groups within a law firm, and an R&D division of a company.

Stakeholders
Stakeholders are the parties impacted by service interactions (Spohrer et al. 2008). Service science specifies four fundamental stakeholder types based on their roles: customer, provider, authority and competitor. Customers are the consumers of the service. Providers offer resources to service systems. Authorities ensure compliance with rules and laws. Competitors are alternative producers of services; their existence drives innovation.

Value Co-Creation
Successful service systems create value through collective efforts of stakeholders (Chen et al. 2008). Stakeholder participation in value co-creation activities builds confidence and trust in the service system, which is crucial for its long-term successful operation.

Networks
Networks refer to patterns of interactions among service systems and between entities in service systems (Spohrer et al. 2008; Barile and Polese 2010; Lyons and Tracy 2013). Examples of interactions that occur over networks are governance interactions between the authority entity and other entities, or the exchange of skills and knowledge among stakeholders.

Ecology
Service systems and service entities constitute the service system ecology (Spohrer et al. 2008; Spohrer and Kwan 2009; Lyons and Tracy 2013). Ecologies may contain different numbers and types of service systems and entities. An ecology may include a variety of resource access rights, network patterns, and governing arrangements. A country can be viewed as a member of an ecology of nations. Any university is part of a global ecology of educational institutions and organizations that support them, such as banks that provide educational loans to students.

Governance
Governance mechanisms direct service systems towards certain objectives. Examples of governance mechanisms are informal social norms, formal contracts, laws, and regulations (Spohrer et al. 2008). Governance mechanisms reduce ambiguity

and ensure viability and efficiency of service systems (Spohrer et al. 2008; Barile and Polese 2010; Lyons and Tracy 2013).

Outcomes
Activities of service systems lead to outcomes. The main outcome is the value for customers. Additional outcomes include contracts between systems, entities, and stakeholders, disputes resolved or unresolved and so forth (Spohrer et al. 2008; Maglio et al. 2009). Outcomes may be intended or unintended.

Measures
Stakeholders evaluate the performance of a service system against benchmarks, which are important to them. To monitor the service system performance, its activities must be measured. The service science framework identifies four primary types of measures: quality, productivity, compliance and sustainable innovation (Spohrer et al. 2008).

4 The Service Science Canvas and Its Application to Entrepreneurship Education

As an analysis aid, we organized the elements of the service science theory into a one-page visual tool we call the Service Science Canvas. The Service Science Canvas was inspired by the Business Model Canvas introduced by Osterwalder and Pigneur (2010). Due to its convenience and the simplicity of use, the Business Model Canvas has become popular as a planning and visualization tool in the entrepreneurship community (see www.strategyzer.com for examples). There have been a number of adaptations of the Business Model Canvas (Maurya 2012; Perez 2017; Van Der Pijl et al. 2016). As a generic service science template, the Service Science Canvas can be used to describe any service system. In this chapter, we apply the Service Science Canvas to cross-campus entrepreneurship education programs (Fig. 1).

The Service Science Canvas for an academic program is akin to the Business Model Canvas for a startup. The bulleted points in each block act as planning guides for academic development teams. The same elements can be mentioned in several blocks. For example, university faculty are the main resource for any academic program, and therefore ‘faculty’ is included in the Resource block. Professors may hold tenured positions and dedicate their full attention to an entrepreneurship program. Alternatively, if they are affiliated faculty or adjuncts, then only a fraction of their time is devoted to the program. We capture this difference by writing ‘privileged’ or ‘shared’ access to the faculty time in the Access Rights block. Including ‘faculty’ in the Stakeholders block reminds us that professors have their own objectives and preferences for participating in an academic program. Below, we explain each block in greater detail.

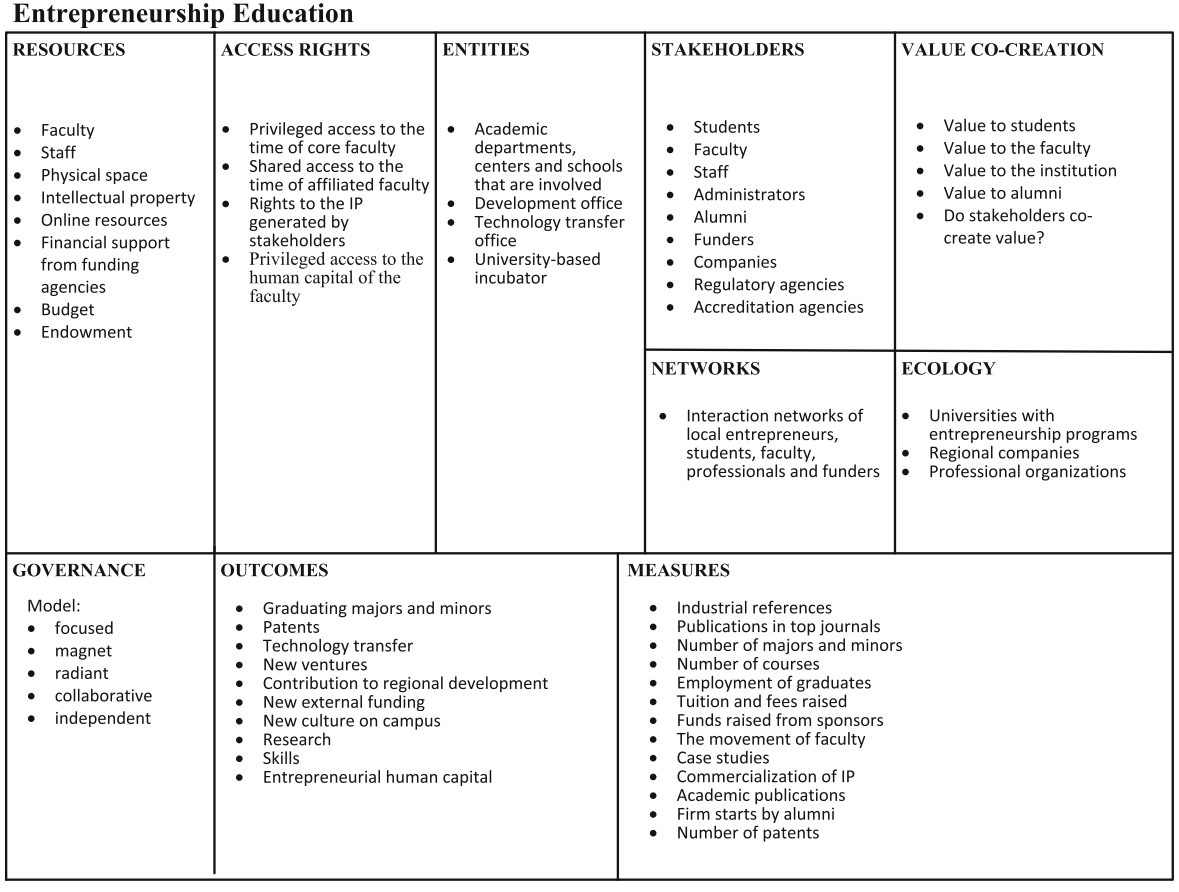

Fig. 1 The Service Science Canvas and its application to entrepreneurship education

Resources

To be successful, academic programs must have adequate resources (Massy 2016; Zaini et al. 2016). Resources include faculty, support staff, physical buildings, online resources, funding and intellectual property. Faculty and staff can be full-time or part-time. Shortages of resources can be eliminated by purchasing access to additional resources. The continuity and significance of the financial support ensures adequacy of resources and insulates academic programs from resistance internal to universities (Fetters et al. 2010). Successful entrepreneurship programs actively raise funds from many sources (Finkle et al. 2013).

Access Rights

Control over resources is determined by access rights. Academic institutions typically own property, such as buildings, equipment, and vehicles. An academic program shares resources with other academic programs at the same university. Academic programs may receive or lease equipment and space from the university or from other organizations. If resources are scarce, that may lead to competition between programs. Universities have privileged access to the human capital of their faculty.

Following the adoption of The Bayh-Dole Act in 1980, the US universities own their intellectual property (IP), which means that the IP that universities create can be purchased or licensed (Kaplin and Lee 2007). IP is not directly owned by academic programs, and therefore entrepreneurship programs have no legal financial claim to the IP. Faculty on the other hand may hold patents to the IP, typically shared with the university.

Entities

Academic entities include academic institutions, programs, departments, centers and schools. Traditionally, entrepreneurship programs have been housed within business schools (Katz et al. 2014; Morris et al. 2014). Making entrepreneurship education available to the entire campus acknowledges that an entrepreneurship program can potentially benefit any academic department (Roberts et al. 2014; Welsh 2014). Other university divisions that are important for the success of entrepreneurship programs are the development offices that reach out to funders, the technology transfer offices and university-based incubators. Universities also form commercial partnerships, joint ventures, and create subsidiary corporations (Kaplin and Lee 2007).

Stakeholders

A vibrant entrepreneurship program has many stakeholders including students, potential employers, faculty, alumni, administrators, benefactors, local entrepreneurs, non-profit foundations, investors, accountants, lawyers, partner universities, and the government (Fetters et al. 2010; Rice et al. 2014). A critical mass of multiple stakeholders ensures the sustainability of an entrepreneurship program (Fetters et al. 2010). Without it, an academic program is susceptible to risks associated with a key faculty member leaving the program or the change in institutional leadership (Fetters et al. 2010; Katz et al. 2014).

Following the general service science framework, we identify four fundamental stakeholder types for entrepreneurship programs:

- *Customers:* Demand for educational services comes from students, and therefore students are primary customers. Students benefit from interactions with the faculty and support staff as well as interactions among themselves.
- *Providers:* Faculty and the support staff are the providers of educational services. The support of enthusiastic faculty is one of the main ingredients of successful campus-wide entrepreneurship education. An entrepreneurship program typically has a core group of entrepreneurship faculty who assist non-business faculty in introducing entrepreneurship elements in their classes (Neck et al. 2014).
- *Authority:* The board of trustees of a university and administrators set the rules, which govern the university and educational programs. After reviewing several universities with entrepreneurship programs, Fetters et al. (2010) concluded that all successful entrepreneurship programs must have the support of the senior leadership, such as the university president or dean. Setting up an academic program is often a decision by senior administration with the tacit support from the faculty. Senior administrators act as advocates for entrepreneurship within the university and in external communities, and they pursue funding (Fetters et al. 2010). Faculty governance may control some aspects of an academic program. For example, faculty governance committees may approve introduction of new courses and recommend academic promotions. Additionally, universities and academic programs are subject to standards of higher education, which are enforced by the national and state level organizations (Kaplin and Lee 2007).
- *Competitors:* Other academic programs on campus and elsewhere are the competitors for any academic program. Academic programs compete for faculty, students and funding. By seeking goal alignment in providing educational services, it may be possible to co-opt and collaborate with competitors.

Value Co-Creation

Value co-creation dictates that academic programs must provide value for all stakeholders, and all stakeholders participate in the value creation process. In the case of entrepreneurship education, value to students comes when they learn how to start a company, acquire skills for innovation, obtain knowledge required to run a company (which may include concepts from accounting, economics, etc.), network with entrepreneurs, and access venture funding. Universities may also provide workspace for startups.

For faculty, an entrepreneurship program may offer new opportunities for teaching, research, community outreach, co-curricular activities and funding. University trustees and administrators may support an entrepreneurship program as an additional vehicle to secure donations from alumni and community entrepreneurs (Finkle et al. 2013). The community at large benefits from educational seminars and workshops on entrepreneurship topics by the faculty and guest-speakers (Finkle et al. 2013).

Another source of value may be university-based incubators. For students, university incubators provide opportunities to start companies under the guidance of seasoned entrepreneurs who volunteer their services. Faculty rely on incubators to

supplement their research with venturing activities, and investors gain privileged access to the latest research on campus.

Networks

Universities are important contributors to regional entrepreneurship (Lella et al. 2012; Holly 2012). They act as focal points for connecting multiple stakeholders by supporting networks of local entrepreneurs, professionals and funders (Fetters et al. 2010; Graham 2014; Bliemel et al. 2014). Such innovation networks increase chances of success for new ventures based on university IP (Holly 2012).

Recognizing their importance, private foundations support innovation networks. For example, the Coleman Foundation Fellows Program aims to create networks of non-business faculty with entrepreneurship interests by encouraging them to exchange teaching tips and practices (Katz et al. 2014). Other professional networks, such as the International Council for Small Business (ICSB), facilitate interaction among faculty from different universities.

Ecology

Entrepreneurship programs are integral parts of a broader educational ecology. Besides the academic programs, the ecology includes a multitude of stakeholders beyond the campus (Audretsch and Link 2017; Fetters et al. 2010). These may include chambers of commerce, government economic development offices, and even corporate partners.

Governance

The Governance block shows organizational structures that are used by entrepreneurship programs (Katz et al. 2014; Morris et al. 2014; Roberts et al. 2014). When entrepreneurship is taught only to business students, it is a *focused* model. A *magnet* system allows any student on campus to take entrepreneurship courses within the business school. If independent champions in different departments are supported and coordinated from a central point on campus, it is a *radiant* structure. In a *collaborative* model, instructors across the campus pull their expertise together to establish a joint entrepreneurship program. In an *independent* model, campus divisions operate their own entrepreneurship programs. Magnet and radiant governance structures are most common (Katz et al. 2014).

Outcomes

The main outcome of an academic program is the production of qualified graduates. For entrepreneurship programs, other relevant outcomes are patents, technology transfer, and new ventures launched. These outcomes contribute to the regional economic development. Entrepreneurship programs may also foster changes to the campus culture. Administrators and trustees may support an entrepreneurship program as a vehicle for external funding.

Measures

It is challenging to identify measures that aptly capture the performance of an entrepreneurship program (Roberts et al. 2014; Gulbranson and Audretsch 2008). For example, if an alumnus starts a business many years after graduating, should it

Table 1 A sample of measurable indicators for an entrepreneurship program. This compilation is based on Gulbranson and Audretsch (2008), Roberts et al. (2014) and our personal observations

Quality • Industrial references • Publications in top tier academic journals • Case studies that can show clear linkages among industrial products, firms, and university research • Students, faculty and staff involvement in voluntary entrepreneurship activities • Commercialization of intellectual property
Productivity • Number of entrepreneurship majors and minors • Number of courses with entrepreneurship components • Employment of graduates • Academic publications on entrepreneurship topics • Conference participation • Firm starts by alumni • Number of patents
Finance • Tuition raised through entrepreneurship related courses • Fees raised through entrepreneurship related workshops and seminars • Funds raised from sponsors for entrepreneurship education activities
Sustainable Innovation • Continuing involvement of entrepreneurial alumni • Jointly funded research activities between the university and industry • Contract research performed by the university for industry • Informal contacts between university faculty and industrial firms • Specific university-industry training collaborations • Temporary exchanges of faculty with industry • Industry usage of university scientific facilities • New industrial processes, techniques, and instrumentation that can be traced to university research

be attributed to the entrepreneurship education he received in college? Similarly, it is difficult to quantify many intangible benefits of an academic program such as receiving a quick feedback from a seasoned entrepreneur that convinces a researcher that a particular business idea is not viable, so the person can explore the next idea (Gulbranson and Audretsch 2008). Table 1 provides a sample of measurable indicators for an entrepreneurship program.

5 Case: Worcester Polytechnic Institute

This section describes cross-campus entrepreneurship education at Worcester Polytechnic Institute (WPI). The Service Science Canvas serves as a methodological tool for information collection and organization. Our analysis, which is based on publicly available information, is not exhaustive regarding all events and activities related to

WPI's initiatives, yet this section offers an example of how an examination of such a process can be performed.

Worcester Polytechnic Institute

Worcester Polytechnic Institute is a private technological university in Worcester, Massachusetts. Worcester is the second largest city behind Boston in the state of Massachusetts. The city was in the forefront of the industrial revolution in the United States in the nineteenth century. Worcester is now known for its nine colleges and universities, several large hospitals and centers of biomedical research. WPI was established in 1865 as one of the first engineering universities in the United States. The university currently offers nearly 100 undergraduate and graduate degree programs. In 2016, most of its 3800 undergraduate students majored in engineering and science. Approximately 1700 students were enrolled in graduate and professional programs. The university was graduating approximately 40 Ph.D. and 700 Master's students per year at the time of the case study.

A Service Science Canvas for WPI is shown in Fig. 2. The information contained in the blocks adheres to the guidelines provided in Fig. 1. Explanations of the blocks in Fig. 2 are offered below.

Resources

The entrepreneurship program at WPI started in 1995 with the formation of the Entrepreneurs Collaborative within the Department of Management (Tryggvason et al. 2010). The Entrepreneurs Collaborative was a group of faculty and staff whose time was allocated to teaching new courses in entrepreneurship. The first alumni donations for the program came the same year. A gift in the amount of $1 million was provided in 1997 by an alumnus who had co-founded the Collaborative. The Collaborative was formally designated as the Collaborative for Entrepreneurship and Innovation (CEI) in 1999. The mission of CEI is to inspire and nurture people to discover, create, and commercialize new technological products and services, and to create new organizations based on those products and services, thereby advancing economic development and improving society. The head of the Department of Management and the associate director of the CEI along with the university president and representatives from the development office obtained endowments from alumni that led to the creation of a professorship in innovation and entrepreneurship and a professor of practice position within the entrepreneurship program. Currently, the School of Business—which is the successor to the Department of Management—offers successful entrepreneurs appointments as Entrepreneur-in-Residence. Their responsibility is to mentor and advise faculty and students with entrepreneurial potential. In appreciation of a recent gift, the School of Business and a new Innovation Studio have been recently named after an entrepreneur and alumnus Robert A. Foisie. An interim president and officials in the university's development office were instrumental in obtaining the donation.

Over the years, the entrepreneurship program attracted funding from private foundations, including the National Collegiate Inventors and Innovators Alliance (NCIIA, which was later renamed VentureWell), the Lemelson Foundation, the Kauffman Foundation, the Coleman Foundation, the John E. and Jeanne

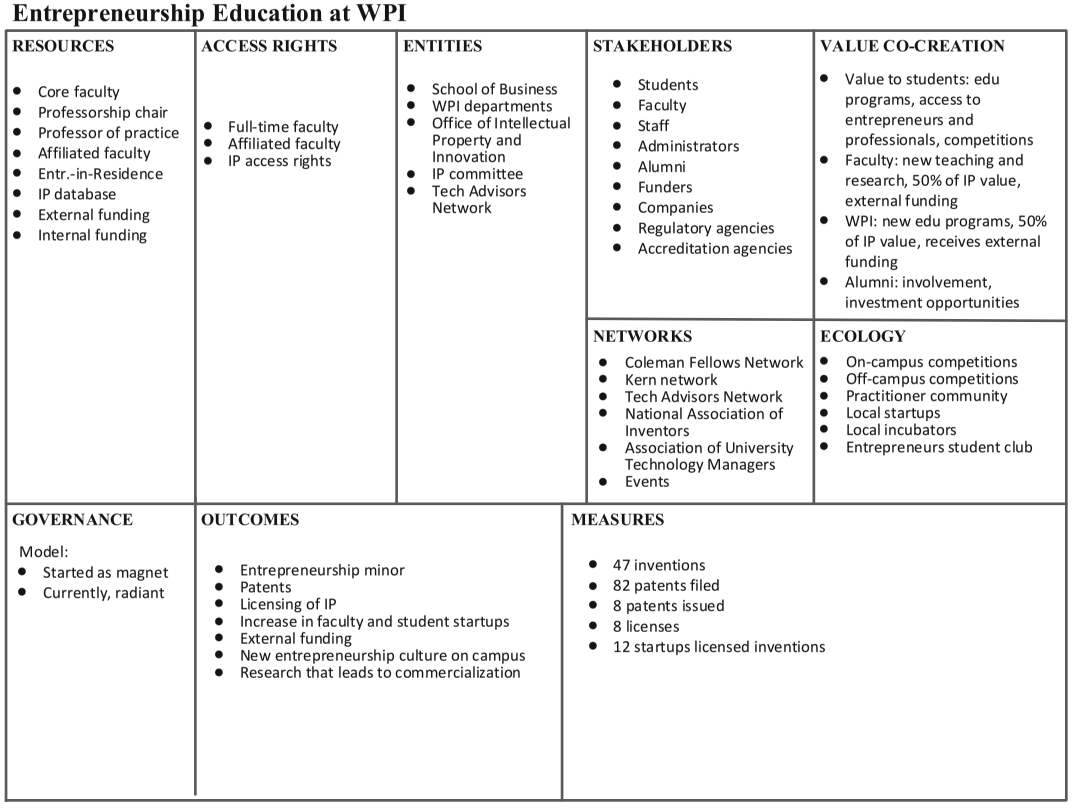

Fig. 2 The Service Science Canvas for entrepreneurship education at WPI

T. Hughes Foundation, the Kern Family Foundation, and the Dearborn Foundation. The Coleman Foundation provided multiple grants, with the first one used to support WPI's CEO-East Collegiate Entrepreneurship Conference in 2002, which is a regional conference of the Collegiate Entrepreneurs Organization. To encourage student interest in entrepreneurship, the Dearborn Foundation funded an undergraduate scholarship in entrepreneurship. Funds from the Coleman and Kern Family foundations led to the designation of Entrepreneurship Faculty Fellows throughout the engineering departments as well as Humanities and Arts, Science, and Social Sciences. Sponsorship by NCIIA, Lemelson, and the Kauffman Foundation allowed WPI to host annual Invention to Venture 1-day workshops.

In 2016, three WPI teams received funding from the Innovation Corps (I-Corps) program by the National Science Foundation (OIPI 2016). I-Corps prepares researchers and engineers to expand their focus beyond the laboratory, requiring the teams to assess the potential for launching a business.

The entrepreneurship program is now part of the university budget. Internal and external funding supports administrative operations, faculty recruitment, courses, workshops, conference travel, networking events, dinners, competitions, student assistantships, and a speaker series.

Access Rights

WPI's Office of Intellectual Property and Innovation (OIPI) assists faculty and students to commercialize their IP developed with university resources. WPI maintains a searchable website that lists all IP on campus (OIPI 2016). Before entering various entrepreneurship competitions, potential entrants from WPI are instructed in the laws and regulations regarding public disclosure, IP protection, and basics of the patent law. Students participate in workshops that introduce them to the Inventor's Notebook, which is a legal record by researchers that documents their progress. OIPI maintains direct contact with numerous corporations for licensing opportunities.

The Collaborative for Entrepreneurship and Innovation (CEI) is located in leased space within walking distance from campus. The location decision was based on the need for the CEI to interact with the business community while still being accessible to students. The Foisie Innovation Studio is centrally positioned on campus providing space for students to interact and innovate.

Entities

Initially, the WPI entrepreneurship program was housed in the Department of Management, which later became the School of Business. Continuing support from the Coleman Foundation and the Kern Family Foundation have stimulated the extension of entrepreneurship education to other schools and departments.

Various entities involved in entrepreneurship activities are:

- The Technology Advisors Network (TAN), a volunteer organization of successful business leaders who coach entrepreneurial teams associated with the university.
- The development office has been responsible for fundraising since the start of the entrepreneurship program.

- The Tech Entrepreneurs Club is a student-run organization, which supplements courses and connects students with the entrepreneurial community in Worcester. Club members represent different majors. They seek to foster the entrepreneurial environment at WPI and to get students involved in the startup world.

Stakeholders

We identify the following four fundamental stakeholder types for the WPI program:

- *Customers:* At WPI, any undergraduate student can minor in entrepreneurship or social entrepreneurship. Undergraduate and graduate students are exposed to entrepreneurship through many courses. For example, following the reception of a grant from the National Science Foundation, WPI launched a doctoral program in biofabrication. The program includes four courses that focus on the commercialization of new technologies.
- *Providers:* The Foisie School of Business currently employs four full-time faculty in entrepreneurship. Faculty in other business disciplines and adjunct faculty provide complete coverage of entrepreneurship education for students at undergraduate, masters and doctoral levels. Coleman Faculty Fellows in non-business departments have revised courses that present entrepreneurship concepts for students majoring in non-business disciplines.
- *Authority:* The WPI administration expressed its commitment to extend the entrepreneurship curriculum. In 2014, a campus-wide initiative on innovation and entrepreneurship was initiated by the president, who formed a multidisciplinary task force charged with designing a hub for coordinating entrepreneurship education programs and activities across campus.
- *Competitors:* Looking beyond the campus, WPI has forged numerous alliances with programs at partner institutions. There is a Higher Education Consortium of Central Massachusetts consisting of eleven colleges and universities that was formed to facilitate communication and cooperation, serving employees, students and the business community. The university collaborates with entrepreneurship programs worldwide for the benefit of stakeholders. In the broadest sense, all institutions of higher education that offer entrepreneurship programs are competitors.

Value Co-Creation

WPI pursues policies that encourage research commercialization. It established a formal IP process (OIPI 2016) to clarify the process for stakeholders. There is a negotiable division of revenue from a baseline at which the inventor receives 50% of equity or licensing fees from the IP, while WPI keeps the other half (OIPI 2016). The university relies on 40 alumni volunteers to review provisionary patent filings.

Although WPI does not provide formal incubation space on campus, the university partners with incubators in the city of Worcester that host startups. The incubators specialize in various technologies including biomedical, energy and sustainability, and robotics.

Networks

The entrepreneurship program at WPI has been actively encouraging communication between stakeholders and entities:

- Two overlapping internal networks of faculty facilitate communication regarding entrepreneurship education, research and practice. One network includes non-business Faculty Fellows supported by the Coleman Foundation, and the second network is a collaboration of engineering faculty brought together by the Kern Family Foundation initiatives. Multi-year grants have been obtained from both of these U.S.-based foundations as a result of initiatives by faculty in Business and in Engineering.
- The Tech Advisors Network (TAN), launched by the dean of the Foisie School of Business, increases connection with the entrepreneurs outside of campus. TAN addresses needs and interests of students, staff and faculty who may be launching technology-based ventures. TAN consists of volunteers, predominantly WPI alumni, who have been successful in their careers and return to advise and mentor entrepreneurial teams. TAN members listen to elevator pitches from start-up teams made up of students, faculty and/or alumni. After hearing the pitches, the volunteers indicate whether they are willing to coach a team.
- WPI has a chapter of the National Association of Inventors. In 2016, the chapter included 62 regular and honorary members (OIPI 2016). WPI participates in the Association of University Technology Managers (OIPI 2016).
- Additional networking opportunities are created during multiple competitions for inventions, innovations, and business ideas. Students are encouraged and supported to compete in open regional, national and international competitions. This participation encourages communication between students, faculty and entrepreneurship community.
- WPI organizes workshops by entrepreneurship scholars and practitioners on teaching entrepreneurship. Networking includes speaker events, dinners with entrepreneurs, workshops, and innovation competitions.
- The university hosts monthly meetings of The Venture Forum, an organization consisting of entrepreneurs, investors and service providers. WPI students and faculty may attend meeting held on campus at no charge.

Ecology

At the time of its founding in 1865, WPI was established to be part of the local ecosystem, producing graduates to be employed by local manufacturing firms. Starting in the 1970s, WPI internationalized its project-based learning system, sending student teams to apply their classroom experiences to real world problems. Projects are conducted in China, Namibia, Paraguay, New Zealand, and many other countries. These teams perform a variety of projects for startups, including feasibility studies, product design and testing, and commercialization plans. In addition to the previously mentioned incubator collaborations, WPI has been a sponsor of one of the largest startup competitions and accelerators in the world, MassChallenge, which is headquartered in Boston, Massachusetts.

Table 2 Entrepreneurship competitions at WPI

The Robert H. Grant Invention Awards
The I3, Investing in Ideas with Impact
The Henry Strage Innovation Awards
The Kalenian Innovation and Entrepreneurship Award
Earth Week—3R Video Competition—Reduce, Reuse, Recycle
The Hitchcock Innovation Prize

The faculty and students affiliated with entrepreneurship education on campus reach out to the practitioner community. In addition to its affiliation with The Venture Forum, the Collaborative for Entrepreneurship and Innovation participates in the Smaller Business Association of New England, the Worcester Business Resource Alliance, the New England Chapter of the Family Firm Institute, and numerous academic professional associations.

Participation in competitions is an integral part of entrepreneurship education. Some faculty choose making participation in these competitions a requirement in their courses, asking students to explain commercialization strategies for their course projects. WPI students can participate in several competitions that provide intensive learning experience (Table 2). Some of the competitions carry the names of their financial sponsors.

Governance

Initially, WPI's program followed the magnet model, when the program was housed in the Department of Management, yet entrepreneurship courses were available to all students on campus. With the support from the Coleman Foundation and the Kern Family Foundation, the entrepreneurship program has been advancing the radiant implementation model. The core faculty are still within the School of Business, but there are now affiliated faculty in different departments on campus. The radiant model for entrepreneurship education is supported by university administration. The university is currently in transition to an Innovation and Entrepreneurship program with a director reporting to the president. This will continue to be a radiant model with champions dispersed in multiple departments.

Outcomes

WPI offers multiple sections of courses that include entrepreneurship curriculum elements. For example, the authors of this chapter co-taught a course on economics of entrepreneurship. Undergraduate students in any major can minor in entrepreneurship or social entrepreneurship at WPI. An international entrepreneurship minor is in preparation. Graduate students from non-business disciplines may qualify for certificates in entrepreneurship upon completion of sufficient coursework. The university offers a Ph.D. in entrepreneurship as well as a specialization in innovation and entrepreneurship in engineering disciplines.

The entrepreneurship program places emphasis on fostering innovative behavior and mindset. Through its activities, the program encourages a cultural shift among

faculty and students toward entrepreneurship. An Entrepreneurship Speaker Series offers pedagogical training to faculty and supports entrepreneur role models for both faculty and students. In order to enhance faculty skills in teaching entrepreneurship, instructors attend workshops and conferences, including The Experiential Classroom at the University of Florida, the Collegiate Entrepreneurs' Organization (CEO) Conference, and conferences organized by the Kern Family Foundation. Non-business faculty members who modify their courses to include learning about entrepreneurship post their syllabi on a website that permits public access.

Measures

In 2016, WPI recorded 47 inventions, 82 patents were filed, and eight patents were issued (OIPI 2016). Prior to 2012, there was no licensing activity centrally coordinated at the university. Since then, 12 companies licensed inventions from WPI, including eight in 2016 (OIPI 2016). In 2016, one of the licenses came from a student project. The Coleman Entrepreneurship Speaker Series hosted six speakers in the 2015–2016 AY. During the same academic year, seven courses were taught by non-entrepreneurship faculty that included elements of entrepreneurship education. Approximately 200 students took those courses in one academic year. In 2015, several new ventures were launched by students.

6 Conclusion

This chapter examines entrepreneurship programs from the service science perspective. Service science is a theoretical framework that is concerned with understanding how to build and sustain efficient service systems. It stresses the importance of value co-creation, the need for adequate resources and the significance of assessing progress. As an analysis aid, we introduce a tool called the Service Science Canvas, which we adapt for entrepreneurship education. A technological university serves as a case study.

The Service Science Canvas offers a snapshot of an academic program, yet programs evolve over time. To address this limitation, future research may consider introducing a timeline that would capture the life stages of a program. A computational model can be developed, similar to Zaini et al. (2016) that would incorporate complex interrelationships between resources, perceptions and educational outcomes.

While the chapter focuses on entrepreneurship education, this approach can be applied to any academic program. For example, using reviews in Nambisan (2015) and Welsh (2014) it is possible to construct a Service Science Canvas for engineering education. Possible benefits of an academic program review using the service science approach could be lowering the risks of launching a new program, increasing the acceptance of the program and decreasing its cost with the goal of making the program sustainable and effective.

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Collaborative Practices and Multidisciplinary Research: The Dialogue Between Entrepreneurship, Management, and Data Science

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Abstract Digital technologies and their applications are systematically altering established practices and making new ones emerge in different realms of society. Research in social sciences in general and management in particular is no exception, and several examples that span various fields are coming into the spotlight not only from scholarly communities but also the popular press. In this chapter, we focus on how management and entrepreneurship research can benefit from ICT technologies and data science protocols. First, we discuss recent trends in management and data science research to identify some commonalities. Second, we combine both perspectives and present some practical examples arising from several collaborative projects that address university–industry collaborations, the impact of technology-based activities, the measurement of scientific productivity, performance measurement, and business analytics. Implications for using data science in entrepreneurship and management research are discussed.

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1 Introduction

Huge amounts of data ("*Big Data*") are produced inside and outside contemporary companies by people, products, and business infrastructures. However, it is often difficult to know how to transform these data flows into effective strategies and actionable plans. Data science[1] has potential for companies of all types to find patterns and models in these data flows and use them as the basis for disruptive analyses and derived software platforms.

From Radio-Frequency Identification sensor data to customer loyalty programs, predictive analytics can improve customers' engagement and companies' operational efficiency. Indeed, several precious insights await organizations that can exploit findings obtained from data science. Data science is a novel discipline, which can enable any effort of digital transformation. Hence, digital transformation, being defined as 'the acceleration of business activities, processes, competencies, and models to fully leverage the changes and opportunities of digital technologies and their impact in a strategic and prioritized way' (www.i-scoop.eu), concerns the need for companies to enact digital disruption and remain competitive in an ever-changing competitive environment.

Big Data[2] is generated continuously, both inside and outside the Internet. Every digital process and economic transaction produces data, sometimes in large quantities. Sensors, computers, and mobile devices transmit data. Much of this data is conveyed in an unstructured form, making it difficult to put into database tables with rows and columns. Aiming at searching and finding relevant patterns in this complex environment, data science projects often rely on predictive analytics, involving 'machine learning'[3] and 'natural language processing'[4] (NLP), as well as on

[1]Data science is defined as 'a set of fundamental principles that support and guide the principled extraction of information and knowledge from data' (Provost and Fawcett 2013, p. 52).

[2]*Big Data* can be defined as 'the Information asset characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value' (De Mauro et al. 2016).

[3]Technology now makes it possible for software solutions to learn and evolve. Software with machine learning capabilities can produce different results given the same set of data inputs at different points in time, with a learning phase in between. This is a major change from following strictly static program instructions, like most of the artificial intelligence models from the 1990s.

[4]Technology now makes it possible for software solutions to talk and interpret language from humans, be it in speech or in documents. Software with semantic processing ability is able, for instance, to perform sentiment analysis, a kind of analytics able to scan large corpora of documents to determine the polarity about specific entities or concepts. It is especially useful for identifying trends of opinion in a community, or for the purpose of marketing.

cloud-based applications.[5] Computers running machine learning or NLP algorithms can explore the available information by sifting through the noise created by *Big Data's* massive volume, variety, and velocity.

The societal impacts of these changes are being debated daily (*New York Times International*, March 1st 2017) and the amount of evidence produced to stress how 'things will never be the same' combines easy-to-communicate anecdotal evidence and more rigorous analyses. The research community is certainly among the various fields where the impact of machine learning, NPL, and cloud architectures is redefining the rules of the game. While clearly relevant in many computationally intensive and data-dependent research endeavours, new opportunities are also opening for unexplored alternatives in other research domains where classification, parsing, and clustering of text and images have so far depended mostly on human-centered activities and interpretation. Management and entrepreneurship research are no exception on several grounds.

First, the way managerial and entrepreneurial activities in companies and institutions are being affected by these changes is clearly an area of increasing interest. In a recent book collecting evidence of several years of research, for example, Parker et al. (2016) analyse how two-sided network effects can be leveraged to build effective cloud-based product platforms, showing how data-driven technologies can be key determinants of competitive advantage. Arun Sundararajan (2016) reached a similar conclusion in his extensive analysis of the different forms of sharing economy and their dependence on several enabling factors all related to the similar evolutions and patterns in data.

Second, the opportunities embedded in the new technologies and methods for data gathering and analyses are being explored to improve both efficiency and effectiveness of sample collections, and to design original alternatives to collect and manipulate empirical evidence. In a recent editorial published in the *Academy of Management Journal*, George et al. (2016) discuss at length how to frame the challenges faced. More precisely, they suggest distinguishing between the effects in management research from data collection, data storage, data processing, data analysis, and data reporting and visualization. Like in many social sciences, whenever research questions are related to specific occurrences, any opportunity to extract, accumulate, and analyse multiple episodes and instances helps to develop hypothesis testing and to identify patterns and regularities. The power of data science goes well beyond the contributions offered by large databases, which have significantly changed the field since the early nineties. However, these new opportunities are still far from being incorporated into doctoral programs for the new generations

[5]Companies can take advantage of the elastic nature of the cloud and deploy their products by exploiting the flexibility, agility, and affordability provided by cloud platforms. Cloud-based applications provide global support and real-time access to *Big Data* from anywhere in the world at any time. By replicating the environment, multiple enterprise environments remain in sync, and their data flows can be easily integrated. Because applications in the cloud are always deployable, always available, and highly scalable, continuous, agile innovation becomes an objective achievable by any business.

of researchers, and they certainly require the education of many editors to be able to properly staff their reviewing teams to ensure that they are adequately equipped to evaluate the pros and cons of applications of new methodologies that leverage data science advances.

Finally, major changes in decision-making processes touch the fundamental bases of several theories and conceptual frameworks. From the notion of bounded rationality (Simon 1972), to the interplay between local and distant search (March and Simon 1958), to the impact of information asymmetry reduction opportunities to determine governance structure (Nayyar 1990), scholars of management and entrepreneurship are witnessing an unprecedented impact of technologies, not simply on practices and methods, but on constructs and theories as well. Take transaction costs economics, for example, introduced by the Nobel laureate Oliver Williamson (1979), and consider a reinterpretation of the continuum between markets and hierarchies under the currently plummeting cost and time needed to gather and analyse the necessary information. Opportunistic behaviours can be thus anticipated with greater precision thanks to more efficient simulations based on evidence recovered from various and widespread sources such as news, blogs, or interactions on social networks. Furthermore, in the context of credit scoring for trading partners, the traditional reference of the so-called FICO score,[6] provided by reputable intermediaries—who parse through dedicated sets of private information retained by various financial institutions—, is being challenged using algorithms to determine organizations' risk profiles based on their relationships and positioning in multiple social networks.

We believe we are only at the beginning of an exciting time full of unexplored opportunities worth pursuing within and across disciplines. Hence, the aim of this chapter is to explore how entrepreneurship and management research can collaborate with data science to benefit from new digital data opportunities. To do so, we present five case examples, elaborating on how researchers can make use of data science in different areas of management research. The next section provides an overview of the selected examples, before each case is presented in more detail in the following sections. The chapter concludes by offering some remarks and implications for further research in the area of entrepreneurship.

2 Overview of Cases

To advance our understanding of the new data possibilities, we explore some preliminary ideas originating within five different collaborative projects, operating at the interface between management and data science research. These cases have been selected to represent a variety of examples of potential and ongoing research

[6]First introduced in 1989 by FICO, a public company established in 1956 as Fair, Isaac, and Company.

that can both inspire and provide specific advice to management and entrepreneurship scholars on how to seize new opportunities in an increasingly digitalized world. First, we look at the case of collaboration between entrepreneurial firms and universities and how data science techniques could be applied to shed light on processes that are largely unknown at present. The recent advent of remote sensing, mobile technologies, novel transaction systems, and high-performance computing offers opportunities to understand trends, behaviours, and actions in a manner that was not previously possible.

Second, we investigate the case of technology innovation management and the challenge of measuring the impact of technology-based activities. A common indicator is the patent protection of intellectual property rights, which is often based on relations between variables at different levels of analysis, using data that is uncodified, dynamic, and generally unavailable in a single dataset. The field of semantic technologies can offer key complementarities to support the (semi-) automated creation of structured data from non-structured content and generate meaningful interlinks.

Third, we explore the case of measuring scientific productivity, which is at the heart of scientometrics approaches. Measures of scientific constructs using data science techniques are subject to the same reliability and validity concerns as any other source of measurement (e.g., questionnaire responses, archival sources), where researchers struggle with the balance between the theoretical concepts they are interested in (e.g., scientific progress), and the empirical indicators they are using to operationalize them (e.g., publications and citations). In scientometrics, measures largely emerge from how publication practices are recorded, and how these archival records represent intentional individual or collective strategies and outputs.

Fourth, we present a case combining entrepreneurship and strategic management interests in the tourism and hospitality industries. In particular, a large amount of unstructured data, such as online searches, accommodation bookings, discussions, and image and video sharing on social media produced by tourists and companies, as well as online reviews, has profoundly affected the whole value chain of different economic agents in the field. And yet, a vast number of destinations as well as SMEs often ignore or underuse this type of data because it is unstructured and therefore difficult to analyse and interpret. Several applications, developed to solve different problems, could offer viable opportunities to overcome these limitations and strengthen local economic systems.

Fifth, our last case takes the collaborations between management and ICT one step further. Specifically, it explores the role of business performance analytics as a valuable support tool for management-related issues by transforming data into information valuable for decision-making. It focuses on the strategic relations occurring between the two domains and their effect on the abilities to collect, select, manage, and interpret data to generate new value.

2.1 Five Examples of Cross-Fertilizations Between Management, Entrepreneurship, and ICT

Case 1: University–Industry Collaborations

University—industry collaboration (UIC) refers to the interaction between industry and any part of the higher educational system, and is aimed at fostering innovation in the economy by facilitating the flow of technology-related knowledge across sectors (Perkmann et al. 2011). Of late, there has been a substantial increase in UICs worldwide and numerous studies that investigate questions in the field.

Based on a systematic review of the literature, Ankrah and AL-Tabbaa (2015) propose a conceptual framework highlighting five key areas of the literature on UIC that required further investigation. First, currently employed measures to evaluate outcomes of collaboration are essentially subjective and more objective measures of the effectiveness of UIC need to be explored. Second, more research is needed to examine the boundaries of the role of government in UICs within the Triple-Helix model (Etzkowitz and Leydesdorff 2000). Third, there is a need to conduct comparative studies across different countries in relation to UIC. Fourth, most of the studies found in the literature are cross-sectional and a longitudinal line of research is needed to explore cause-effect relations in the evolution of UICs. Finally, the impact of academic engagement as a form of UIC on the outcomes is almost completely overlooked. Accounts of both formal activities, such as contract research and consulting, and informal activities, such as providing ad hoc advice and networking with practitioners, are largely unexplored in the literature and could provide supporting evidence to an intangible potential value for UIC (see also Perkmann et al. 2015).

Among the research gaps in the literature listed above, informal inter-organizational ties offer a fruitful avenue for the application of recent developments in ICT and data science. One of the main outcomes of UIC, namely the exchange of knowledge and technology, occurs by means of formal and informal ties both at the individual and organizational levels. Formal links facilitate knowledge transfer while informal links generate knowledge creation (Powell et al. 1996). Notably, among the industrial partners, entrepreneurial firms rely significantly on informal, or embedded (Granovetter 1985), links during the early stages of their life cycle, when they most need to acquire and develop new knowledge and are most likely to engage with universities for this purpose (e.g., Anderson et al. 2010).

Informal ties remain largely unexplored within the context of UIC, as well as in the innovation and inter-organizational networks literature (West et al. 2006). Data science and ICT can now offer a great deal of new information or *Big Data* that can be leveraged to further explore the nature of informal links, the extent to which they permeate inter-organizational collaborations and their main antecedents and consequences. Informal network ties may be captured by exploiting the wealth of data stored and exchanged on social network sites (SNSs), making large-scale collection of high-resolution data related to human interactions and social behaviour economically viable. There is increasing evidence of entrepreneurs' growing use of

Facebook, LinkedIn, Instagram, Twitter, and other SNSs. These sites have the capacity to help entrepreneurs initiate weak ties (Morse et al. 2007) and manage strong ones (Sigfusson and Chetty 2013).

Virtual networking is complementary to real-world interactions and facilitates the establishment of new connections and the development of trust relationships. Therefore, even simple measures of social network interconnectedness between industry and university actors have the potential to uncover a great deal of existing informal ties and on-going informal collaborations. The data on SNS links are generally publicly available and can be collected by means of various web-scraping methods. Complementary data can be obtained with the aim of recently developed software tools. For instance, NVivo 11′s tool can code Facebook screen shots, providing textual and visual data for the analysis of different kinds social interaction. Another example is the software CONDOR (MIT Center for Collective Intelligence) that can identify subnetworks of people talking about the same topics by sourcing various SNSs and applying clustering and sentiment analysis techniques.

Furthermore, the new data science methods and tools allow the UIC researchers to progress significantly to analyse not only the extent of the network of informal ties, but also the actual flows of information that occur through those channels. Large amounts of data and analytic gold lie hidden in multiple formats such as text posts, chat messages, video and audio files, account logs, navigation history data, profile biographic and meta- data, and other textual and visual sources. Email communications significantly extend the range of the sources from which this rich, high-granularity data can be pooled. This wealth of data can be mined using content analysis and machine learning techniques to measure the extent and nature of the information exchanged. It is possible, for example, to determine whether communications occur at the personal level, aimed at the development and maintenance of personal trust relationships; or at the technical level, aimed at the exchange of both tacit and explicit knowledge, the former being vital for the innovation process and overall UIC outcomes. In this regard, evidence suggests that virtual communication exchanges tend to shift from explicit, more codified knowledge at the beginning of the relationship towards tacit, more detailed knowledge exchange when the collaboration relationship matures (Hardwick et al. 2013). Nevertheless, Polanyi (2013) points out that the narrower channel of virtual communication may restrict the transfer of tacit knowledge and that this is best shared in face-to-face interactions.

Developing the tools to leverage the newly available streams of data can potentially answer these and several other questions related to UIC and offer great promise to both management scholars and policymakers. Should the newly available data reveal significant informal links between participants of successful collaborations, the operationalization practices of UIC might need to be extended to include processes and activities that incentivize the creation and development of informal networks. While these efforts are already made in practice (Ritter and Gemunden 2003), the insights provided by the analytical tools of data science might offer new, smarter ways to promote engagement in informal activities.

Therefore, we argue that ad-hoc data science models and tools to tap into the abundant wealth of data offered by newly available sources such as social media and

organizations' unstructured data offer great opportunities to deepen our understanding of inter-organizational networks and significantly boost the outcomes of UIC.

Case 2: Technology Innovation Management

Technology Innovation Management (TIM) refers to the study of the processes to launch and grow technology businesses and the related contingent factors that affect the opportunity for, and constraints on, innovation (Tidd 2001). Technology entrepreneurship, focused on the development and commercialization of technologies by small and medium-sized companies; open source business, analysing firms adopting a business model that encourages open collaboration; and economic development in a knowledge-based society (McPhee 2016) are some commonly investigated topics in this field.

The heterogeneity and complexity of this area is a fruitful field to show how artificial intelligence and web data may open important opportunities to foster research. Digitalization affects individual and team behaviours; organizational strategies, practices, and processes; industry dynamics; and competition. In the paper by Droll et al. (2017), for instance, a web search and analytics tool–the Gnowit Cognitive Insight Engine–is applied to evaluate the growth and competitive potential of new technology start-ups and existing firms in the newly emerging precision medicine sector.

More generally, empirical research in TIM is often based on relations among variables at different levels of analyses, whose data are uncodified, dynamic, and generally unavailable in a single dataset. Thus, providing a longitudinal and multilevel analysis is a crucial requirement for advancing research in TIM. A comprehensive data science approach, characterized by richness of data, allows researchers to answer new questions; avoid premature conclusions; identify fine-grained patterns, correlations, and trends; and shed new light on observed phenomena.

However, this goal poses two challenges: (i) automated importing and cleaning of data and (ii) dis-ambiguous integration of fragmented data. The first issue is a well-known aspect of the data science domain. When considering a large corpus of non-structured data that should be converted into structured information to address analytic and sense-making tasks, the use of automatic and/or semi-automatic tools is the best (and probably the only) way to complete the conversion in a reasonable timeframe. Several tools allow the automatic analysis–e.g., Apache UIMA (Ferrucci et al. 2009)–and conversion–e.g., DeepDive (Zhang 2015) and ContentMine (Arrow and Kasberger 2017)–of unstructured content; they are supported by large communities of computer scientists and data scientists to guarantee their sustainability and evolution over time. However, these tools represent only preliminary steps toward increasingly structured data automation processes.

In the past 15 years, web technologies have been radically expanded and now include several languages and data models that allow anyone to make available structured data on the most disruptive communication platform in recent decades–the web. These new tools, named *semantic web* technologies, enable researchers to describe structured data on the web by means of Resource Description Framework

(Cyganiak et al. 2014), share these data according to common vocabularies defined by using OWL (Motik et al. 2012), and query them by means of an SQL-like language called SPARQL (Harris and Seaborne 2013).

The real advantage of using such technologies is that the data are not enclosed in monolithic silos, which usually happens with common databases; rather, they are available on the web to anyone as a global and entangled network of linked resources. These resources can be browsed and processed by means of standard languages, and the statements they are involved in can be used to infer additional data automatically by means of appropriate mathematical tools. These semantic web technologies are the most appropriate mechanism to expose the structured data, obtained from a conversion of unstructured information, in a shared environment such as the Web, and for enriching them by adding new links to other relevant and even external data and resources that someone else may have made available with the same technologies.

The use of these technologies within the scholarly communication has resulted in a new stream of literature, *semantic publishing* (Shotton 2009). Broadly speaking, semantic publishing concerns the use of web and semantic web technologies and standards for enhancing scholarly and/or industrial work semantically (by means of RDF statements) so as to improve its discoverability, interactivity, openness, and (re) usability for both humans and machines. There are already examples of projects that have begun to make scholarly-related data available on the web by means of semantic web formats, such as OpenCitations (http://opencitations.net), which publishes citation data (Peroni et al. 2015), Open PHACTS (https://www.openphacts.org/), which makes available data about drugs (Williams et al. 2012), and Wikidata (https://wikidata.org), which contains encyclopaedic data (Vrandečić and Krötzsch 2014). However, as far as we know, these technologies have not been used yet for sharing and interlinking resources in several TIM contexts.

In the following, we will present two applications that highlight the power of data science in TIM projects. Specifically, the first example shows the use of disambiguation techniques to address problems of lack of unique identification names, derived by common errors of data entry, incorrect translations, abbreviations, name changes or mergers between institutions. In the second example, Natural Language Processing (NLP), which involves automatic processing by an electronic calculator of information written or spoken in a natural language, is applied to deconstruct data and import them into a final dataset.

The PATIRIS (Permanent Observatory on Patenting by Italian Universities and Public Research Institutes) project (http://patiris.uibm.gov.it) maps patent data over time with the aim to analyse the *innovative productivity* of Italian public research institutes. Rather than focusing on single patent documents, PATIRIS allows users to analyse patent groups–in different countries and over time–related to a common invention, defined as 'patent families.' The use of patent data to measure innovative activity requires precise arrangements to properly characterize inventions rather than single patent documents. The lack of unique IDs for patent assignees by the various international patent authorities generates a significant number of name variants, creating substantial distortions. For this reason, disambiguation techniques of the

assignee names are required to match a single institution to multiple variants of its name. This problem may be addressed manually with a limited number of observations but automated and structured ICT techniques are recommended for larger samples. This is also particularly useful when an update of the data over time or integration of information from different data sources are required. PATIRIS, for instance, updates its data twice per year and obtains assignee-level information through the MIUR (Ministry of Education, Universities and Research) dataset (www.miur.it).

The TASTE (TAking STock: External engagement by academics) project (http://project-taste.eu) has the aim to systematically map academic entrepreneurship from Italian universities and better understand the determinants and consequences of science-based entrepreneurship (i.e., Fini and Toschi 2016; Fini et al. 2017). Key distinguishing features of the project include (i) the adoption of a multi-level approach, (ii) the integration of multiple data sources, and (iii) the longitudinal structure of the data. TASTE integrates five different domains at the individual-, knowledge-, firm-, institutional- and contextual-level. More precisely, it analyses about 60,000 academics, their 1000 patents, and 1100 spin-offs, characterizing their 95 universities and 20 regions for the period 2000–2014. To obtain such a multilevel structure, the researchers integrated data from ad-hoc surveys sent to university research offices, technology transfer offices, spin-offs and entrepreneurs; LinkedIn; the European Patent Office and PATIRIS; the Italian Ministry of the University and Research; Eurostat; and others. In this research design, the automated and structured retrieval, which was designed to import, clean, and integrate the data, was critical for the integrity of the data and the feasibility of the project. Recently, the project has also implemented *semantic publishing* techniques.

These examples show how the combination of ICT and management research techniques allow academics to investigate new and unexplored research questions (George et al. 2016) by exploiting the three core characteristics of big data: 'big size' of datasets, 'velocity' in data collection, and 'variety' of data sources integrated in a comprehensive way (McAfee and Brynjolfsson 2012; Zikopoulos and Eaton 2011).

Case 3: Scientometrics

Scientometrics is a multi-disciplinary field that aims at studying ways for measuring and analysing progress in science and related technologies through various approaches. But who decides what constitutes *scientific progress* and whether specific people, places, and times have helped science to progress or not, and on what basis? What are the criteria for researchers and professors to be promoted? What are the criteria for whether academic departments continue or get cut, and whether research projects get funded or not? There is an increasing trend in western countries towards using 'objective' criteria to make such decisions but the scare quotes indicate that these criteria are at least partially open to strategic manipulation and potentially outright gaming. We discuss some of these dangers and potential strategies to ameliorate them below.

Operational classifications in social science are called *coding*: when social scientists assess an observation into a specific class (progressive/not progressive) or

assign it a specific number (i.e., a score of five, as opposed to four on a clearly articulated anchoring scale). Accumulated publications and citations, corrected for self-citation, weighted for number of co-authors, and aggregated across individuals, departments, faculties, and institutions, is an example of a coding process. Coding is a fundamental part of the process of measurement. We expect scientists to design appropriate measures and to implement them faithfully during data collection. Properly defined and executed measurements provide us with a precise picture of the way things are (e.g., scientific progress) that we want to study and give us the basic information for our scientific generalizations and probabilistic models (Cartwright 2014), which we may use to change the world around us and design interventions in that world where necessary.

Measurement is finding a grounded and systematic way to assign values or numbers to observations (i.e., putting them into categories in a rule-governed and consistent way). Measurement involves three steps that are interrelated, which should not only be consistent but also mutually supporting (Cartwright and Runhardt 2014):

1. *Characterisation*: lay out clearly and explicitly what the quantity or category is, including specific features of it for researchers to make use of when assigning numbers or categories to observations.
2. *Representation*: provide a way for researchers to represent the quantity or category in scientific work–e.g., a categorical or continuous scale.
3. *Procedures*: describe what researchers need to do to carry out the measurement successfully.

Nevertheless, we must be clear that the way measuring is done can have implications well beyond the confines of the sciences, and for this reason scientific measures are likely be hotly contested politically (Cartwright and Runhardt 2014). In the case of scientometrics, the scientists and their host institutions, e.g., universities and research institutes, are both aware that if their work is not classified as progressive, then the public and private organisations that fund them may well respond in specific ways that they don't want. In what follows, we describe some of the procedures that are available to manage potential bias in the measure of scientific progress from potential strategic reporting behaviour by researchers and their host institutions that can distort our measurements.

One of the main topics within scientometrics that has seen a huge investment of effort by ICT (information and computer technology) parties concerns the creation of citation indexes, released as commercial (e.g., Scopus, https://www.scopus.com) and even open services (e.g., OpenCitations, Peroni et al. 2015, http://opencitations.net). While counting citations is one of the most common and shared practices for assessing the quality of research–e.g., in several countries in Europe it has been used several times as one of the factors for assigning scientific qualifications to scholars–it is not the only one that can be considered for evaluating the quality of research. These additional assessment factors are usually classified according to two categories: (i) *intrinsic factors*, i.e., those related to the qualitative evaluation of the content of articles (quality of the arguments, identification of citation functions, etc.); and

(ii) *extrinsic factors*, i.e., those referring to quantitative characteristics of articles such as their metadata (number of authors, number of references, etc.) and other contextual characteristics (the impact of publishing venue, the number of citations received over time, etc.). Data Science technologies, including Machine Learning and Natural Language Processing tools, provide the grounds for automatizing the identification of these factors, such as the entities cited in articles (Fink et al. 2010), rhetorical structures (Liakata et al. 2010), arguments (Sateli and Witte 2015), and citation functions (Di Iorio et al. 2013).

The use of intrinsic-factor data can be very effective but also time consuming. They can be gathered manually by humans (e.g., through questionnaires to assess the intellectual perceptions of an article as in peer-review processes) as described in Opthof and colleagues (Opthof 2002). Other data of this specific kind can be extracted automatically by means of semantic technologies (e.g., machine learning, probabilistic models, deep machine readers) to retrieve, for instance, the functions of citations (i.e., author's reasons for citing a certain work) (Di Iorio et al. 2013).

Extrinsic factors, on the other hand, do not analyse the merit of a particular study considering its content; rather, they focus on using contextual data (such as citation counts) that should be able to predict, to some extent, the quality of the work in consideration. Thus, even if they are less accurate than the intrinsic factors, the extrinsic ones are usually preferred because they can be extracted in an automatic fashion by analysing papers, and they are available as soon as the paper is published. In addition to citation counts, other extrinsic factors can be: (i) the impact factor of the journals in which articles have been published, the number of references in articles, and the impact of the papers that have been cited by the articles in consideration, as introduced in Didegah and Thelwall (2013); (ii) the article length in terms of printed pages, as in Falagas et al. (2013); (iii) the number of co-authors and the rank of authors' affiliations according to QS World University Rankings, as in Antonakis et al. (2014); (iv) the number of bibliographic databases in which each journal of the selected articles was indexed, the proportion of the high-quality articles (measured according to specific factors) published by a journal and all the articles that have been published in the same venue in the same year independently from their quality, as in Lokker et al. (2008); (v) the price index–i.e., the percentage of papers cited by an article that have been published within 5 years before the publication year of such article, as in Onodera and Yoshikane (2014); and (vi) altimetrics about the papers–e.g., tweets, Facebook posts, Nature research highlights, mainstream media mentions and forum posts, as in Thelwall et al. (2013).

Donald Campbell (e.g., 1966) was one of the first to see the potential of unobtrusive measures in contexts where subjects were unlikely to offer unbiased responses to conventional data gathering procedures (e.g., questionnaires). However, perhaps only George Orwell (1949) could have imagined the breadth and depth of social science constructs that it is becoming possible to operationalise using data science tools.

Case 4: Strategy in the Tourism Sector

Tourism destinations are defined as complex amalgams of 'products, amenities and services delivered by a range of highly interdependent tourism firms including transportation, accommodation, catering and entertainment companies and a wide range of public goods such as landscapes, scenery, sea, lakes, cultural heritage, socio-economic surroundings' (Mariani 2016, p. 103). These elements are typically marketed and promoted holistically by local tourism organizations, conventions, and visitor bureaus. These are generally referred to as Destination Management Organizations (DMOs). More specifically, DMOs facilitate interactions and local partnerships between tourism firms for the development and delivery of a seamless experience that might maximize tourists' satisfaction and the profitability of local enterprises. In continental Europe, most of the tourism destinations consist of Small and Medium Enterprises (SMEs) located in a specific geographical area that, on one hand, cooperate for destination marketing and product development purposes (under the aegis of a DMO) to increase inbound tourism flows and tourist expenditure while, on the other hand, they compete to win more customers (i.e., tourists and visitors) and profit from them.

This is the case of the Italian tourism sector where a high number of destinations consisting of a myriad of SMEs try to increase their market share of tourist arrivals, overnight stays, and tourism expenditure. Over the last three decades, globalization in travel and increased income allocated to travel have intensified competition between tourism destinations and among companies (Mariani and Baggio 2012; Mariani and Giorgio 2017). However, the most relevant driver of competitive advantage is technology development in ICTs (Mariani et al. 2014) that has brought about many different intermediaries (e.g., travel blogs, travelogues, online travel review sites, social media) for customers to share their opinions and reviews about destinations and tourism services in real time. The role played today by online travel review sites such as TripAdvisor or booking engines such as Booking and Expedia is becoming increasingly relevant as online ratings have been found to play a crucial role in pre-trip purchase decisions and to affect organizational performance measured through revenues and occupancy rates (Borghi and Mariani 2018).

Therefore, in addition to the traditional statistics related to arrivals, overnight stays in hotels, and accommodation facilities, DMOs today should deal with an increasing amount of unstructured data such as online searches, accommodation bookings, discussions, and images on social media produced by tourists and companies, as well as online consumer reviews.

However, DMOs as well as SMEs in the tourism and hospitality sector often ignore these data because they are unstructured, and therefore difficult to analyse and interpret. While individual SMEs have typically neither the budget nor the competences to deal with these data, only the most overfunded DMOs (in North America and Northern Europe) have equipped themselves with specific destination marketing systems that work in a similar way to enterprise resource planning systems. These platforms pool together data from both the supply (e.g., hotels, transportation companies, theme parks) and demand (e.g., bookings from prospective tourists) sides, matching them. Data science techniques are used to collect, analyse, process

(through online-analytical processing), report, and visualize data about the market trends, segments, evolution of bookings and occupancy rates, display offers of accommodation and transportation services as well as assemble accommodation, transportation, and other leisure activities (Mariani et al. 2018; Mariani and Borghi 2018).

However, it is still very difficult and complex to bring together the vast amount of structured and unstructured data produced before, during, and after visiting a destination. An interesting attempt has been carried out with the Destination Management Information System Åre (DMIS-Åre), developed by researchers of the Mid-Sweden University for the Swedish destination of Åre (Fuchs et al. 2014). The system consists of three sets of indicators: (i) economic performance indicators; (ii) customer behaviour indicators; and (iii) customer perception and experience indicators. The first group includes prices, bookings, reservations, hotel overnights, and so on. These data are relatively easy to extract. They are complemented with data about the users' behaviour: for instance, web navigation behaviours before reservations. It is particularly useful to have the analysis of booking channels and devices used for reservation. Customer behaviour indicators can be leveraged to identify clusters of tourists and create customized offers as well as identify and analyse trends, either historical or emergent. The last group of indicators includes information about the perception of the users and provides valuable indications about the destinations' attractiveness.

Building on the DMIS of Åre (Fuchs et al. 2014) and on an updated systematic review of the most relevant contribution at the intersection between Business Intelligence and *Big Data* in tourism and hospitality over the last 17 years (Mariani et al. 2018), we propose a prototype of a Destination Business Intelligence Unit (DBIU). The platform is useful for DMOs to: (i) improve the competitiveness of the destination (in terms of tourist arrivals and tourism expenditure as well as sustainability and carrying capacity); (ii) enhance the competitiveness of the SMEs operating in their hospitality sector. To this aim, our DBIU in addition to economic performance indicators, customer behaviour indicators, and customer perception and experience indicators adds sustainability and environmental indicators. Figure 1 summarizes our proposal and shows the relation with DMIS-Åre. The idea is to provide users with information about traffic and weather conditions, as well as consumption of electricity, gas, and water. These data can be used first to improve the users' experience by providing updated information in real time. In addition, data science techniques and tools can be used to better design and manage tourism services at the destination level by means of analysing tourists' preferences through their social media activity on smartphones and social location-based mobile marketing activities (Amaro et al. 2016; Chaabani et al. 2017).

Sustainability is increasingly important for today's destination managers and tourists, and can also be embedded in marketing and promotional strategies to attract green tourists (Mariani et al. 2016a, b) and improve the carrying capacity of the destination.

Moreover, our DBIU improves the "Functional, emotional value and satisfaction data" helping to enhance customer perception and experience indicators. The right

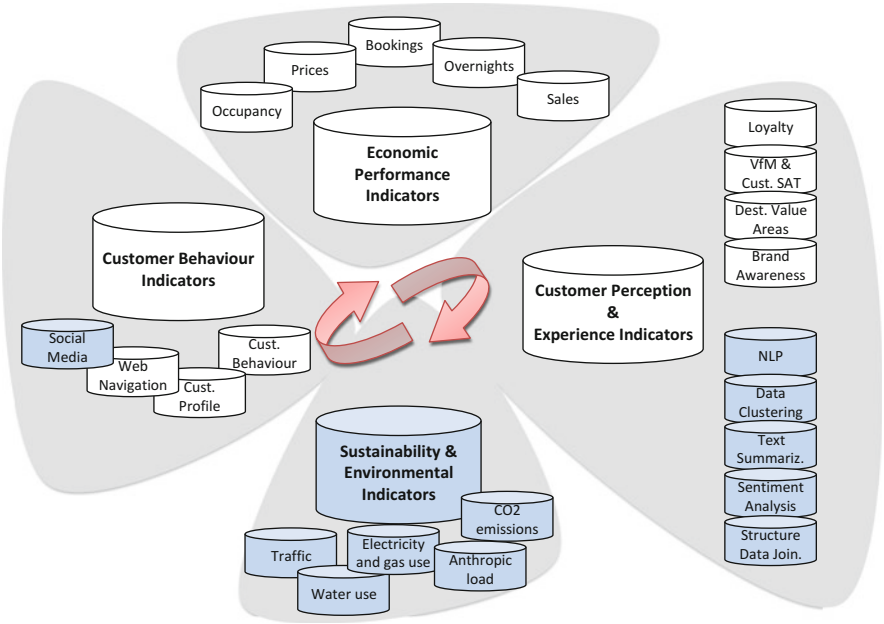

Fig. 1 Prototype of a DBIU

bottom part of the figure shows (in blue) our improvements. The primary goal is to analyse both structured and unstructured information by using modules of Natural Language Processing (NLP), text summarization, and sentiment analysis. The main data sources are the online reviews: they contain a significant amount of data but in different formats, languages and structures. Data science techniques can be exploited to (i) extract information from multiple sources (ii) define a common data model and normalize such heterogeneous information to that model, (iii) combine data into aggregated and parameterized forms, and (iv) visualize data in a clear way for the final customers. These techniques contribute to gaining a more comprehensive picture of users' perceptions.

As shown on the left-hand side of the picture, DBIU improves the customer behaviour indicators by leveraging a tool developed for data retrieval and analysis from the major social media. The tool consists of four modules, following the schema mentioned above: data extractor, parser, analyser, and visualizer modules (for a detailed description, see Mariani et al. 2016a, 2016b, 2017). That said, this DBIU might allow not only destination marketers and DMOs to match and process a vast amount of heterogeneous data but could also allow DMOs to share some of the relevant data related to customer behaviour and customer perceptions in real time with local SMEs operating in the accommodation and transportation industries. While this prototype could certainly be the object of further improvement, we believe that it represents an interesting tool to strengthen local economic systems heavily reliant on tourism.

Case 5: Business Performance Analytics

Current competitive marketplaces are "hyper-challenging" for organizations in a continued search for opportunities to maintain and improve business growth and profitability. In this context, management control systems play an important role to support management by providing key information and quick feedback for strategic and operational decision-making.

Technology is changing the rules of business and how to transform data into knowledge has become a key issue (Davenport et al. 2010). There is a growing consensus that business analytics and *Big Data* have huge potential for performance management (Bhimani and Willcocks 2014), informing decision-making, and improving business strategy formulation and implementation (CIMA 2014). Such potential has been generally acknowledged by the literature; however, organizations report significant difficulties in extracting strategically valuable insights from data (CIMA 2014).

Progress in ICT has opened new opportunities in terms of modelling organisational operations and managing firms in real time and has attracted interest in the relations between control and information systems (Dechow et al. 2007). While information systems have been considered important enablers of performance management, their role is not yet understood either theoretically or practically (Nudurupati et al. 2011, 2016). Indeed, several questions arise. A key issue concerns the analysis of data availability and sources (Zhang et al. 2015). Secondly, quantity and variety bring additional concerns in terms of data quality and relevance (IFAC 2011; Bhimani and Willcocks 2014). As for the former, organizations have access to an unprecedented amount of data and to previously unimaginable opportunities to analyse them. ICT represents a strategic success factor because of its potential to collect and offer such huge amounts of data. As for the latter, while the availability of data does not necessarily mean information, the ability to understand and extract value from them becomes critical too. From this perspective, Business Performance Analytics (BPAs) offer valuable support (Silvi et al. 2012) because they link data collection and use to a previous understanding of an organization's business model, its deployment into key success factors and performance measures, and finally performance management routines.

Consistent with the literature, this fifth case focuses on the challenging relationship between BPA and ICT and its effect on their abilities to collect, select, manage, and interpret data. Specifically, it highlights the key issues that arise when integrating the use of BPA within the performance measurement and management process, in the light of the support provided by ICT in (i) automatic data collection (i.e., tools able to extract a large amount of data from multiple heterogeneous sources), (ii) data analysis (i.e., tools combining machine-learning data warehouse and (iii) decision-making techniques to identify patterns and trends) and data visualization (i.e., novel interfaces and paradigms make data available and easier to consume).

BPA refers to the extensive use of multiple data sources and analytical methods to drive decisions and actions, by understanding and controlling business dynamics and performance (Davenport and Harris 2007, p. 7) and supporting effective PMS design and adoption (Silvi et al. 2012). Examples are decision support systems, expert

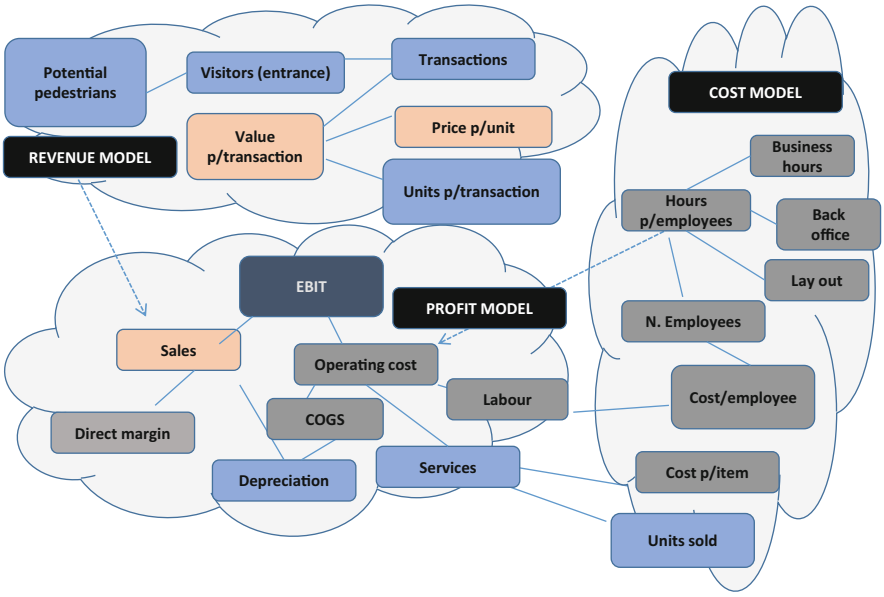

Fig. 2 Bookstore performance map

systems, data mining systems, probability modelling, structural empirical models, optimization methods, explanatory and predictive models, and fact-based management. BPA are then focused around management needs and their design requires (i) the comprehension of a company's business model and context, and the way its performance is achieved, (ii) the identification of key success factors, information needs, data sources, (iii) the provision of an information platform and analytical tools (descriptive, exploratory, predictive, prescriptive, cognitive); (iv) the assessment of performance factors and drivers, and (v) the visualization of business performance and dynamics and their management.

Figure 2 shows an example of a business performance map of a bookstore. Specifically, business profitability (EBIT) is the result of the company's revenues and cost model. Revenues–driven at a first level by price and unit sold–can be further broken down, showing the most elementary revenue drivers: people flow, entrance rate, and conversion rate, and purchase. On the other hand, costs are driven by volumes, product categories, and related cost, as well as by activity hours (labour), shop layout (efficiency), sourcing factors (delivery time), etc. Gauging these dynamics and their factors allows the store manager to understand better the way performance is achieved and can be improved.

On the other hand, this performance and measurement system requires data availability, data analysis, data visualization technologies, analytical methods, routines and performance management skills, and attitudes and talents. Hence, the implementation of BPA and analytical Business Performance Management systems

is by nature a complex task, as it involves managerial, analytical, and ICT competencies and tools. From a technological point of view, there are at least three main challenging steps: (i) data collection, (ii) data analysis, and (iii) data visualization.

Data collection. Data originates from different internal and external sources, and are stored in several systems, with different languages and forms (conversational, video, text, etc.), timing, size, accuracy, and usability (open- and closed-access). Particularly interesting is the integration of structured data with unstructured and semi-structured data, extracted from documents, which represent a huge source of knowledge and competitive assets made available by Natural Language Processing techniques (Cambria and White 2014). As discussed by Zhang et al. (2015), some specific features of digital and *Big Data* challenge the capabilities of modern information systems; they are known as the 4 Vs: huge Volume, high Velocity, huge Variety, and uncertain Veracity. Despite the mentioned potential benefits, then, these critical issues still undermine ITC systems' effectiveness for BPA purposes (Beaubien 2012) and a number of questions arise. How to collect data? How to blend them? What about data security?

Data Analysis. This concerns the choice of the analytical method (descriptive, exploratory, predictive, prescriptive, and cognitive). From a technical point of view, key issues are how to use data for those typologies of analytics and how to design expressive data models. The interaction between domain experts and technical experts is crucial to achieve this goal. Another key issue is the integration between different models (for instance, predictive, prescriptive or cognitive models) and techniques to combine data, such as embedded analytics, machine learning, artificial intelligence, data warehousing, and data mining (Han et al. 2011; Kimball and Ross 2011). Automatic reasoning and decision-making about data complete the path.

Data visualization. The challenge is how to report the analytical and performance infrastructure into visual formats easy to access and understand, aligned with user experience and expectations. The success factor is not only to aggregate data but also to extract unexpected and hidden information and trends.

To summarize, in an age of digital economy, a successful contribution of performance management systems and ICT to business competitiveness and innovation is undoubtedly interrelated and their effective implementation requires a holistic approach. Achieving competitive advantage with analytics requires a change in the role of data in decision-making that involves information management and cultural norms (Ransbotham et al. 2016). Another issue is about analytics talent, in form of "translators," as first, able to bridge IT and data issues to decision making with a contribution to the design and execution of the overall data-analytics strategy while linking IT, analytics, and business-unit teams. Furthermore, data scientists should combine strong analytics skills with IT know-how, driving towards sophisticated models and algorithms. Because digital skills and talents are scarce, they represent an opportunity for research and education, and value for community wellbeing.

3 Conclusions and Implications for Entrepreneurship Research

Entrepreneurship research covers a rather wide range of problems, contexts and processes, usually combining different social science perspectives. Generating better understanding and theories about entrepreneurial and value-creation processes is challenging because new ventures develop different internal resources and characteristics, evolve under changing external environments and pursue business ideas that are changing over time. Collecting primary data for quantitative studies covering all these aspects is extremely time consuming and resource demanding. It involves mapping of the individual entrepreneurs, their ventures, and the external environment from inception and over a significant period of time until the venture has reached a mature stage. Some of these challenges can be overcome by tapping into the increasingly rich sources of digital data that are being generated about the activities of individuals, firms, and their contexts. Making use of data science and ICT tools is necessary to tap into and refine these data sources.

While the technical availability of databases and their subsequent commercial development in the seventies and eighties opened numerous opportunities to access longitudinal and structured data, their level of specification and detail has been inadequate on many grounds (too general, incomplete, self-reported, etc.). Data gathering, storage, and manipulation have therefore become a key element in any research program, but often with inefficient replication of efforts and low levels of sharing to allow for proper replicability or further enhancement of analyses. The evolution in data science technologies and research opportunities are becoming pervasive in many different types of research and approaches as illustrated by the various cases presented in this chapter. We are at the break of a new dawn for reconsidering the use of field data in entrepreneurship research.

First, its ubiquitous nature calls for creativity in designing new approaches to collect evidence as traces in a field track, left there not to mark the trail, but simply because of walking. And yet, as much as zoologist and anthropologists have used tracks to understand migration patterns and their evolutionary consequences, several digital marks can have a profound relevance to understand individual and collective behaviour and their implications for entrepreneurship. Case 1 offered us a specific example associated with the analysis of interpersonal networks that clearly has the potential to inspire new ways of collecting data on the characteristics and performance of entrepreneurs and entrepreneurial teams.

Second, the possibility of standardizing the data-gathering procedure in multiple geographical locations could help overcome significantly the current limitations of pursuing comparative analysis in different countries and settings. Although interoperability standards and data coding procedures are still far from allowing for a frictionless aggregation, the progress in these areas has shown clear opportunities, as Case 4 exemplified in the field of tourism. Many industries increasingly rely on digital platforms for key business processes, which provides new opportunities to shed light on the role of entrepreneurship in these industries.

Third, new and original datasets could come from the aggregation of existing sources and be designed from the beginning as able to automatically or semi-automatically update to continue providing users with both historical accounts and the most recent evidence. Cases 2 and 3 discussed examples related to datasets of different sizes, compositions, and spans, ranging from research driven to institutionally and commercially driven ones. Such combinations of data sources to trace entrepreneurial efforts over time will be highly valuable for generating a better understanding of the entrepreneurial process and the resulting outcomes and impacts of entrepreneurship at different levels of analysis.

Fourth, and probably more evident in its short-term impact, decision making processes, tools and roles are being revolutionized in many organizations and will soon impact all of us in direct or indirect ways. Business analysis and intelligence, as described by Case 5, are two areas where the attention of entrepreneurship scholars have long focused to identify the sources of competitive advantage, map the evolution of organizational complexity over the life of new ventures, or assess the differences (if any) between managers and entrepreneurs. Clearly, digitalization and the use of data science not only provide new opportunities for academics, but are also profoundly influencing the opportunities of entrepreneurship in many areas of society. Hence, entrepreneurship scholars experience changes in both the empirical phenomenon as well as the data and methods available, driven by data science.

This chapter has been written as a collaborative effort between data scientists and management scholars and thereby illustrates the need for cross- and multi-disciplinary approaches to fully benefit from the rapidly increasing access to big data. And yet, the more we try to link what has been presented by many creative scholars in this chapter as new ideas to productively and creatively match entrepreneurship and data science research, the more additional ideas are emerging. We are looking forward to reading ideas from other scholars and we hope this chapter has offered some inspirations to begin an exciting and unpredictable new journey.

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What Happened Next? A Follow-Up Study of the Long-Term Relevance and Impact of a Collaborative Research Project

Stefano Cirella

Abstract Focusing on the impact of management research has increasingly triggered reflections on collaborative modalities that may generate more engaged and impactful research. Continuing this debate, this chapter aims to contribute to foundational knowledge in the realm of collaborative research. The social nature of the collaborative relationship and process, as well as criteria for impact and the role of key actors, appear to enhance the generation of relevant results, determining impactful courses of action that develop even in the long term. This chapter draws on follow-up interviews on the long-term relevance and impact of an earlier collaborative research project, illustrating the relevance of actionable knowledge and its long-term impact in an organisation. In this context, the discussion emphasises the social nature of the collaboration, while the implications focus on relationships between collaborative research and the development of soft skills and entrepreneurial human capital.

Keywords Collaborative research · Collaboration · Long-term relevance · Long-term impact · Actionable knowledge · Soft skills · Intrapreneurship

1 Introduction

> . . . we should consider action, research and training as a triangle that should be kept together for the sake of any of its corners.
> Kurt Lewin (1946, p. 42)

Although the field of management studies and education is focusing increasingly on the relationship between management theory and practice (Perriton and Hodgson 2013; Perry and Zuber-Skerritt 1994) and the impact of knowledge production is a major area of concern (e.g. Alvesson 2012; Butler et al. 2015), the challenge of

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generating relevant research in, and with, organisations is ongoing (Marcos and Denyer 2012; Huff and Huff 2001). Wright and Wright (2002, p. 173) suggest that "a primary reason for this perceived lack of relevance is the failure of much organizational research to be responsive to all potential research stakeholders".

The relationship between research and practice, and between researchers and practitioners in particular (Hodgkinson et al. 2001; Alferoff and Knights 2009), is key to this challenge, since research impact is the outcome of a process based on co-generation of knowledge (e.g. Antonacopoulou 2009; Starkey et al. 2009; Bartunek 2011; Bartunek and Rynes 2014). From this perspective, methodological approaches must include some degree of action and collaboration (Hatchuel and David 2008), in line with the tradition of action research (e.g. Cassell and Johnson 2006) and collaborative processes (Shani et al. 2008; James and Denyer 2009) between a plurality of actors who share the design and development of the research effort (Shani and Coghlan 2014).

In this context, this inquiry seeks to understand whether and how a collaborative research project may have long-term impacts in an organisation, beyond the end of the research process. Thus, this chapter contributes to foundational knowledge on collaborative management research (CMR), illustrating and discussing the generation of actionable knowledge from CMR-based research and its long-term relevance and impact. In particular, the collaborative relationship and process, with its social nature, criteria for impact and the role of key actors, appear to enhance the generation of relevant results which may directly or indirectly determine long-term courses of action, as well as the development of soft skills and entrepreneurial human capital in the context of a collaborative partner in industry.

At the empirical level, this chapter provides insights from a follow-up study relating to an earlier two-and-a-half-year empirical research effort conducted jointly with a medium-sized Italian company. The aim of this follow-up is to explore whether the collaborative research approach may offer a methodology through which to gain both scientific *and* actionable knowledge with long-term relevance and impact. In particular, drawing on follow-ups with actors in the company, this study illustrates that the *social* qualities of the collaborative relationship and process may lead to persistent results. In fact, a few years after the end of the collaboration, the company was adopting actions and decisions relating to some of the research results, and some key actors involved in the CMR experience were playing a pivotal role, underlining the tangible potential for a long-term impact of CMR.

2 The Collaborative Research Approach

With the shift from Mode l to Mode 2 types of knowledge production (Gibbons et al. 1994), collaboration is the essence of "multi-, inter- and trans-disciplinary teams" working on real-life problems (Iglič et al. 2017, p. 154). For example, the Triple Helix (Etzkowitz and Leydesdorff 2000) envisages triadic relations between academia, industry and government.

Research methodologies based on diverse collaborative ties have been advanced over time, each emphasising distinct scientific, collaborative or action features (Cirella et al. 2012). Reason (2006, p. 199) articulates "a multidimensional view of the quality of knowing-in-practice as the outcome of action research", encompassing worthwhile practical purposes, democracy and participation, many ways of knowing, and emergent developmental forms. The CMR orientation, within the tradition of action research (Cassell and Johnson 2006; Dickens and Watkins 1999), is grounded in a philosophy of practical knowing and collaboration (Shani et al. 2012). It aims to bring management and researchers closer together to understand and address relevant organisational issues (Cirella et al. 2012). Pasmore et al. (2008b, p. 20) define CMR as follows:

> Collaborative management research is an effort by two or more parties, at least one of whom is a member of an organization or system under study and at least one of whom is an external researcher, to work together in learning about how the behaviour of managers, management methods, or organizational arrangements affect outcomes in the system or systems under study, using methods that are scientifically based and intended to reduce the likelihood of drawing false conclusions from the data collected, with the intent of both proving performance of the system and adding to the broader body of knowledge in the field of management.

The next two sub-sections explore the process of CMR and its role in generating relevant impact in the realms of research and practice.

2.1 Collaborative Process and Relationship: A Social Perspective

A process view of collaborative research "envisions four major sets of interrelated clusters [...] that affect the CMR process" (Cirella et al. 2012, p. 285). As illustrated in Fig. 1, these are: (1) contextual factors, (2) the quality of the collaborative relationship, (3) the quality of the CMR process itself, and (4) the outcomes of the collaborative effort (Cirella et al. 2012).

The context in which the collaboration takes place is a key factor determining the quality of the collaboration that will develop. Management of the collaboration is equally, if not more, important (Bartunek 2007; Cirella et al. 2012). The nature and quality of developing collaborative relationships have a significant impact on the

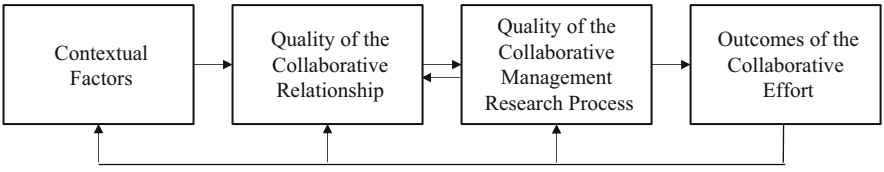

Fig. 1 A process model of collaborative management research. Source: Adapted from Cirella et al. (2012, p. 285)

collaborative research (design and inquiry) and, in turn, the outcomes. This includes variables such as the perceived level of need for collaboration, and reciprocal influences between different interests, values, languages and meanings (Cirella et al. 2012). In establishing collaborative relationships and developing collaborative research (i.e. second and third clusters in the model), CMR implies co-determination of the focus and scope of the study (Pasmore et al. 2008a). Neither the organisation nor the researchers impose their view. On the contrary, the collaboration is truly co-determined through continuous open dialogue between the researchers and key members of the organisation on issues of mutual interest (Cirella et al. 2012). CMR entails investigating how actors operate at different levels in the organisation, including top management, middle management and the workforce. This requires collaboration between a variety of actors, with varying levels of participation, to gather multiple perspectives and understand the contributions of each actor. Collaborative research efforts "involve partnership between external or internal researchers and internal members of a complex adaptive social system in various ways throughout the research process" (Shani and Coghlan 2014, p. 435). The collaborative nature of CMR requires all organisational members to be granted the right to discuss issues and participate. This means an "equal right to discuss the order of a collective process even if there is no equal right to rule it" (Hatchuel and David 2008, p. 153).

The expected outcome of CMR is the creation of results shared within the social system. The value and relevance of CMR lies in its capacity to create fruitful, continuous cooperation, while fully respecting the identities of the different actors (Hatchuel and David 2008). Iglič et al. (2017) suggest a theoretical framework for understanding research collaboration in the context of collaborative processes. They emphasise scientific and technical human capital theory (Bozeman et al. 2001) and a resource-based view on collaboration (Van Rijnsoever et al. 2008), along with contextual features of the social organisation of the research field and its cognitive characteristics (Birnholtz 2007). In particular, collaboration may enhance the human capital of each actor involved in the process, in terms of individual resources, knowledge, skills, reputation, and relevant social ties with a variety of actors (Iglič et al. 2017). In addition, collaborating across organisational boundaries (e.g. Cummings and Kiesler 2005) and involving actors from different types of organisation enhances various aspects of human capital. For example, exposing actors from the organisation (e.g. employees participating in a CMR team) to the process and content of CMR may support those employees in creating new ideas, identifying new solutions, or generating new insights. This relates to the concept of "intrapreneurship", referring to "dynamic employees" creating "entrepreneurial, wealth-creating ideas from their own organisation" (Koch 2014).

Critiques of CMR suggest that it is difficult "to integrate knowledge that has been generated in different contexts of science and practice" (Kieser and Leiner 2012, p. 14), with particular reference to communication difficulties between practitioners and researchers, and the impracticality of turning managers into co-researchers, since "the academics do research and the practitioners concentrate on activities in their context" (Kieser and Leiner 2012, p. 21). In contrast, action/collaborative researchers suggest that structured dialogue is key to turning these difficulties into

a constructive relationship. Mohrman et al. (2001) claim that teaming up practitioners and management researchers in joint forums or platforms may enable them to understand each other's points of view and work toward shared interpretations, thus generating research that may help solve problems in practice. Ripamonti et al. (2016, p. 55) underline the importance of "creating space for collaborative dialogue between managers and researchers" in a form of "dialogical action research", while other studies suggest specific collaborative artefacts. For example, extensive use of tentative research-related categories on hard-copy documents, cards or flipcharts may provide further support for researcher—practitioner interactions to sustain the co-generative feature of the research process (Carlsen et al. 2014).

2.2 The Impact of Collaborative Research: Short Term and Long Term

Marcos and Denyer (2012) argue that CMR as a research paradigm, with its social processes and mechanisms, is an alternative approach to the "unfolding of knowing and practising". Pasmore et al. (2008a) state that CMR can contribute to the challenges of rigour, reflectiveness and relevance. Concerning relevance in particular, they underline that relatively few studies based on a CMR approach have made "a significant difference to the bottom line" (Pasmore et al. 2008a, p. 577). In fact, CMR *per se* does not necessarily guarantee more relevant research (Kieser and Leiner 2011).

Thus, Pasmore et al. (2008a, p. 581) suggest that relevant CMR should produce returns on investment (demonstrating "returns that make the collaborative effort worthwhile"), and be practical, co-determined, re-applicable, teachable, face valid, interesting, specific, and of true significance. Combining these criteria enables different characteristics of impactful CMR in organisational settings to be emphasised. First, in line with Raelin (1999), these criteria suggest a way to design CMR that has a greater impact on improving organisational performance quickly in the short term, and significantly in the long term. If the research is to be viewed as important by practitioners and executives, they must be involved in co-determining its goals, as well as how it is carried out (Mohrman et al. 2001). This is conceivably the single most defining characteristic of CMR. To have the greatest impact in the long term, the research process must be aligned with the most important goals of the organisation. The quality and impact of CMR in research and practice can be notably improved when both practitioners and scholars are working to the same agenda. Face validity is an important aspect with regard to the impact of research findings. A plurality of voices throughout the inquiry process (Reason 1999) is a vital aspect necessary to avoid overcomplicating or oversimplifying the results and suggested solutions.

The CMR process should also be practical, meaning that the time taken to conduct the research effort should not be excessive, and it should achieve applicable outcomes to achieve observable results in the short term (Pasmore et al. 2008a). This is also a way of demonstrating the greater value of CMR in the short term, as well as

revealing further implications of the knowledge produced in the long term. In particular, the outcomes of CMR should include ideas and approaches that are re-applicable. CMR studies are usually conducted in departments or single locations within organisations. If the results of these studies are interesting, there will be a natural inclination to apply the results elsewhere in the organisation and, beyond the originating organisation, to the community of practice more generally. Both internal and external re-application require the ideas and approaches to be teachable to others.

An intrapreneurship perspective may also be relevant to long-term impact. As suggested above, actors from the organisation involved in different ways in the CMR process are more likely to access new resources and identify and shape new opportunities and initiatives. Intrapreneurs are ultimately agents of change (Pinchot 1984), and may actually be agents for "translating" CRM results into ideas and initiatives with a longer-term perspective. For example, the organisational members of a CMR team may play a pivotal role. The CMR team itself can be seen as a platform supporting potential intrapreneurs, as the research orientation may provide them with the conditions needed for intrapreneurship, such as a creative environment and greater freedom (Pinchot 1984).

The next two sections focus on an illustrative case. After a summary of the research context, an original follow-up study is presented to explore its further impact.

3 Background of the Research Project: A Brief Summary

The CMR process in this case was a collective effort developed by a research group from the Polytechnic University of Milan (Italy), composed of three researchers in organisational behaviour and human resources management, and Fashion, an Italian company that creates silk fabrics mainly for well-known fashion customers. The study included two main research cycles, lasting for two-and-a-half years (Cirella 2011). As illustrated in Cirella et al. (2012), initial meetings with the CEO and top management team suggested that understanding and facilitating creativity within the organisation would address an important area of ongoing concern and challenge. A collaborative approach was viewed as the solution offering the greatest merit for surfacing and capturing the meaning of creativity, and for exploring alternative ways to design and manage the creative process in a complex social context.

3.1 The Company

Fashion is a family-owned, medium-sized company that designs and produces silk fabrics, clothes and accessories for women and men. The business largely produces licensed products, handling these products from beginning to end. Italian silk has a high reputation, and the company's clients are some of the most famous and

prestigious *maisons* in the global luxury industry. Competition in this area is especially high. Clients in the luxury industry set high prices, and know the precise margins they want to achieve before production begins. Moreover, the expectation in the industry is that every collection will be distinct from the previous one. The pressure is constantly on creativity. Thus, designing and managing creativity was and is a major challenge, as well as an area of great interest and concern (Cirella et al. 2012). This research focused specifically on the organisational unit involved in the creation of the products, i.e. the Design unit or "*atelier*".

3.2 Overview of the Research Process

Previously published articles focusing on the methodology (e.g. Cirella et al. 2012) and specific results (e.g. Cirella et al. 2016) of this research have already provided considerable detail. Thus, this and the next sub-section briefly review and summarise the research process and its key results, before presenting the follow-up study and exploring the longer-term impact of this research.

Following initial discussions with the company's CEO and top management to refine the scope of the CMR project, a joint CMR team was established to carry out the study, comprising three individuals from the company and three academics. A first research cycle explored the notion of collective creativity. After the data collection and initial analysis, the CMR team made sense of the data and generated a shared interpretation, then the top management team was invited to participate with the CMR team in interpreting the data (Cirella et al. 2012). Based on management input, the CMR team then organised a workshop. As reported in Cirella et al. (2012), 31 members of the organisation participated in a 3-h collaborative process of sense making, and identified specific actions that could be taken to address some of the emerging issues.

Further meetings between the CMR team and the CEO resulted in a decision to continue the collaboration. This second research cycle was jointly designed to study key organisational variables and organisational learning mechanisms (e.g. Shani and Docherty 2008) affecting creativity. The CMR team decided to develop and administer a comprehensive survey, and this instrument was validated through careful review in CMR team meetings, as a result of which some items were carefully reworded. After data collection and analysis (Cirella 2016; Cirella et al. 2016), a document summarising the results was shared with the CMR team for meaning creation, and a specific report was then produced by the CMR team and made available to everyone in the organisation. Shared data interpretation continued in meetings between the CMR team, the CEO and the top management team.

3.3 Overview of the Results

In the first research cycle, the model that emerged from shared interpretation of the data indicated that creativity was a phenomenon that occurred and could be

enhanced at a collective level within the organisation. This "social" interpretation, i.e. collective creativity, was substantially different from the traditional view of creativity present in the company, which related more to the artistic beauty of the physical product itself. This result raised implications for both knowledge production and immediate managerial actions. For example, the original functional organisation of the Design unit was altered by creating four divisions in which members with different roles could develop creative solutions synergistically for each product cluster (Cirella et al. 2012). This solution sought to embody the collective and collaborative side of creativity.

In the second research cycle, analysis of the data revealed significant relationships between learning mechanisms and a creative climate (Cirella et al. 2016), and between organisational variables and creativity (Cirella 2016). Shared interpretation of these results emphasised the need for a tapestry of learning mechanisms to support creativity. This second research cycle also generated both scientific knowledge and further knowledge relevant to immediate managerial actions, such as a protocol to define roles more accurately, and exploration of more effective post-project review practices.

4 The Follow-Up Study

A few months after the end of the second cycle of research, the CEO's term ended. He was a highly reputed manager external to the family that owns the company. The new CEO, whose previous experience had been mainly in an important consultancy firm, was identified by members of the family, following the family succession.

After the change, as a result of the high-quality, trusting relationship established between the company and the researchers, the new CEO and the professor leading the research group met. The CEO wanted to know all the details and results of the two CMR research cycles, and agreement was reached to keep in touch in order to evaluate a possible new research cycle. Although the dialogue continued at different levels, for example between one researcher and one member of the CMR team who had been promoted to a top managerial position (the marketing and product development manager for licensed products, the most important business in the company), the momentum of the CMR had been lost, and there was no trigger to launch a new formal CMR cycle. However, other more specific by-product collaborations took place, such as lectures by managers and practitioners from the company on MSc courses at the university.

Two to three years after the completion of the research process, it was interesting to explore what had happened next, and particularly whether any additional impact relating to the CMR experience had occurred in the organisation. This was explored through unstructured interviews and contacts with a few members of the company, focusing on understanding any new impacts (such as initiatives, projects and developments) deriving from the results on creativity. Relevant company documents were also identified and collected. Evidence from this follow-up illustrates the launch of

new initiatives identified as directly or indirectly connected with the research efforts and results. The next sub-sections describe the various directions of impact.

4.1 A New and Extended Meaning of Creativity

Based on the results of the first CMR cycle, and thanks to wide involvement in the research, particularly by some key actors, the meaning of creativity has essentially changed at the company, with the introduction of the concept of "collective creativity by design". In practice, this means that the new approach to creativity includes answering all possible facets of clients' needs. Two concrete examples were given.

Traditionally, most clients agree exclusive licences with Fashion for their silk products. Nevertheless, Fashion has recently concluded agreements with new clients to be partners in the silk design. This includes clients that already have an integrated chain in silk products: they have their own archives, and cover the process from design to print. However, if they need to "play" with a motif, for example to create many different scarves, they will consult Fashion as a specialist partner.

The second example concerns the time available for the design process and for developing creativity. This time is relatively short, since most of Fashion's clients traditionally launch two to four collections per year. Fashion is now also able to serve clients with even more challenging needs. For example, it works with a few luxury *maisons* that produce small packages of new proposals every month. People in Fashion seem to have a new approach to this challenge, for example in thinking that even a short time-frame may be a stimulus, as long as there is a clear process. This relates to the variables of collective creativity discussed in the first research cycle, including the role of structured processes in developing creativity.

The widespread emphasis on creativity has also had organisational implications. First, of the 450 people in the company, more than 150 are involved in product design, including product managers, designers and colour experts, representing more than a third of employees. This has risen from 22 per cent when the survey in the second research cycle was conducted, demonstrating a serious commitment to creative power.

Second, the designers are able to develop more direct relationships with clients, along with the product managers; therefore, clients often know their own designers personally. The *atelier*, the sub-unit in which all the designers are grouped, is now an open system. The designers are excited to know more about the world of the clients (their styles, archives and resources), and the clients are usually excited to meet their own designers, rather than just the product manager. This appears to relate to the first cycle of the research, which focused on the role of the client's initial input, which is crucial for enhancing creativity, but is often challenging or difficult to understand. The designers also have a clear understanding that their creativity must be translated into a successful business endeavour. This represents a new concept of creativity—creativity "with objectives", in terms of costs and sales expectations—in addition to the beauty of the creations themselves.

4.2 An Enhanced Role for the Company Archive

Following the view of structural learning mechanisms for sustaining creativity emphasised in the results of the second research cycle, the company has sought to revitalise its archive. Some ideas for extended use of the archive were suggested and implemented by a CMR team member. The strength of the results then convinced management to continue seriously in this direction. The archive has been transformed into the active core of the company, and a first innovative decision has been taken to open the archive to clients. Clients, many of whom are truly in love with the company archive and its long history, can visit the archive and stay all day. They often choose specific items as inputs for new orders, either as a strict reproduction of an image or as a source for new ideas.

Fashion has also identified a new initiative to "rediscover" the creative power of its traditions from the archive, and how this can contribute to positive performance. It has launched two Fashion-branded collections, called "Young" and "Traditional", both inspired by the Fashion archive, which has become a concrete engine for ideas.

"Young" is a series of collections designed for young customers. For each collection, a famous architect and designer, who is a partner of Fashion for this project, picks two contrasting motifs from the Fashion archive (for example a traditional motif with flowers and a motif with geometrical shapes) and a new motif is created through intersections of stripes of the two motifs. She works largely in the archive, where she spends her time browsing through books and antique clothes and playing with combinations and intersections. For the "Traditional" collection, the heart of the creations is also the archive. A group of designers searches the company archive to identify specific motifs on which to work and eventually modernise in order to design collections for more traditional customers.

4.3 New Arenas for Collaboration

Both research cycles, with a collective focus on creativity, emphasised that the process of designing and creating a product requires deep and genuine collaboration between different roles (first research cycle), with a need to adopt platforms for collaboration (second research cycle).

Two key categories of role in the company were previously physically divided: designers, colour experts and product managers were located in an ancient building in the city centre, and the factory, with engineers and print experts, was about 8 km away from the headquarters, in the suburbs. Employees have now been moved from the city centre to the factory, and everyone involved in the process works in the same place. Although this decision was driven mainly by efficiency, the new offices at the factory were designed to facilitate collaborative and collective creativity, in line with the need that emerged from the research results. New offices, proper open spaces and meeting rooms are physically close and meet the various needs of collaboration, from informal chats to large meetings, and people can easily meet and solve

problems face to face. The headquarters, an ancient and beautiful building in the city centre, is now home to the archive and is used to host events and special meetings with customers.

In moving from a physical platform to an organisational platform, another engine for collaboration and intrapreneurship was created within this new context. About a year after the end of the CMR process, the new CEO created a team-based project called "Fashion Factory". The team is flexible and includes different talents, with at least one designer, a print expert, a tailoring specialist and a marketing specialist. The group has no input from any client, but develops small collections, experimenting with new ideas and original prints. These products are then proposed to product managers and sales specialists for them to select innovative ideas and propose them to clients. The aim is twofold: enhancing collaboration and collective creativity between different talents, while making creativity strongly visible to clients. In other words, this project represents an arena for collaboration, providing a stimulus for the organisation and complementing its more common client-oriented creativity.

As a final remark, the company is performing positively. The reasons for this are commonly perceived to be not only improvements in efficiency, but also the company's strong creative identity.

5 Discussion

Based on the follow-up illustration, this section discusses the potential long-term relevance and impact of CMR by exploring its social nature, in light of Pasmore et al.'s (2008a) criteria for relevant CMR.

5.1 The Social Nature of Collaborative Management Research

This illustration reports on a complex social process relating to a collaborative study with a company dealing with the challenge of creativity, and an exploration of what happened next. It examines CMR as a modality to create *socially relevant* knowledge, with involvement (and development) of a plurality of actors at different levels, and with effects that can last in the long term.

In adopting this frame, the direct involvement of multiple perspectives was key, as was evident in the creation of a plural CMR team in the illustration. Moreover, all organisational members became increasingly directly involved during the whole CMR experience. At the beginning, the involvement was less intense because the main objective (and challenge) was mutual learning about the two parties: the organisation and academics. Representatives of the different perspectives were then involved separately in order to explore the multiple voices in the organisation

and, in some cases, recognise existing tensions. Later, the involvement was more direct, frequent and interactive, facilitating the production of *socially* relevant knowledge in the organisation. For example, in the collaborative workshop, with the support of collaborative artefacts, a complex social system, including employees and managers, sought to design a model for collective action (Hatchuel 2005). The company's managers were also highly involved in the CMR process. The process itself started with the "blessing" of the CEO, and managers at different levels were always involved in the most crucial stages of the process, creating opportunities to integrate managerial decisions into the CMR process, as both an object of study and an outcome based on the knowledge generated.

Interestingly, with respect to the topic of creativity, the framework of collective creativity, highlighting the social interactions occurring in creativity, was able to connect top managers, middle management, designers, blue-collar workers and researchers. These elements of social relevance led to continuous development that lasted in the long term. Also, different single relationships between ex-members of the CMR team from the company and the university occurred after the end of the collaboration. Table 1 provides an overview of these processes relating to what happened after the end of the collaboration.

In general, the long-term impact of CMR is a result of the dissemination, reproduction and extension of knowledge and related practices (Corradi et al. 2010), and this may potentially affect the organisational culture and identity, in terms of double-loop learning (Argyris and Schön 1978). The most interesting aspect is that this double loop may continue to develop in the long term, after the formal conclusion of the collaborative experience, thanks to the effect of *socially* relevant knowledge and *social* change mechanisms (Park 1999). In this matter, ex-members of the CMR team played a key role. They continued to be definitive agents of change and, in some instances, intrapreneurs who directly generated new ideas and initiatives. For example, initiatives around extended use of the archive were based on the

Table 1 What happened next: An overview of processes, polyphony and impact

	Polyphony		Impact	
Processes	*Actors*	*Main challenge*	*Research*	*Practice*
Continuous learning and implementation (at the company)	Top management, ex-members of CMR team, other organisational members	Sustaining organisational learning mechanisms with a long-term perspective	Evidence of long-term relevance and impact of scholarly outcomes	Continuous development of the organisation, i.e. development of new initiatives relating to creativity
Maintaining/developing collaborative relationships	Ex-members of CMR team (from the company and university) developing new single/specific relationships	Maintaining the relationships despite no current formal collaboration	Follow-up study and room for potential future research studies	Exchange of knowledge between the company and academia, along with specific by-product collaborations

ideas of a CMR team member, who was able to promote her ideas entrepreneurially (bottom-up) and generate *social* consensus around them. Another member of the CMR team was promoted to a top managerial position, enabling her to "translate" deep insights from the CMR experience into support for new values and longer-term initiatives based on creativity, and involving designers in particular.

These dynamics seem coherent with the notion that knowing in practice requires the involvement and continuous work of connecting individuals, groups, organisations and institutions in situated contexts (Scaratti et al. 2009). It encourages critical reflection "on taken-for-granted practices ... resulting in the identification of individual and collective capabilities" (Dover and Lawrence 2010, p. 309).

5.2 Criteria for Impactful Collaborative Research

Actionable and relevant results were achieved, and dissemination of the new knowledge was promoted through researcher—practitioner collaboration (Antonacopoulou 2009). In particular, Pasmore et al.'s (2008a) criteria for CMR relevance, presented earlier, are key to this challenge, as they may create the preconditions necessary to generate relevant results that last in the long term. Some specific examples around these criteria are illustrated in this section.

Co-determination (Pasmore et al. 2008a) is one of the most evident criteria in the illustration. Continuous co-determination of the process was guaranteed by the leading role of the CMR team and its plurality of voices. All phases of the CMR were guided by the principle of co-determination, and all decisions were made together with all parties involved (Cirella et al. 2012). In the long term, courses of action were addressed as a result of research that was co-determined overall.

The criteria for relevant CMR (Pasmore et al. 2008a) should be continuously present in all phases of the collaboration, planting the seeds for long-term relevance and impact. For example, the collaborative workshop during the first research cycle activated a process of sense making (Weick 1995), making the results teachable and implantable as it facilitated the identification of specific courses of action. In fact, hard-copy documents with raw data organised into narrow categories and flipcharts for team work (i.e. using artefacts in line with Carlsen et al. 2014) were designed and used to support discussions in the workshop and, as a result, top management committed to taking some of these actions and created a timeline for further steps. This approach seems to have achieved the production of *socially* sustained knowledge deployed through discourses and intermediaries (Scaratti et al. 2009). A second example relates to the design of a survey and data collection in the second research cycle. The survey design was completely co-determined by all parties involved, although this process was complex in terms of establishing different equilibria, and some difficulties emerged. For example, as noted in some journal entries on the project based on the idea of a reflective journal (Coghlan and Brannick 2005), although the English language was always the standard, it was necessary to have an additional meeting of the research team speaking in Italian in order to overcome some misunderstandings about the deep meaning of some items. Also, during the

data collection, two researchers were on the company premises to collect hard copies of the survey from employees. This offered opportunities for short face-to-face meetings to answer questions and curiosities ("interesting", Pasmore et al. 2008a), which created more excitement and interest in the project. The response rate was about 81 per cent (Cirella 2016; Cirella et al. 2016), which in itself indicates the level of participation and the perceived relevance of the study. Moreover, those who completed the survey were keen to receive feedback on the results. For this reason, a report with a synopsis of the emerging statistical results was prepared by the CMR team and sent to the organisation ("teachability", Pasmore et al. 2008a). Integration of CMR sense making into this final report was a very important feature; this is where research-based interventions risk ceasing to be collaborative, as concepts are integrated into something that makes sense principally to the researchers. This created room for other courses of action on the implementation of specific organisational learning mechanisms ("face validity", Pasmore et al. 2008a), even after the end of the collaboration. This is an example of relevance to practice, following a practice-based approach (Ripamonti and Scaratti 2012; Gherardi 2009).

In conclusion, the learning, extension and reproduction (Corradi et al. 2010) of relevant organisational learning mechanisms continued at all levels of the organisation, even after the CMR process had formally ended. The changes related to a new common orientation toward creativity developed in a continuous *social* process of enactment of new knowledge. For example, the CMR team member who had been promoted to a top managerial position played a pivotal role because she was able to connect deeper insights from the research studies with current courses of action to improve the organisation ("re-applicability" and "positive ROI", Pasmore et al. 2008a). Development of a continuous process of improvement included a series of initiatives that, as a whole, represented a major change in the long term.

In general, following the criteria for relevant CMR, the CMR process seems to be a possible trigger for knowledge production with greater impact in the short, middle and long term (Orr and Bennett 2012; Raelin 1999), developing insights to help practitioners articulate and develop what they perhaps already do or somehow know (Eikeland and Nicolini 2011). This discussion is in line with emerging changes in the production of knowledge (Pettigrew 2004) that focus around *who* is involved in processes of knowledge production, dissemination and use (Cirella et al. 2012), with the opportunity to shed light on soft skills development for these key actors, as discussed in the next section. The discussion also underlines that theoretical advancements and practical relevance are closely linked, because the latter is achieved through the former (Radaelli et al. 2014).

6 Implications for Collaborative Research and Soft Skills

One potential merit of this study relates to the effort to underline the social nature of CMR and, thanks to its *social* qualities along with the criteria for relevance, its role in producing knowledge for long-term relevance and impact. In terms of implications, this study definitively underlines the importance of some essential *soft* (and

social) skills, for example relating to cooperation, communication and openness, for both researchers and practitioners, when dealing with the challenges of collaborating in the context of action/collaborative research. At the same time, it suggests that CMR itself, through its development of a collaborative and complex process of mutual learning and inquiry, promotes enrichment of the soft skills of each actor involved in the process (such as ability to negotiate, ability to network with a variety of stakeholders, communication), along with new specific knowledge and insights from the inquiry. CMR may also promote the development of entrepreneurial human capital, in particular in terms of intrapreneurship by key actors in the CMR process, who are able to continue to use and exploit CMR outcomes, with potential long-term benefits for organisations.

In particular, in the context of industry, soft skills are key for managers and practitioners seeking to collaborate with researchers to generate impactful research. Openness to academia is probably a general prerequisite, but in light of the *social* nature of CMR, a set of essential soft skills relating to collaboration would be extremely beneficial, such as team-working skills and an ability to communicate effectively in different settings. Also, the role of intrapreneurs seems particularly critical to sustaining the outcomes of CMR in the organisation in the long term. Key actors involved in the collaboration, and particularly CMR team members, should be provided with greater freedom and support for their creativity (Pinchot 1984). These actors should ideally have some essential traits relating to intrapreneurship, such as a risk-taking approach, proactivity and self-motivation. This should be clearly considered when defining (or modifying) CMR team composition in different phases and cycles of the CMR process. At the same time, as discussed above, the CMR experience may promote the development of complex *soft skills* relating to collaboration and entrepreneurial human capital, particularly in terms of intrapreneurship. Thus, exposure to the CMR process may be a modality (or a trigger) for developing the potential of some key organisational actors, in terms of intrapreneurship and improvement of collaborative skills. This, in turn, may support the longer-term impact of CMR-related outcomes, as a result of initiatives and ideas from these agents of change. In the follow-up case, for example, the "Fashion Factory" project was a platform created by the new CEO to continue to promote creativity and intrapreneurship.

In the context of academia, it seems important for management research to place greater emphasis on understanding (with further research) and developing (for example, with doctoral and post-doctoral training) the soft skills of researchers, and of action/collaborative scholars in particular. This contribution reinforces and extends the view of the importance of collaboration in the context of management education, and entrepreneurship education in particular. Bischoff et al. (2017) combine literature from the fields of entrepreneurship education, entrepreneurial ecosystems and stakeholder theory, and inquiries into European higher educational institutions, to confirm that stakeholder collaboration and involvement, in different possible forms, matter in the context of entrepreneurship education. Similarly to the CMR context, Bischoff et al. (2017) emphasise complementarity between the academic view, and the practical view of external stakeholders with their real-life aspects and problems. Their findings also reveal that entrepreneurs and company

representatives are the actors most frequently involved in collaborations, but these practices of collaboration frequently relate to individual initiatives, depending on key people and their long-term commitment. This suggests that collaboration between academia and other stakeholders is an ongoing challenge that should be tackled at different levels and in different forms. With a more research-oriented perspective, this study attempts to illustrate a possible modality for effective collaboration.

The combination of (collaborative) "action, research and training" is reflected in the quote by Lewin from his seminal piece on action research (1946, p. 42) at the very beginning of this chapter.

7 Conclusions

If collaboration between firms and with customers is key in industry, even in very advanced forms (for example, developing "collaborative services", as illustrated by Ogilvie 2015), collaboration between industry and academia is also a major area of interest at different levels. Bringing these two realms closer may ultimately contribute to a mutual evolution of science and society (Etzkowitz and Leydesdorff 2000; Nowotny et al. 2001; Hatchuel and Glise 2004; Senge 2008).

From a research perspective, this chapter provides a comprehensive view of CMR, in particular discussing its *social* nature and its potential to generate relevant results that may determine impactful courses of action that develop in the long term. It thus contributes to the debate on knowledge production in organisational settings, and its relevance and impact.

The follow-up study and its discussion also emphasise the key roles of the agents involved in the CMR process. Of course, some *soft skills* seem to be essential for these actors in order to develop effective collaboration, but at the same time, key mechanisms relating to the CMR process, for example the CMR team, collaborative workshops and engagement of employees, seem to trigger the development of further *soft skills* and entrepreneurial human capital, in particular in terms of intrapreneurship, which in turn may sustain the long-term impact of CMR, even beyond the formal end of the collaboration.

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Enhancing Collaboration: Does a Game Make a Difference?

Mara Grasseni, Roberto Lusardi, and Stefano Tomelleri

Abstract In recent decades, collaboration has become increasingly central in the management strategies of private companies due to the complexity of organizational design and workflow and the heterogeneity of professional profiles and knowledge domains. Collaboration is also relevant for public institutions, where the progressive reduction of resources requires an increasingly cooperative approach among actors who are supposed to follow the same socio-economic orientation for the "common good". Given the growing attention towards this topic, this study implemented and tested an educational tool for stimulating collaborative behaviours and attitudes. The tool is named *Totem & Tribe,* and it is a sociological-rooted educational game. For testing the game's reliability and effectiveness in shaping collaborative behaviours and attitudes, a mixed sample of students and entrepreneurs was asked to play within a university setting. The participants were first-year students in Economics and Education at the University of Bergamo and entrepreneurs who participated in the Executive Education Programme organized by the Department of Management Engineering of the same university. Participants were asked to fill in a questionnaire with several questions regarding different aspects of collaboration and competition. The same questionnaire was administered before and after the game (pre and post test). This chapter presents in detail the theoretical and pragmatic characteristics of the game, the testing procedure (design, sample and method) and the main results.

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1 Introduction

In recent decades, collaboration has become increasingly central in the management strategies of private companies due to the complexity of organizational design and workflow and the heterogeneity of professional profiles and knowledge domains. Collaboration is also relevant for public institutions, where the progressive reduction of resources requires an increasingly cooperative approach among actors who are supposed to follow the same socio-economic orientation for the "common good".

Given the growing attention towards this topic, this study intends to discuss and test an educational tool for stimulating collaborative behaviours and attitudes. The tool is named *Totem & Tribe* (T&T), and it is a sociological-rooted educational game.[1] Based on a fantasy scenario comprised of clans, primitive artefacts and magic, it exploits the potential of simulations in the learning process for fostering groups' creative interactions to bring out cooperative/competitive interactions and leadership styles. Through the gaming experience, players have the opportunity to recognize the effectiveness of collaborative interactions and leadership. The game was developed following the symbolic interactionism approach, which theorizes how individuals shape society and are shaped by society through meaning that arises in interaction. For testing the game's reliability and effectiveness in shaping collaborative behaviours and attitudes, a mixed sample of students and entrepreneurs was asked to play within a university setting. Participants were asked to fill in a questionnaire with several questions regarding collaboration, interdependence and trust. The same questionnaire was administered before and after the game (pre and post test). Participants were first-year students in Economics and Education at the University of Bergamo and entrepreneurs who participated in the Executive Education Programme organized by the Department of Management Engineering of the same university. This chapter discusses the theoretical background, the characteristics of the game, the testing procedure—design, sample and method—and the evaluation outcome. This chapter analyses and discusses the ways in which the game has modified personal and group behaviours and attitudes.

2 Collaboration and Related Concepts

There are numerous ways to explain the term "collaboration" and to define which behaviours are expected from collaborative staff or which organizational outcomes are expected from collaborative practice (Stadtler and van Wassenhove 2016). The

[1]Game concept, design and development by Doni and Tomelleri (2011).

international literature on organizational studies and management, which for decades has been producing knowledge on this topic, reveals a plurality of epistemological perspectives, hardly attributable to a unitary vision of the term (Austin et al. 2006; Bedwell et al. 2012; Ribeiro-Soriano and Urbano 2009). This paper suggests that the studies on collaboration have highlighted three fundamental theoretical aspects: (1) the practical nature of collaboration, which highlights the ritual and symbolic dimensions; (2) the interdependence of subjects, which emphasizes the mutual bonds existing between collaborating individuals; and (3) the role of trust as a background condition for mutually intelligible interactions.

A fundamental contribution to understanding collaboration has been brought by Richard Sennett (2012) and his organizational analysis guided by anthropological and sociological studies. The American scholar has demonstrated that social behaviour is fuelled by rituals and symbolic meanings embodied in ordinary practices. The theoretical assumption is that collaboration is not just a means by which some results are achieved. Collaboration activates several positive social behaviours, such as: effective communication, cohesion and sharing values, respect for others, mutual help and personal openness (Ariño 2003). Hence, it is reductive to limit the field of collaboration to group or organizational roles, functions or objectives. Collaboration relies, above all, on cultural repertoires and ordinary practices, which often contain (largely) unconscious systems of meanings (Lusardi and Tomelleri 2017; Tomelleri et al. 2015). Within this line of research, another important contribution is brought by the approach known as "collaborative work". Taking a multidisciplinary point of view, this approach has emphasized how technological artefacts in the workplace act as mediators of social interaction and can be used to strengthen collaborative practice (Cambrosio et al. 2004; Xiao 2005). The sharing process put in place by collaboration is recognized as more effective and efficient than individual work. Moreover, collaboration requires the presence of mutual trust relationships among the people who belong to the group (Sennett 2012; De Jong et al. 2016).

The second theoretical aspect pointed out in literature emphasizes the psychosocial dynamics that involve individuals and groups during collaborative activities. This approach is aimed at analysing collaboration as a form of social interdependence. The concept of interdependence stems from the studies of psychologist Kurt Lewin (1935) on groups. According to this well-known American psychologist, the group is an interdependent whole: Being endowed with its own structure, the group is more than the sum of its members. This means that a change in one member affects the well-being of all the other participants in the group's emotional and social life. Lewin's concept of interdependence helped lay the groundwork for his pupil Morton Deutsch's (1949, 2003) studies on interdependent social interactions and subsequent theoretical reworkings. The basic premise of this theoretical contribution relies on the idea that how individuals' goals are structured determines people's behaviours and that the model of interaction determines the outcomes of the situation (Johnson and Johnson 2005). During collaborative exchanges, a positive interdependence is established, resulting from the quality of the members' interactions: Sharing common goals becomes the driving force behind the growth and development of both individual and group (Toma and Butera 2015). Individuals are emotionally linked to one another

in such a way that the possibility that one of them will achieve his/her goal depends on the possibility that others have to achieve their own. In a collaborative situation, individuals "promote each other's success through helping, sharing, assisting, explaining, and encouraging" (Johnson et al. 1994, p. 10). They perceive that the collaborative bond existing among them is the key to collective success, which cannot work if they pursue individualistic purposes. This is the case in competitive exchange, in which a negative interdependence (competition) is established as the result of oppositional interactions: Individuals are bound to one another in such a way that the higher the probability that one of them achieves his/her goals, the lower the probability becomes that others will reach their own (Johnson and Johnson 2009). Each member of the group works against the others to achieve his/her own best result; in this case, personal success hinders other members and the community.

The third relevant theoretical aspect is trust: the system of expectations that links people in collaborative contexts. How Sundaramurthy (2008) pointed out, trust is a critical source of competitive advantage for family firms in the early stages that often deteriorates as the firm grows. Focusing on business organizations, Hattori and Lapidus (2004) showed how different interactive settings imply different degrees of trust. Not all relationship or business activities requires the same level of trust: The level goes from the absence of trust typical of predatory contexts—in which the strategic objective is elimination of others competitors—to the necessary trust link for collaborative contexts—in which individual actions converge towards shared objectives full of symbolic meanings. If in a competitive setting, trust mainly invests the respect for the rules, which guarantee the functioning of the setting, while in a collaborative context, trust becomes the link that maintains the collective orientation of action towards shared success. This type of trust does not regard individual subjectivity as much as the whole system of expectations in which people are involved. As Watson affirms, "[T]rust in this sense does not mean to trust the whole person in all of their aspects, but, rather, to trust only that they are committed to this practice, competent to perform it, and that they trust this of you. Not to trust in this way is to fail to participate (or have information) altogether" (2009, p. 478). Trust is pointed out as an antecedent of collaboration because it guarantees a common orientation towards the common good (Rezazadeh and Nobari 2017; Watson 2009), facilitates the circulation of information (Chen et al. 2014) and stimulates the development of a system of shared values (Kramer and Pfitzer 2016).

This analysis, therefore, shows that collaboration is a phenomenon that is mainly understood in practice, is based on positive relationships of interdependence and requires significant levels of trust to be activated. This essay discusses how the game proposed here relies on these aspects. But first, some clarifications about the approach used in the study.

3 Cooperative Learning, Sociological Games and Collaboration

This study adopts the educational approach named cooperative learning (CL). This is a theoretical and methodological framework that defines learning as situated and relation practice (Mayer and Alexander 2016). CL includes different educational theories and tools that consider the group of learners as a fundamental resource for individual learning. The teacher/stimulator prepares conditions and structures for the activities of the group, and the learners organize themselves to learn in an autonomous way. From a systemic and relational perspective, in CL, simulations and social games play a fundamental role in the learning process (Clapper 2015). Through simulation and gaming, it is possible to learn how to become a member of the community, because social relationships are important for the acquisition of transversal skills, leadership and negotiation, as well as for the overall development of personal identity. Participating in simulations and games, individuals find themselves living different situations that require a progressive and dynamic evolutionary adaptation of intelligence. In essence, through sociologically rooted games, participants interacting with each other learn to identify, define and analyse social, relational and cultural factors that influence their behaviour. This means that learning does not take place in a passive and unidirectional manner. Learning is mediated by the practical experience and the sharing with the other subjects involved. This kind of learning, rooted in situational experience and horizontal sharing of information, is widely present in schools and universities across the world (Johnson and Johnson 2009; Iyer 2013). It has also been how the use of game-based learning approaches in higher education increases students' motivation and achievement (Nadolny et al. 2017). This has been reported as effective in entrepreneurial education, as well, where "formal modes of passive education and training are unlikely to have a strong influence or impact on the development of the entrepreneur as a practitioner" (Higgins and Elliott 2011, p. 360). This essay will illustrate how this approach works for learning collaborative behaviours and attitudes.

3.1 What Is a Sociological Game?

The act of playing is older than society. Indeed, although the concept of society can be theoretically defined, it requires human relations and institutional arrangements. The higher mammals did not have to wait for human beings to teach them how to play. Nor it can be argued that human societies have developed the very concept of play as an essential feature. As Huizinga (1949, p. 1) affirmed, "[E]ven in its simplest forms on the animal level, play is more than a mere physiological phenomenon or a psychological reflex. It goes beyond the confines of purely physical or

purely biological activity. It is a significant function—that is to say, there is some sense to it. In play there is something 'at play' which transcends the immediate needs of life and imparts meaning to the action. All play means something." The game possesses an intrinsically metaphorical nature. As humans play, they stage the reality that surrounds them, the cultural meanings they inhabit (Montola 2012). The question becomes how to play the game of society consciously: as to say, a way to experiment and study the production of subjectivity (identity, individual action, groups, active minorities, etc.) and the production of structures (space, time, body, resources, institutions, organizations). This is what this paper calls the "sociological game". A sociological game is essentially a social positioning game (Goffman 1967). The main activity of players is to participate, together with others, by creating and directing a distinct and recognizable self-image. This primarily means that those who play occupy a space, and that occupation has immediate social relevance. As anthropologists know well, there is no neutrality in the relation with others (Plessner 1970). At the same time, each person's own position acts as an indicator of difference; it signals the relationship with the places that others are occupying and with the roles they are playing.

3.2 Theoretical Aspects Incorporated into the Game

T&T mocks Freud's famous work *Totem and Taboo*, a book that is, in many ways, extraordinary and that marked not just the cultural destiny of psychoanalysis but also the way of considering the deep history of human nature. As Freud discussed in this volume, the totem usually identifies the community. In Australian tribes studied by sociologists and anthropologists (such as Emile Durkheim and Marcel Mauss), the totem is a fundamental law made explicit, embodied in a living creature that is considered a tribe's ancestor. T&T highlights the genesis of leadership and of symbolic power among the members of a community. This activity has been designed to help in understanding the bond between symbolic power, communicative interactions and collaborative practice.

Based on a fantasy scenario comprised of clans, primitive artefacts and magic, T&T exploits the potential of simulations in the learning process for fostering groups' creative interactions to bring out leadership styles and cooperative/competitive interaction (Hofstede et al. 2010). Each time the game is played, local cultures, organization features and personal and professional biographies generate unexpected dynamics that make each event exciting and instructive for participants. Despite this uniqueness, the game is rooted in social processes that tend to repeat from one setting to another, regardless of local conditions. From the beginning, the game stimulates the tension between the social expectations of egalitarianism and the hierarchies of power that shape societies (Bauman 2000). The competitive pressure and social inequalities (caused by the heterogeneity of participants—differences in gender, age,

skills, desires, values, ideas, alliances, friendships, etc.) spread around the community of players. The individualistic behaviours and discourses that seem to remain in the mainstream cultural models of contemporary society show their limits during play. The game dynamics emphasize how selfishness and self-interest usually lead to paralysis and frustration, while altruism and trust or openness are not just ideals but rather represent effective strategies for managing organizations and orienting group behaviours. The game demonstrates how collaboration is not rooted in individual motivations or psychological propriety but is instead generated though everyday practice, communicative interactions and informal rituals (Sennett 2012). The learning group, placed in the elementary conditions of social life, emphasizes the basic dynamics of social interaction; in particular, it replicates the critical relationship with authority. This is critical because authority, power and its management are relational dimensions generated by conflict based on physical superiority or charisma (Weber 1958). Nevertheless, these forms of power are never guaranteed once and for all, nor can they guarantee order and stability in the community. The social agency generated by the game dynamics involves the experience of crisis. During the crisis situation, groups deal with ambivalent emotional reactions: escape and avoidance, on the one hand, and temerity and impulsiveness on the other (Morin 1984). In this sense, the crisis entangles the groups in a condition of ritual effervescence in which the usual frames of the ritual regulations ("good manners", hierarchical order, etc.) are perceived as fragile and unstable. This effervescence leads to exciting moments when new rituals are produced, but at the same time, these are accompanied by fear, especially among those who are in leadership positions, whether they are effective or not. Decision-making processes are rooted in rituals that are more or less formalized or institutionalized. The degree of "freedom" granted within the rituals is what is called "styles of decision". These styles oscillate between two extremes: on one hand, there may be a clear and aggressive violation of rituals or rules (such as disputes, insubordination, neglect of the setting, etc.), while on the other, there is a standardization of behaviours (avoidance and the reproduction of norms). Rebellion and routines make it possible, if they are considered types of behavioural polarity, to detect styles based on social variables, such as ethnic identity, gender, age, seniority and professional roles. In this regard, the experience of play should be read through the lens of styles and social variables, such as avoiding to reduce the complexity of interaction and the use of social stereotypes or dominant cultures in the community (Montola 2012).

4 And Finally: The Game

Within a simulation placed in a fantasy setting, participants can address issues such as the development of leadership, negotiation practice, conflict escalation and competition and collaboration in a very experientially rooted way. The game has been created for the learning purposes of private and public organizations, especially for those working in the field of welfare. From health professionals to social workers

and educators, the game has enabled large groups of operators to develop the social and relational skills relevant for the improvement of their services. Several teams have also used the game in business contexts (MBA programmes and companies' internal training).

Game Synopsis

Instructional Objectives

To understand and analyse hierarchical relationships in social groups. To qualify and identify different styles of leadership and power management. To understand and develop cooperative behaviours in stressful situations. To develop sensibility and skills for bargaining and negotiation. To understand and manage the emotional aspects of social interactions.

Game Objectives

A prehistoric tribe consisting of several clans will face a severe crisis (caused by a deep famine) that will put before the community the decision to become farmers or warriors-raiders. Each participant, acting as an individual and as a member of a clan, will have to decide the fate of the community and whether to abide by the decision that the tribe's chief will make in the last phase of the game.

Debriefing Format

Participants will discuss in a plenary session to share their experiences and reactions and analyse the dynamics of the game from their own points of view. Discussions will then be oriented by the trainers towards the topics most appropriate with the specific group's dynamics.

Target Audience

Individuals interested in learning, training and managing communication and inter-professional skills. The game has been developed for educational purposes in university learning and third-sector entrepreneurship settings, but it has also been used effectively in business and commercial situations.

Playing Time

180 min.

Debrief Time

45–60 min.

Number of Players Required

16–30.

Participation Materials

The different phases of the game require:

- One paper poster
- Sheets of paper
- Pens
- Markers
- 44 pieces of cardstock listing individual talents

(continued)

Other Materials/Equipment

The activity should be carried out in a large room with movable chairs, because the setting changes in the different phases of the game. To better capture the socio-relational dynamics of the game, the trainer should be accompanied by an observer. His/her task will consist of contributing to the final discussion.

4.1 Trainer's Guide

T&T requires a minimum of 16 participants and an appropriate space furnished with movable chairs. It is recommended (but not required) that players use flip charts and ordinary stationery. The game can be led by one or more trainers; the presence of additional trainers depends on the degree of detail and the richness of analysis required. The trainer should begin by welcoming the participants and briefly introducing the game, without previewing the later steps of the activity. Participants may ask for more details, and it is possible to answer in general terms, but the trainer should avoid unveiling the coming developments in the game.

Flow of the Exercise T&T includes a five-step game session and a debriefing. The game consists of five phases that must be completed in a fixed amount of time. In each phase, the players must fulfil a specific task. The phases are described one at a time during the game. Once the game begins, participants will play each phase in the order described below, so that they cannot anticipate the events of the following phases.

1. The scenario description and the choice of the tribal chief (45 min)

The group is seated in a circle and the trainer starts the game by describing the scenario:

> About 5000 years ago, a tribe of hunters and gatherers, located in a specific space (the place in which the activity is performed), had to choose its leader, who then must decide which of the proposals the clans should develop to ensure the future survival of the tribe.

The group meets to achieve its first aim: the identification of the tribal chief. Participants must choose a leader within the group for the duration of the phase. There are no particular indications that should influence the choice of the chief. If the group decides upon its choice of chief before time is called, the players should wait out the remaining time.

2. The distribution of talents (40 min)

The chief physically leaves the group. From this point, the chief will be responsible for the next phases of the game and for ensuring that players respect all of the rules. The chief is informed of the developments in the game by the trainer.

During this phase, each participant *randomly* receives one or more "talents" or gifts (as listed below) from the trainer. Only the chief will be allowed to know all of

the talents available, as he/she will receive a copy of the complete list. It is necessary that the distribution of talents occur randomly and individually, because only the chief should know the real potential of the collective.

After the deployment of the talents, the trainer poses the following question:

> Between the objects and symbols you have received, what are you willing to donate to the community, and what do you prefer to keep for yourself as a legacy for the construction of the final choice?

The nature of the final choice is not expressed yet, but it is anticipated that it will be a momentous decision for the development and the survival of the tribe. The chief is excluded from this commitment (because he/she does not receive any talents), but the chief can decide whether or not the donations offered are sufficient and appropriate. The chief cannot force anyone to donate but can refuse to accept the overall donations. If the chief considers the donations insufficient, he/she must repeat the exercise until a satisfactory amount is reached. At the end, the chief records the list of donated talents on a poster that is visible to all tribe members.

Talents List

1. Bison leather	16. Clothing	31. Clay
2. Bricks	17. Axe	32. Salt
3. Children	18. Honey	33. Writing
4. Constellations	19. Clothes	34. Dagger
5. Dogs	20. Shield	35. Water
6. Fire	21. Poison	36. Women
7. Games	22. Sickle	37. Unknown lands
8. Lance	23. Dagger	38. Numbers
9. Masks	24. Ropes	39. Percussion
10. Medicinal herbs	25. Arrows	40. Cymbals
11. Ornaments	26. Bows	41. Drums
12. Seeds	27. Hammer	42. Friendly tribes
13. Tent	28. Opium	43. Loom
14. Traps	29. Magic	44. Pots
15. Wheel	30. Latrine	

3. The sudden crisis and the division into clans (45 min)

The scenario is completed with the following information:

> The tribe is going through a period of unexpected and particularly severe famine. This brings the tribe to a historical and cultural crossroads. You must decide whether to become a community of farmers or of warriors-raiders.

The tribe is divided into four or five groups (called clans) of up to six persons. The assignment of members to each group follows no rules; it is left to participants to decide to which clan they want to belong. After this, the chief explains the goal of this phase: each clan must develop a project concerning the tribe's future. Each clan chooses its own spokesman (the clan chief), who will present and discuss the project during the final phase. Each clan is supposed to decide between the two options (farmers or warriors-raiders) on the basis of the clan's disposition of talents.

For their project, clans can use both the talents owned by its individual members (if they decide to share them with the clan they belong to) and community talents, which are listed on the poster. Projects should consider the future of the entire tribe, not just single clans. During this phase, the tribal chief can assist in the clans' project meetings, but he/she cannot intervene.

4. The final decision (30 min)

The tribal chief brings together the clan leaders in the middle of the room and then sits in the middle of them. Other members will be situated with their clans in the corners of the room. In this phase, the chief chooses from among the projects developed by the clans and decides on the future of the tribe. He/she is also responsible for managing the final meeting, coordinating the interactions and defining the turn-taking. Only clan leaders are allowed to speak during this phase. Other clan members may only observe their leaders' performances. If the tribal chief prefers one project, and it includes talents belonging to the individual members, it will be necessary to negotiate those members' willingness to share them with other clans. The new talents are the property of the clan, not of the community, even if the tribe's chief appreciates the project. This phase ends when the time is called, or when the leader chooses the project to follow.

5. The showdown (20 min)

All participants return to the starting position. Tribe members are called on individually to decide whether they will join the project chosen by the chief, and they must declare their decision. The trainer does not intervene, except for managing the turn-taking.

At this point, the game is over. Participants are still seated in a circle. The trainer opens the discussion with a first roundtable. Questions can focus on objective, reflective, interpretative and decisional aspects of what happened during the activity. The conversation should be free, and it is not necessary for everyone to speak. Nonetheless, the trainer will encourage everyone to share his/her own reflections. After the first round, during which participants are called to share their experiences, one or more guided topics are introduced to push the reflection to a more theoretical level. The purpose of the debriefing is not to confirm or criticize the decision made by the chief but to clarify the dynamics that allowed such a decision to be generated within the group. Participants are thus called to analyse their own social practices—the decisive moment of every participatory learning experience. There is no "correct" solution for this game. There are endless possibilities for understanding groups' actions within their cultural and social environments.

5 Data and Descriptive Statistics

The hypothesis of the study is that the game forces participants to put themselves "in other people's shoes" and this produces mutual interactions that foster collaboration and interdependence. Furthermore, trust is intended as a background condition of mutually intelligible interactions. For testing these predictions, in 2015, nine sessions of the game were run with university students and entrepreneurs, involving 218 players. The participants were first-year students in Economics and Science of Education (from now on just Education) at the University of Bergamo and entrepreneurs who participated in an executive programme organized by the Center for Young and Family Enterprise (CYFE). Each participant was asked to fill in a questionnaire aimed at measuring several aspects related to collaboration, interdependence and trust.[2] In addition, questions on socio-demographic characteristics were added. The same questionnaire was administered before and after the game.

Participation in the game was on a voluntary basis. Professors announced during their economics or sociology classes the need to recruit students for an experiment, and no details were disclosed on the aim or the features of the game itself.

Regarding the Education classes, the students were both undergraduates and master's students, and those who wanted to participate were randomly allocated to four sections of the game (two undergraduates and two master's). Regarding the Economics classes, the selection process was a little different. The students were all undergraduates in their first year. Professors announced that they needed 100 students for the experiment, and participants could gain 1 point extra on top of the grade of the intermediate test of their course. This was more a formal than a substantial incentive, as the grade of the intermediate test represented only 50% of the final grade. Students had 2 weeks from the communication to register online, and by the actual deadline, 200 students had registered (around one-third of the total number of first-year students enrolled in the Economics and Business department). Then, 100 students were randomly selected and randomly allocated to four sections of the game. Finally, regarding the entrepreneurs, all of them took part in the game, which was played at the beginning of the course, when the entrepreneurs were not yet acquainted with one another.

The information available regards 218 respondents, and Table 1 shows the distribution of participants among fields of studies, gender, mother's and father's education, occupation and place of residence.

The information on parental background makes it possible to distinguish between students with high-educated parents and students with low-educated ones.[3]

[2]For measuring disposition differences about collaboration and interdependence, selected items from the entrepreneurial aptitude test (TAI) developed by Favretto et al. (2003) and from the cooperation orientation scale developed by Chen et al. (2011) were adopted. The latter was also translated in Italian. For measuring trust among people, selected items from the Organizational Trust Inventory (short version) developed by Cummings and Bromiley (1996) were adopted and translated in Italian.

[3]Mother and father are classified as high-educated if they have a high school certificate that allows them to attend the university or a degree.

Table 1 Descriptive statistics

	% of students
Economics	36.30
Education	38.53
Entrepreneurs	24.77
Female	61.68
Male	38.32
High-educated mother	38.07
High-educated father	39.45
Mother's occupation: entrepreneur or self-employed	13.76
Father's occupation: entrepreneur or self-employed	30.28
Place of residence: city	63.30
Place of residence: town	36.70
Obs.	218
	mean (std. dev.)
Collaboration	3.506 (0.428)
Interdependence	3.439 (0.452)

Regarding the parents' occupations, a distinction was made between students with a mother or father who is an entrepreneur or self-employed and students whose parents are employed in other kinds of occupations. Finally, the information collected made it possible to distinguish between respondents who live in small or big cities and respondents who live towns with fewer than 5000 inhabitants.

As the main aim of this empirical analysis is to evaluate the attitude towards collaboration and interdependence, the most suitable questions were selected from the many reported in the questionnaire for both of the previous aspects. The statements for measuring the collaboration were selected following the theoretical framework. These were the questions that fit better with the idea that collaboration is connected to positive social behaviours such as: affective communication, cohesion and sharing value, respect for others, mutual help and personal openness. The same process of selection has been carried out for the interdependence variable. The selected items supported the idea that interdependence is the results of members' interactions, common goals, and the belief that the value of the group is more than the sum of its members.[4] The answers regarding collaboration and interdependence were based on a 5-point scale, where 5 meant "always", 4 "often", 3 "sometimes", 2 "rarely" and 1 "never". Then, for each participant, the average of his/her answers after the game across the two aspects (collaboration and interdependence) was computed.

Table 1 shows that the percentage of students is equally distributed between Economics and Education, respectively 36.30% and 38.53%, while the share of

[4]For each selected statements see Table 3.

entrepreneurs is lower, 24.77%. There is a higher percentage of female students than male, 61.68%, and regarding place of residence, 63.30% of participants come from cities. Regarding parental occupations, 38.07% of students have a high-educated mother, and only 13.76% have an entrepreneur or self-employed mother. The percentage of fathers who are self-employed or entrepreneurs is higher, 30.28%, while the percentage of students with a high-educated father is very similar to the figure for mothers.

The two variables of interest are continuous by construction, and the means of collaboration and interdependence are, respectively, 3.506 and 3.439.

As already mentioned, the questionnaire was administered before and after the game, and this is the main interesting aspect of the research, as the comparison of the answers given before and after the game makes it possible to test the hypothesis and the predictions of the theory. Therefore, to evaluate the attitude towards collaboration and interdependence, the mean of the three variables before and after the game was computed for each participant. Then, the percentage of respondents who, after the game, changed their average answers in the direction of an improvement of their attitude towards the two aspects was calculated.

In addition, given the idea that trust may influence attitudes towards collaboration and interdependence (Watson 2009), the sample was divided with reference to the mean of participants' answers on statements related to trust.[5] Therefore, a distinction was made between individuals with a level of trust above the mean of all participants and individuals with a level of trust below the mean of all participants. This classification makes it possible to evaluate whether the improvement in collaboration and interdependence changes according to the different levels of trust.

Finally, to better understand the role of the game and which statement was more affected by the game, for each of the statements, the percentage of respondents who, after the game, changed their answers in the direction of an improvement in their attitude towards collaboration and interdependence was computed.

6 Results

To give an initial and summarized view of the changes in the respondents' answers, Table 2 shows the percentage of participants who exhibit an improvement of their means of collaboration and interdependence.

The average attitude towards collaboration seems to be greatly enhanced after the game; the percentage of individuals who improve their opinion of collaboration is 53.21%. The results for interdependence suggest that the use of games and

[5]The statements related to trust are: In my opinion, my colleagues are reliable; I know my colleagues will keep their word; I know my colleagues behave honestly with me; I know my colleagues will not deceive me. The answers regarding trust were based on a 5-point scale where 5 meant "strongly disagree", 4 "disagree", 3 "neither agree nor disagree", 2 "agree" and 1 "strongly agree".

Table 2 Percentage of respondents who improved their average idea of collaboration and interdependence according to their level of trust

	Collaboration	Interdependence
% Improvement:	53.21%	44.04%
Trust above the mean	58.87%	41.94%
Trust below the mean	45.74%	46.81%
Obs.	218	218

experiments during university courses may have a positive impact on students' perceptions and behaviour.

Focusing on the influence of trust in driving the results, it was observed that the improvement in the idea of collaboration is greater for individuals with a level of trust above the mean. The reverse is observed for interdependence, where the percentage of individuals who improve their idea of interdependence is higher for those with trust below the mean. This phenomenon leads to an interesting reflection: the ambivalent role of trust. On the one hand, in fact, trust's nature as an antecedent on collaboration is confirmed. It is confirmed that in order to develop collaborative contests, it is necessary to leverage and stimulate trust relationships among the participants (Rezazadeh and Nobari 2017). However, as this study has shown, this trust is not a matter of inter-subjective bonds but rather of a reciprocal system of expectations in which the collective orientation acts as a fiduciary glue for the group (Watson 2009). In the interdependence relationship, subjects tend to evaluate the reciprocal behaviours in a more specific way, by further examining the behaviour of others in relation to their own behaviour and expectations. It is a more personal and subjective relationship, characterized by emotional connotations (Toma and Butera 2015). In this way, reciprocal trust among people becomes the outcome of a system of relations in progress, characterized by mutual exchanges among members over time. This is a more unstable relationship than the collaborative link, on which, however, the game exerts a positive effect, with an improvement of 44.04%.

The same analysis was performed with a focus on field of studies, gender differences, parents' background and place of residence, but the t-test does not confirm the existence of significant differences between the groups considered. Given this evidence, a better idea of collaboration and interdependence after the participation in the game seems not to depend on one's own socio-demographic characteristics. However, this evidence may strengthen the prediction that sociological games may have a role in influencing individuals' attitudes in the expected direction.

The different attitudes towards the aspects previously considered may be related to the participants' personality traits. To evaluate this issue, the same analysis was implemented, focusing on 15 items available in the questionnaire regarding individuals' personality traits.[6] Participants were asked to rate themselves on a 7-point scale

[6]The 15 questions used to identify the personality traits are based on those reported in the British Household Panel Survey (BHPS), a survey conducted by the Institute for Social and Economic Research.

from “does not apply”, which takes the value of 1, to “apply perfectly”, which takes the value of 7.[7] The mean was calculated for each question, and a variable was created that, for each respondent, took the value of one if his/her answer is above the mean of the personality trait considered and zero if his/her answer is below that mean. Finally, the percentage of participants who improved their idea of collaboration and interdependence, given their personal characteristics, was calculated.

On the whole, the evidence suggests that the change of the respondents’ opinion after the sociological game is not related to the individuals’ personal traits. The differences in the means of the two groups are statistically significant only in one case.[8]

The following analysis focuses on the results of each item considered in the construction of the variables of interest, collaboration and interdependence. The improvement according to the level of trust is indicated.

Table 3 shows the percentage of respondents who improved their idea of collaboration and interdependence. Focusing on collaboration, the share varies from statement to statement, and in most cases it is greater than 20%. For two of the seven statements, it is greater than 27%. The most interesting results are found for statements 2, 6 and 7.

Regarding the improvement of the idea of collaboration by level of trust, the results show that for all of the statements but one, a relationship exists between the two aspects. The individuals with a high level of trust exhibit a higher percentage of improvement in attitude towards collaboration after the game.

The percentages of improvement for interdependence statements are lower than those for the statements concerning collaboration; in other words, it seems that the game has less impact on the perception of interdependence.

Finally, regarding the impact of trust on the improvement, the same pattern was not found for all the statements, suggesting that the attitude towards interdependence is less affected by the level of trust than the attitude towards collaboration.

The researchers are aware that the evidence presented is descriptive and must be interpreted with caution, but the results seem to highlight that the sociological game is able to affect participants’ attitudes towards collaboration and interdependence in the direction expected.

[7]The answers reported in the questionnaires administered after the game were used. However, in the literature there is evidence that the personality traits used are stable over time (Caspi et al. 2005).

[8]The results are available on request.

Table 3 Percentage of respondents who improved their idea of collaboration and interdependence

Collaboration	% Improvement	Interdependence	% Improvement
1. In a discussion you always listen to everything the others say before answering	21.10	1. It is a pleasure for me to work and study with others	12.39
Trust above the mean	24.19	Trust above the mean	12.90
Trust below the mean	17.02	Trust below the mean	11.70
2. I try to convince others by offering myself as an example	27.06	2. Studying/working with others improves my performance	14.22
Trust above the mean	28.23	Trust above the mean	16.94
Trust below the mean	25.53	Trust below the mean	10.64
3. To evaluate the effectiveness of what I say, I consider the answers that others give me	22.48	3. You must rely on others' help to obtain great results	22.48
Trust above the mean	25.00	Trust above the mean	24.19
Trust below the mean	19.15	Trust below the mean	20.21
4. I work in order to have harmony and collaboration around me	19.27	4. You must study/work with others to be successful	19.72
Trust above the mean	20.97	Trust above the mean	18.55
Trust below the mean	17.02	Trust below the mean	21.28
5. I try to work in such a way that others believe in what I ask of them	21.56	5. Change is an opportunity to develop	16.97
Trust above the mean	21.77	Trust above the mean	16.94
Trust below the mean	21.28	Trust below the mean	17.02
6. In teamwork, I try to stimulate the participation of everyone, especially those who tend to participate less	24.31	6. After exchanging opinions with others, I see things from another point of view	20.64
Trust above the mean	21.27	Trust above the mean	20.16
Trust below the mean	27.66	Trust below the mean	21.28
7. When there are differences of opinions, I try not to avoid barriers	28.29	7. When reality proves not to be what I expected, I am willing to change my expectations	17.89
Trust above the mean	29.84	Trust above the mean	19.35
Trust below the mean	27.66	Trust below the mean	15.96
		8. When faced with a decision, I look to others and their behaviour	27.52
		Trust above the mean	29.84
		Trust below the mean	24.47
Obs.	218	Obs.	218

7 Conclusions

This study placed the sociological game T&T under empirical verification and, at the same time, considered the factors that enhance collaboration. First of all, it was intended to evaluate how game structure and dynamics favour collaborative dynamics. The game is designed to stimulate reciprocal interactions among participants. Apart from the leader, the group of players is a community of peers—a tribe, as it is called in the game. Participants spend a lot of time together: They know each other, they exchange expectations, and work they together. The phases of the game require that participants share ideas, resources and goals. And T&T requires that they find individualistic or collaborative strategies to realize these objectives. The game exposes the players to a collective stress, since it provides that they must perform complex tasks and face the same challenging situation. The results of the tests show that these stimuli increase the participants' degree of collaboration and interdependence. Thus, they generate a virtuous circle: The more people interact under certain conditions, the more they tend to collaborate and create links among themselves. This circle has the property of reinforcing collaboration and interdependence at the same time, as well as of compensating for the ineffectiveness of trust in encouraging interdependence.

The results show that trust is an important antecedent to collaboration, but it is mutual interactions that stimulate the degree of interdependence. This is possible because, during the game, people are forced to put themselves "in other people's shoes", increasing their reciprocal knowledge and interdependence. The social behaviour is therefore negotiated, time after time, during a kind of interaction that is by its own nature collaborative. It is a constant exercise of social positioning (Goffman 1967), and collaboration grows among people who recognize themselves as peers while facing a common challenge (Sennett 2012).

The conditions of T&T that foster collaboration are the following: mutual interaction, common goals, low hierarchy, and trust. The style of leadership and the figure of the leader do not seem to influence the collaborative dynamics. The results of the tests do not highlight particular differences between the different game sessions or therefore between the different styles of leadership played. The organization of the game, mutual interactions and the common purpose contribute to favouring attitudes and collaborative behaviours in a more marked way than the leader's ability to influence groups (Bales 1959).

Collaboration, as shown by studies on entrepreneurship (Austin et al. 2006; Bedwell et al. 2012; Ribeiro-Soriano and Urbano 2009), is a key element for the growth of entrepreneurial activities. The results of this study, which involved university students and entrepreneurs, show that the game T&T is effective in stimulating collaboration in both educational and business environments. There were no significant differences between the game sessions, and this makes it possible to hypothesize that the processes activated by the game are transversal to different social environments and groups in learning. Within the limits of time and space of its realization, the game is confirmed to be an effective method of cooperative learning, based on peer interactions.

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