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Global Entrepreneurship and Development Index 2014

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Global Entrepreneurship and Development Index 2014

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This volume is an adaptation of a published version of the full GEDI 2014 report.

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Chapter 1
Introduction

After 6 years, the world has begun to put the global recession of 2009 behind it: while some parts of the world have pushed through the recession and returned to economic health, others have yet to emerge from massive debt and lackluster growth. Entrepreneurship plays an important role in both dynamics, as gradual recovery brings strategic opportunities for growth. In China, for example, entrepreneurs can help reduce economic dependency on infrastructural investment by catalyzing consumer demand. In country such as Greece, however, where the uncertainty of a lagging recovery dampens the confidence of business, entrepreneurs are having a more difficult time helping to turn the economy around.

The world economy is facing important medium- and long-term challenges. Whereas rich countries are challenged to increase their economic productivity to sustain current standards of living while their population is rapidly aging, low-income economies will need to integrate more than three billion young adults into the world economy by 2050. Economic initiatives by enterprising individuals are likely to be the key in addressing the challenges of long-term productivity in rich countries, whereas low-income countries struggle to find the most productive way to integrate their rapidly growing populations into their economies.

Over 100 years ago, in the *Theory of Economic Development,* Joseph Schumpeter pointed out that entrepreneurs are important for development. Today, we can expand on that to say they are not only important but are also the key drivers of economic

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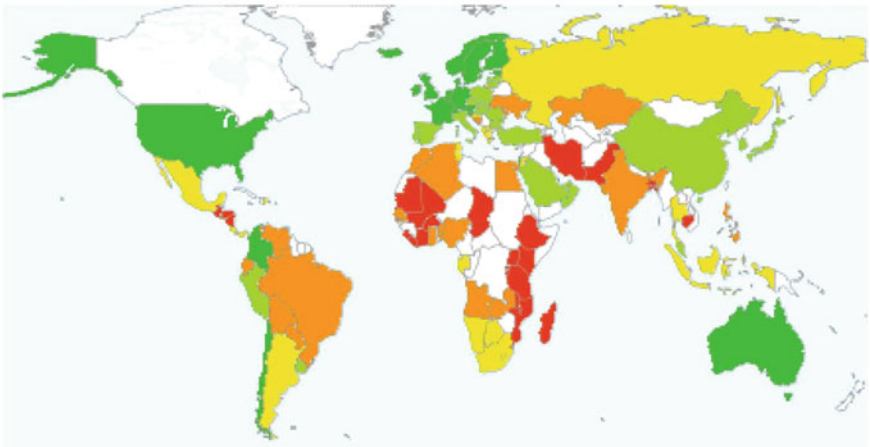
development. While Schumpeter was describing countries with similar levels of development, in today's globalized world, we are dealing with countries at very different levels of development. Over time, the importance of institution such as the rule of law and education in economic development has become increasingly clear to economists and policymakers alike (Acemoglu and Robinson 2011), and we now must understand clearly why institutions are important for development and what roles they play. We have learned that one reason they are important is because they create the incentive structure that determines the behavior of entrepreneurs. Without positive incentives in society, entrepreneurs will not engage in productive activities.

This is the fourth edition of the *Global Entrepreneurship and Development Index* (GEDI), whose *mission* is to provide a detailed look into the entrepreneurial character of nations. This composite index, which includes both individual- and institutional- country-level data, gives policymakers a tool for understanding the entrepreneurial strengths and weaknesses of their countries' economies, thereby enabling them to implement policies that foster productive entrepreneurship. GEDI was designed to help governments harness the power of entrepreneurship to address these types of challenges.

The *purpose* of GEDI is to capture the essence of entrepreneurship, and thus to contribute to a richer understanding of economic development and to fill a gap in our ability to measure it. The GEDI offers a way to measure the quality and the scale of the entrepreneurial process in 120 countries around the world. It also captures the contextual features of entrepreneurship by measuring entrepreneurial attitudes, abilities, and aspirations. These data, and the contribution they make to the process of forming businesses, are supported by three decades of research into entrepreneurship across a host of countries.

Departing from both output-based entrepreneurship indexes (i.e., new firm counts) and process-based indexes (i.e., comparisons of policies and regulations), the GEDI is designed to profile "national systems of entrepreneurship" (2014). Moreover, because entrepreneurship can have both economic and social

Map: 2014 GEDI results



Top quintile			Second quintile			Third quintile			Fourth quintile			Bottom quintile		
Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank
United States	82.5	1	Lithuania	49.6	25	Croatia	40.9	49	Nigeria	31.6	73	Cameroon	24.6	97
Australia	77.8	2	Poland	49	26	South Africa	40.3	50	Jamaica	31.4	74	Liberia	24.5	98
Sweden	73.7	3	Latvia	48.4	27	Cyprus	40.2	51	India	31.3	75	Iran	24.1	99
Denmark	72.5	4	United Arab Ei	48.2	28	Montenegro	39.5	52	Moldova	31.1	76	Honduras	23.9	100
Switzerland	70.9	5	Oman	47.6	29	Brunei Daruss	39.2	53	Bolivia	31.1	77	Kenya	23.8	101
Taiwan	69.5	6	Portugal	46.9	30	Lebanon	38.9	54	El Salvador	31	78	Tanzania	22.5	102
Finland	69.3	7	Spain	46.8	31	Barbados	38.5	55	Kazakhstan	30.6	79	Nicaragua	22.1	103
Netherlands	69	8	Korea	46.7	32	Argentina	38.4	56	Brazil	30.4	80	Rwanda	21	104
United Kingdo	68.6	9	Hong Kong	46.5	33	Mexico	38.2	57	Trinidad & Tob	30.3	81	Gambia	21	105
Singapore	67.9	10	Slovakia	46.5	34	Greece	37.7	58	Ukraine	30.2	82	Malawi	20.8	106
Iceland	67.5	11	Japan	46.1	35	Tunisia	37.2	59	Morocco	29.5	83	Guatemala	20.7	107
France	67.2	12	Bulgaria	45.4	36	Costa Rica	37.2	60	Ecuador	29.2	84	Mozambique	20.6	108
Belgium	66.5	13	Bahrain	45.4	37	Namibia	36.8	61	Algeria	29.1	85	Burkina Faso	19.8	109
Norway	65.1	14	Uruguay	45.3	38	Macedonia	36.1	62	Swaziland	29	86	Ethiopia	19.8	110
Chile	65	15	Turkey	44.7	39	Botswana	35.6	63	Paraguay	28.8	87	Madagascar	19.5	111
Germany	64.6	16	Romania	44.6	40	Thailand	35.5	64	Angola	28.7	88	Côte d'Ivoire	19.4	112
Austria	63.9	17	Czech Republ	44.5	41	Panama	34.8	65	Philippines	28.5	89	Uganda	19.3	113
Ireland	61.8	18	Hungary	44.5	42	Dominican Re	34.3	66	Zambia	28.4	90	Mali	18.8	114
Puerto Rico	61.7	19	Kuwait	44.2	43	Indonesia	34.2	67	Bosnia and He	27.7	91	Pakistan	18.7	115
Israel	59.6	20	Malaysia	44.1	44	Serbia	33.9	68	Venezuela	26.4	92	Mauritania	18.5	116
Estonia	58.9	21	Saudi Arabia	43.4	45	Russia	33.2	69	Ghana	26.2	93	Sierra Leone	17.6	117
Slovenia	52.7	22	China	41.6	46	Gabon	32.7	70	Egypt	25.2	94	Burundi	15.5	118
Qatar	52.6	23	Peru	41.3	47	Albania	32.6	71	Senegal	24.7	95	Chad	15	119
Colombia	49.8	24	Italy	40.9	48	Jordan	31.7	72	Benin	24.6	96	Bangladesh	13.8	120

consequences for the individual, the GEDI also captures the dynamic, institutionally embedded interaction between the individual-level attitudes, abilities, and aspirations that drive productive entrepreneurship.

The GEDI is not a simple count of, say, new firm registrations, nor is it an exercise in policy benchmarking. The index also does not focus exclusively on high-growth entrepreneurship; it also considers the characteristics of entrepreneurship that enhance productivity, which is innovative, market expanding, usually growth oriented, and has an international outlook.

Finally, the GEDI recognizes that entrepreneurship can mean very different things in different economic and institutional contexts. A horticultural venture, for example, would have different economic consequences for the Kenyan economy than would a social media start-up in Silicon Valley. Recognizing that entrepreneurship has a different impact in different contexts, the GEDI combines individual-level data with data that describe national institutions, as well as economic and demographic structures, to provide an institutionally embedded view of the drivers of productive entrepreneurship.

As you can see from the map, GEDI has almost universal coverage in Europe, North and South America, and Asia like the other important indices. All the large countries are now included. We still have some countries missing in Africa and Eurasia. We hope to have this coverage complete in the next few years. We also have a few countries where the data are very old and we could not include them in the index, for example, Canada and New Zealand. Canada will be included in the 2015 version again.

The GEDI method has gone through significant changes since the three previous versions (Acs and Szerb 2011, 2012; Acs et al. 2013). First, we have changed the institutional variable of Risk Capital from Venture Capital to the Depth of Capital Market in order to include a more complex measure of the financial markets (Groh et al. 2012). This is important because venture capital represents only a small percentage of firm finance. Second, we have altered the GEDI point calculation to address concerns about marginal rates of substitution between pillars. Finally, we have introduced a gender pillar to the entrepreneurial abilities sub-index (Acs et al. 2011).

In this 2014 version, we have evolved from the previous Penalty for Bottleneck methodology to one that equalizes the average pillar value across pillars. The result is an improvement in rates of substitution across pillars; however, this change in methods means that 2014 results cannot be directly compared to the GEDI report rankings from 2011, 2012, and 2013, as rankings have changed slightly in some cases and point values have changed more significantly. To achieve a valid comparison, all the points and rankings in the 2014 GEDI report (even those for previous years) have been calculated with the new methodology. A detailed explanation of the redesigned and improved version of GEDI method is provided in Chap. 5.

In this introduction, we compare the 2013 version of the index[1] (Acs et al. 2013) with the 2014 version and review changes in country rankings. Note that the 2013 version points and rankings are also calculated with the renewed GEDI method. Table 1.1 presents the 10 most entrepreneurial countries in the 2014 edition of the GEDI and compares them to the 2013 GEDI rankings.

The USA maintained its number-one position on the GEDI, although its point value decreased slightly, from 82.6 to 82.5. Four of the top-10 countries have lower GEDI point values in 2014 than they did in 2013. As a result, the divergence between the USA at the top and the European countries that follow has decreased

[1] This version uses data collected in mid-2012.

Table 1.1 The 10 most entrepreneurial countries in 2014

Country	GEDI 2014	Rank 2014	GEDI 2013	Rank 2013
USA	82.5	1	82.6	1
Australia	77.8	2	78.2	2
Sweden	73.7	3	73.3	3
Denmark	72.5	4	69.7	8
Switzerland	70.9	5	69.8	7
Taiwan	69.5	6	66.2	11
Finland	69.3	7	64.9	13
Netherlands	69.0	8	73.1	4
United Kingdom	68.6	9	70.3	6
Singapore	67.9	10	62.0	18

slightly. The difference between the USA and the strongest European nation, Sweden, decreased from 11.3 % in 2013 to 10.7 % in 2014. Australia and the UK have also experienced a decline, while the Netherlands lost four positions due to a 4.2 points decrease in its GEDI point value.[2] At the same time, Singapore, Finland, Taiwan, Denmark, and Switzerland managed to increase their levels of productive entrepreneurship. Taiwan, with its historically high score of 69.5, jumped to sixth place, and with 67.9 points Singapore ranks tenth, also for the first time in GEDI history. After a decline from 2011 to 2012, Finland regained its privileged position in the group of the 10 best entrepreneurial nations.

Table 1.2 lists all 120 countries in the latest, 2014 GEDI ranking. We have already seen that the top spots are dominated by the USA and Australia along with small Scandinavian countries. This is followed by a mixture of more and less populous countries around the world. The table shows that developing countries in Africa, South America, Asia, and the Middle East occupy the bottom rankings. Bangladesh and Chad occupy the last two places, after many African countries were added. Nigeria is the most populous country in Africa and ranks 73rd on the GEDI index. The United Arab Emirates, which continues to lead the Middle East, is clustered with Poland, Latvia, Oman, and Portugal. The relatively low rankings of India and, surprisingly, China are explained by their large rural and agricultural sectors, which pull down their rankings.

Table 1.3 shows the countries that made the greatest gains on the GEDI from the 2013 edition to the 2014 edition. The 10 countries that made the greatest gains changed rankings from a high of 18 places to a low of 5. Colombia increased by 5.3 points followed by Costa Rica with 6.7 points. In addition to changes in Latin America, we also see changes in Europe with Finland, France, and Estonia making significant improvements in the entrepreneurship climate. In Asia, India improved significantly, and in Africa, Angola gained over 6 points.

[2] The Netherlands was one of the biggest improvers in the 2011–2012 time period.

Table 1.2 Points and ranks of the countries in the 2014 GEDI

Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank
USA	82.5	1	Czech Republic	44.5	41	Trinidad and Tobago	30.3	81
Australia	77.8	2	Hungary	44.5	42	Ukraine	30.2	82
Sweden	73.7	3	Kuwait	44.2	43	Morocco	29.5	83
Denmark	72.5	4	Malaysia	44.1	44	Ecuador	29.2	84
Switzerland	70.9	5	Saudi Arabia	43.4	45	Algeria	29.1	85
Taiwan	69.5	6	China	41.6	46	Swaziland	29.0	86
Finland	69.3	7	Peru	41.3	47	Paraguay	28.8	87
Netherlands	69.0	8	Italy	40.9	48	Angola	28.7	88
United Kingdom	68.6	9	Croatia	40.9	49	Philippines	28.5	89
Singapore	67.9	10	South Africa	40.3	50	Zambia	28.4	90
Iceland	67.5	11	Cyprus	40.2	51	Bosnia and Herzegovina	27.7	91
France	67.2	12	Montenegro	39.5	52	Venezuela	26.4	92
Belgium	66.5	13	Brunei Darussalam	39.2	53	Ghana	26.2	93
Norway	65.1	14	Lebanon	38.9	54	Egypt	25.2	94
Chile	65.0	15	Barbados	38.5	55	Senegal	24.7	95
Germany	64.6	16	Argentina	38.4	56	Benin	24.6	96
Austria	63.9	17	Mexico	38.2	57	Cameroon	24.6	97
Ireland	61.8	18	Greece	37.7	58	Liberia	24.5	98
Puerto Rico	61.7	19	Tunisia	37.2	59	Iran	24.1	99
Israel	59.6	20	Costa Rica	37.2	60	Honduras	23.9	100
Estonia	58.9	21	Namibia	36.8	61	Kenya	23.8	101
Slovenia	52.7	22	Macedonia	36.1	62	Tanzania	22.5	102
Qatar	52.6	23	Botswana	35.6	63	Nicaragua	22.1	103
Colombia	49.8	24	Thailand	35.5	64	Rwanda	21.0	104
Lithuania	49.6	25	Panama	34.8	65	Gambia	21.0	105
Poland	49.0	26	Dominican Republic	34.3	66	Malawi	20.8	106
Latvia	48.4	27	Indonesia	34.2	67	Guatemala	20.7	107
United Arab Emirates	48.2	28	Serbia	33.9	68	Mozambique	20.6	108
Oman	47.6	29	Russia	33.2	69	Burkina Faso	19.8	109
Portugal	46.9	30	Gabon	32.7	70	Ethiopia	19.8	110
Spain	46.8	31	Albania	32.6	71	Madagascar	19.5	111
Korea	46.7	32	Jordan	31.7	72	Côte d'Ivoire	19.4	112
Hong Kong	46.5	33	Nigeria	31.6	73	Uganda	19.3	113

(continued)

Table 1.2 (continued)

Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank	Country	GEDI points	GEDI rank
Slovakia	46.5	34	Jamaica	31.4	74	Mali	18.8	114
Japan	46.1	35	India	31.3	75	Pakistan	18.7	115
Bulgaria	45.4	36	Moldova	31.1	76	Mauritania	18.5	116
Bahrain	45.4	37	Bolivia	31.1	77	Sierra Leone	17.6	117
Uruguay	45.3	38	El Salvador	31.0	78	Burundi	15.5	118
Turkey	44.7	39	Kazakhstan	30.6	79	Chad	15.0	119
Romania	44.6	40	Brazil	30.4	80	Bangladesh	13.8	120

Table 1.3 The 10 biggest gains on the GEDI from the 2013 to the 2014 edition

Country	Points 2013	Points 2014	Difference in points	Difference in ranking
Colombia	44.5	49.8	5.3	−18
Costa Rica[b]	30.5	37.2	6.7	−16
Namibia	30.9	36.8	6.0	−14
India[c]	26.6	31.3	4.7	−13
El Salvador[a]	26.5	31.0	4.5	−12
Angola[b]	22.6	28.7	6.1	−12
Singapore	62.0	67.9	5.8	−8
Finland	64.9	69.3	4.4	−6
France	62.5	67.2	4.7	−5
Estonia[a]	50.7	58.9	8.2	−5

Legend [a] 2011 individual data are estimated
[b] Individual data used in 2011 are from 2010
[c] Individual data used in 2011 are from 2008

Table 1.4 shows the biggest losers in the 2013 edition of GEDI relative to the 2014 edition. Some counties improved their relative position while others decreased by similar amounts. The decline was most notable in Europe with Italy leading the way followed by the Czech Republic, Hungary, Greece, Spain, and the Netherlands. These results are across the board in Europe reflecting the extent of the Euro crisis and the recession. We also saw declines in Middle East with Saudi Arabia and the United Arab Emirates losing ground.

The most important change we have made to the index is that we have added another pillar of entrepreneurship—Gender—to reflect the increasing participation and importance of females in the system of productive entrepreneurship. The issue of gender is influenced by a complex interaction between markets, institutions, and attitudes which has direct effects on entrepreneurial behavior and economic outcomes. In this Index, we included a pillar to gain insights into the status of women's entrepreneurship at the country level. The Gender pillar includes two dimensions: The percentage of female start-ups combined with a measure for equal economic participation and opportunity. A useful way to view the results of the gender pillar

Table 1.4 The 11 biggest declines on the GEDI between the 2013 and 2014 editions

Country	Points 2013	Points 2014	Difference in points	Difference in ranking
Italy[b]	48.8	40.9	−8.0	17
Czech Republic[c]	50.4	44.5	−5.9	14
Hungary	49.4	44.5	−5.0	14
Greece	42.9	37.7	−5.1	11
Saudi Arabia[d]	48.0	43.4	−4.6	11
Puerto Rico[a]	69.1	61.7	−7.4	10
Croatia	45.0	40.9	−4.1	9
United Arab Emirates	54.4	48.2	−6.2	6
Spain	51.1	46.8	−4.3	6
Netherlands	73.1	69.0	−4.2	4

Legend [a] Both 2011 and 2012 individual data are from 2007
[b] Individual data used in 2011 are from 2010
[c] Individual data used in 2012 are from 2011
[d] Both 2011 and 2012 individual data are from 2010

is through a 2 × 2 matrix which compares the gender pillar scores with a country's level of GDP.

Figure 1.1 has four quadrants representing the midpoint of the gender index and $25,000 in GDP, about half of global income levels. The lower left quadrant represents poor economic conditions and low levels of economic participation and opportunity for women. It is where income is low and women's economic opportunities are restricted. The upper left quadrant represents a condition that is still economically low but women's economic participation and opportunities are improved. The lower right quadrant represents countries where economic conditions are good but economic participation and opportunities for women are poor. The upper right box represents both good economic conditions and high levels of economic participation and opportunities for women. One would expect countries might go from the lower left quadrant to the upper right quadrant over time.

However, as the results of Fig. 1.1 show, it is not necessarily the case that economic development alone reduces or eliminates gender inequalities. Market and institutional failures as well as restrictive attitudes must be addressed as they come at an economic cost. Countries able to fully unleash the potential of women as entrepreneurs will be in a better position for sustained economic growth.

Figure 1.1 shows our four quadrants for each of the 120 countries in our GEDI index. What is rather surprising is that there is almost no discernable pattern across the countries. In other words, the correlation between gender equality and economic development does not exist. Moreover, the gender pillar does not correlate with the other 14 pillars of GEDI nor does it correlate with income. We find countries in all four quadrants.

However, when we look at the world from the perspective of different sub-regions, some patterns do appear. First, and perhaps the most interesting, sub-Saharan African

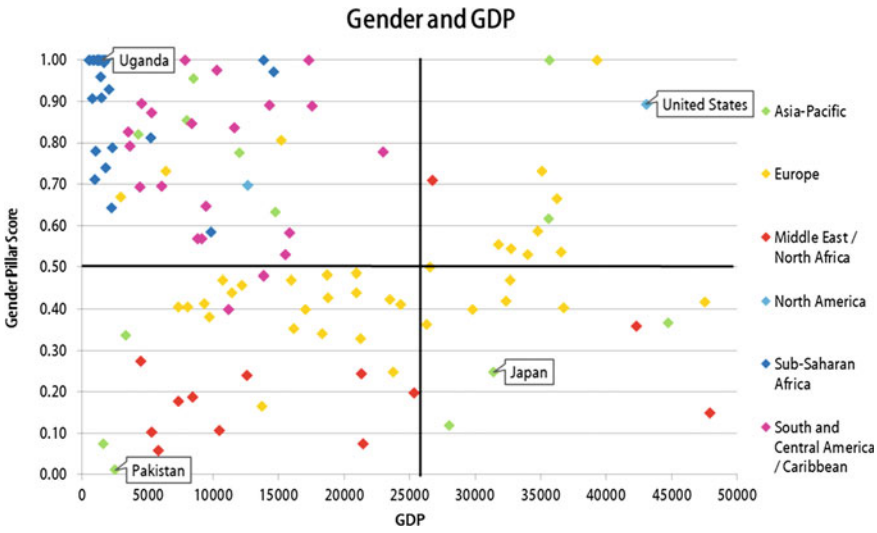


Fig. 1.1 Regional patterns in gender equality and GDP

countries seem to almost all cluster in the poor economic and greater gender equality. Even the poorest countries appear to offer higher levels of gender equality—a phenomenon driven partly by high numbers of necessity-driven micro-entrepreneurs. Middle East and North African countries seem to cluster mostly in the poor cultural conditions and they straddle both the low-income and high-income conditions. Europe occupies a place in between these two extremes with most countries around a 0.50 gender score and a middle income level. North America occupies the upper right quadrant with good gender equality and high levels of income. Latin America is closer to better cultural conditions and worst economic conditions.

Four examples stand out. Uganda represents a country with a perfect gender score of 1.0. However, it is a factor-driven economy with a per capita GDP of $1,165.00 or about $3 a day per person. It scores very poorly on almost all of the other pillars including 0.04 on the quality of human resources and 0.07 on high-growth firms in the country. Pakistan represents the quadrant with low-gender equality and poor economic conditions. It has a more balanced set of GEDI indicators with Gender being the worst pillar at 0.01. The country has a $2,491.00 per capita GDP and is also a factor-driven economy.

The lower right hand box is populated by rich countries characterized by low levels of gender equality. Our example here is Japan, one of the richest countries in the world with a $32,425.00 per capita GDP and a population of almost 130 million people. Its gender score is 0.25. Japan also has an unbalanced GEDI profile with very strong showings in high-growth companies, process, and product innovation. However, its entrepreneurial strengths are sapped by a lack of start-up skills and opportunity presentation. This does not mean that Japan does not have strong cultural basis for economic development only that it is not shared by all. The USA is our example of a country with high income and good gender equality along with

Australia and Singapore. The USA not only ranks first in the GEDI index but also it scores very high in gender equality with a score of 0.89.[3]

Box 1: Ingerrecuperar: Recycling Smelting By-products into Valuable Building Materials

Profitable firms that produce net environmental benefits are the much discussed but infrequently demonstrated achievement of sustainable development. But Carolina Guerra, a native of Colombia, has successfully created just such a firm. Guerra and her cofounders at Ingerrecuperar saw and seized an opportunity to turn aluminum dross—a hazardous by-product of the smelting process—from a waste product into a valuable input for materials used in construction.

Guerra's approach was two-pronged: raising awareness on the environmental impact of aluminum dross, and finding a profitable way to recycle it. She won the Cartier Women's Initiative Award for Ingerrecuperar in 2011, which brought international attention to her efforts and added to the credibility of the initiative.

The GEDI Context

Colombia is an efficiency-driven economy ranked 39th in the 2012 GEDI and third in Latin America. Colombia's main strengths in terms of entrepreneurial performance include a positive attitude toward entrepreneurship as a career choice, a low regulatory burden, and a population confident in its business skills. Its weaknesses include low government R&D investment, few informal investors, a small tech sector, and a high level of corruption.

The GEDI results confirm a number of Guerra's observations and experiences doing business in Colombia. She feels that new legislation passed in 2011 has dramatically improved the situation for businesses. As she recalls, "When we started in 2007, we had to scratch our way through with our nails," adding that new businesses were not given any incentives or tax breaks: "We had to pay the same tax rate as a multinational!"[4]

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[3] Gender is a complicated subject and difficult to capture through the addition of a gender pillar. In 2013, the Global Entrepreneurship and Development Institute launched the Gender-GEDI which is first ever index for female entrepreneurship. The Gender-GEDI project spearheaded by Ruta Aidis and sponsored by Dell Computers ranks and scores countries according to their potential for fostering "high–impact" female entrepreneurs. (www.thegedi.org) (www.dell.com/dwen).

[4] Ruta Aidis interview, June 5, 2012.

Excerpt from a case study contributed by Ruta Aidis for "Identifying the obstacles to high-impact entrepreneurship in Latin America" by Zoltan Acs and Paulo Correa, The World Bank (2014).

Guerra's experiences also convey that new businesses in Colombia have a very difficult time accessing outside funding, especially start-up funding for innovative eco-firms such as Ingerrecuperar, whose founders self-financed the initial operation and went without salaries for two years until the business became profitable. Guerra also noted that corruption continues to present a barrier for new businesses in Colombia.

Through their innovative efforts, Guerra and her partners at Ingerrecuperar served as leaders and educators to both the private and public sectors in Colombia in terms of recycling and proper hazardous waste disposal. They introduced a new technology for recycling aluminum dross into materials that meet standards for LEED-certified buildings. As the first and only company in Colombia with an environment license to recycle aluminum dross, they have positioned themselves in an exponentially growing niche eco-market.

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Chapter 2
National Systems of Entrepreneurship

2.1 Introduction

Although the economic importance of entrepreneurship has been formally recognized at least since the times of Schumpeter over 100 years ago, purposeful policy efforts to harness this driver of economic growth originated substantially later. It is really during the past 30 years or so that policymakers have started to target small- and medium-sized firms and new entrepreneurs. Policy initiatives have gradually grown more refined over time, and today many talk about "entrepreneurship ecosystems," a term used to refer to a palette of policy measures that address the broad range of needs new ventures have during their early life cycle. However, such policies often are based on a relatively narrow conception of how entrepreneurship actually contributes to economic growth. While a broad range of benefits has been associated with entrepreneurship, ranging from innovation (Acs and Audretsch 1988) to job creation (Blanchflower 2000; Parker 2009) to productivity (e.g., van Praag 2007), a coherent framework articulating such benefits has been lacking. To address this gap and to provide a coherent theoretical grounding for the GEDI approach, we have advanced the theory of National Systems of Entrepreneurship (Acs et al. 2013).

In this chapter, we lay out the main features of this theory and illustrate how the GEDI methodology captures its core features. We propose that a major shortcoming in policy thinking is the failure to recognize that entrepreneurship is a systemic phenomenon and should be approached as such. The concept of National Systems of Entrepreneurship addresses that gap by recognizing the systemic character of country-level entrepreneurship, and the fact that entrepreneurial processes are fundamentally driven by individuals, despite being embedded in a country-level context. Finally, we illustrate how the GEDI method can be harnessed for entrepreneurship policy analysis, design, and implementation.

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2.2 The National Systems of Innovation

From the times of Adam Smith (1723–1790) and David Ricardo (1772–1823), many theories have been advanced to explain economic development. With the exception of Schumpeter, however, these theories have tended to overlook entrepreneurship as a potentially useful economic function that drives growth. Schumpeter famously identified entrepreneurs as "agents of creative destruction" who challenge industry incumbents by introducing new products, services, innovative processes, and organizational innovations that offer greater value than what the incumbents are able to offer. Industry incumbents, Schumpeter argued, are by nature monopolistic and prefer to establish and exploit a status quo, and without the challenges presented by entrepreneurs, they would stop innovating and be content just to exploit their market leadership. By innovating, entrepreneurs force incumbents to upgrade their game or to exit the market if they cannot. To Schumpeter, this creative destruction was the ultimate source of economic development.

Schumpeter preferred this entrepreneur-centric model early on, but he later changed his mind, prompted by the emergence of large corporations with dedicated R&D laboratories. Schumpeter came to believe that this change enabled large corporations to internalize technological development, and the economies of scale in R&D meant that new entrepreneurs could no longer effectively challenge incumbents for market leadership. Schumpeter's "Mark II" model was later to dominate the Schumpeterian approach to explaining economic development, while the entrepreneur-centric "Mark I" model was largely ignored.

Modern theorizing about economic growth begun with the work of Solow (1957), who explored the relationships among labor, capital investment, and economic output. They theorized that increasing capital investment leads to greater economic growth, since capital investment enables a more effective use of labor. However, diminishing returns to this investment mean that, beyond a certain point, additional capital investment will stop producing additional economic growth. The only way to move beyond this steady state is through technological advances. This was the infamous Solow residual, which treated technological development as exogenous to the economic system.

Another pair of economists, Paul Romer and Robert Lucas Jr., were not satisfied with the Solow theory and sought to make technological development part and parcel of economic dynamism. Human capital and technological innovation were central notions in their theory, which posited that human capital exhibits increasing returns and that well-educated individuals tend to invent new things. Attempts to take advantage of those new things (i.e., technological advances) are what drive economic growth. Interestingly, they also used the term "entrepreneur," although not to refer to individuals who start new firms but to inventors who create and exploit technological advances.

Romer (1990) and Lucas (1988) were influential in using technological innovation as a central, endogenous variable in explaining economic development. However, they did not elaborate much on how these advances were produced.

To address this gap, economic historians and innovation sociologists started to explore in greater detail the determinants of countries' innovative performance. This effort gave rise in the early 1990s to the concept and theory of National Systems of Innovation (NSI) (Edquist 1997; Lundvall 1992; Nelson 1993). This new literature maintained that innovation and the accumulation of knowledge are the fundamental drivers of economic growth. In economic systems, knowledge is produced in a cumulative and iterative fashion, and the process itself is regulated by a country's institutions (Lundvall 1999). Because the process of creating knowledge is embedded in a country's institutional context, it cannot be properly understood without considering the context within which the process is embedded. This also means that the "linear model of innovation," in which knowledge outputs are gradually refined and moved from basic research to applied R&D and eventually to the market, was oversimplifying because it did not consider context and assumed that individual firms were mainly responsible for a country's innovation performance. The NSI literature instead maintained that a country's innovation performance is determined by the structure of its National System of Innovation. It is this structure, and interactions between the institutional operators within it, that determines a country's innovation outcomes. Consequently, substantial time and effort were dedicated to describing different national (and, subsequently, sectoral) systems of innovation: how they functioned, their structure, interactions between different organizations, and so on.

Although the concept of NSI inspired a significant literature that explored determinants of country-level innovation, this literature also had a number of shortcomings. Ironically, although it drew significant inspiration from Schumpeter, the NSI literature failed to consider the actions of entrepreneurs to any extent. Instead of Schumpeter's entrepreneur-centric Mark I model of innovation, this literature was mainly influenced by Schumpeter's later Mark II model, which emphasized the role of large firms in innovation. Consequently, the NSI literature became preoccupied with static structure while ignoring entrepreneurial agency. In this structural tradition, "institutions engender, homogenize, and reinforce individual action: It is a country's institutions that create and disseminate new knowledge and channel it to efficient uses" (Acs et al. 2013). Institutions and structures somehow produce and disseminate new knowledge, and the motivations, aspirations, and activities of individuals do not really matter. The key is to get structures right, and action will follow. Because of this emphasis, the NSI literature acquired quite a static flavor and was seen by many as unable to really predict innovation performance, rather than simply explaining it.

The NSI literature has consistently had a strong descriptive emphasis, yet it has never had a single, coherent theoretical grounding. Because of this, NSI research has primarily explored description rather than prescription, not to mention prediction. Therefore, while the NSI literature has been influential and informative, its popularity has also waned somewhat in recent years.

One may speculate why the NSI literature has so consistently failed to incorporate entrepreneurship as a central element of innovation production. Perhaps one important reason is that its routine-reinforcing and structural emphasis is difficult to

reconcile with the entrepreneurship literature, which breaks routines and is individual centric. Nevertheless, entrepreneurs still are largely ignored by theories of economic development and growth, and calls for policies that harness entrepreneurship for economic growth therefore remain, strictly speaking, without a strong theoretical foundation.

This problem is due in part to the corresponding failure of entrepreneurship research to systematically address the broader macroeconomic implications of entrepreneurial action, as well as the regulating influence that an entrepreneur's context exercises on that action. Simplistically put, whereas the NSI literature has been all about context at the expense of the individual, the entrepreneurship literature has been all about the individual at the expense of context. The heterogeneous literature on entrepreneurship has, for the most part, focused on the individual—that is, the entrepreneur—and on the new venture. Although the research questions addressed by the entrepreneurship literature are varied, it is fair to say that this literature has been preoccupied by two major questions: What factors propel some individuals to start new firms, and what factors explain the growth of new ventures? We know a good deal about who starts new firms and why, and about what makes new firms successful, but we still know relatively little about when and how entrepreneurship contributes to economic development.

2.2.1 National Systems of Entrepreneurship

We propose that a way out of this "institutions versus the individual" dilemma is to think about the role the entrepreneur's context plays, not only in regulating opportunities and considering personal feasibility and the desirability of entrepreneurial action, but also in regulating the outcomes of that action (Acs et al. 2013). To start understanding how entrepreneurs might contribute to economic development, it is important to note several salient characteristics of entrepreneurial action:

1. Entrepreneurial action takes place within uncertainty; entrepreneurs take risks when creating new firms to pursue perceived opportunities.
2. Entrepreneurial action involves mobilizing resources; entrepreneurs need to access and mobilize their own resources and those controlled by others in order to pursue opportunities.
3. The great majority of entrepreneurial actions are initiated by individuals or teams of individuals.
4. Entrepreneurs' actions in pursuing opportunities are regulated not only by the entrepreneurs' perception of the opportunity but by their perception of the desirability and feasibility of the pursuit.
5. The consequences of entrepreneurial action are regulated not only by the entrepreneurs' own competencies but also by a number of contextual factors, such as the availability of external resources and access to markets.

To understand entrepreneurship as a systemic process, it is important to emphasize the resource mobilization aspect of entrepreneurial action. As entrepreneurs mobilize resources to pursue opportunities, it creates "entrepreneurial churn" (Reynolds et al. 2005), which should put resources to productive use. Because of uncertainty, entrepreneurs mobilize resources on a hunch. If this hunch proves correct, there is an opportunity to mobilize resources for value-adding uses. If the entrepreneur guesses wrong, however, she or he will stop pursuing the opportunity and the mobilized resources will be put to alternative uses. The net total of this activity, therefore, should be the allocation of human capital and resources to value-adding uses, which should drive total factor productivity.

At the macro level, therefore, entrepreneurship operates as a trial-and-error resource allocation process, which itself is driven by a multitude of entrepreneurial decisions made by individuals. Importantly, this process is regulated by contextual factors. For example, to act on perceived opportunity, the prospective entrepreneur must see the opportunity as feasible and desirable. Perceptions of feasibility will be regulated by factors such as resource availability, market openness, property protection, and so on. Perceptions of desirability will be regulated by factors such as perceived social norms, general attitudes toward entrepreneurship, and culture, to name a few. Furthermore, once the entrepreneur has decided to act, the context will regulate the likely outcomes of this action, for example, through resource availability, market openness, and other such factors.

The two key issues to understand in the above are (1) that without individual-level decisions to act, there will be no action; and (2) that the context will regulate who decides to act. The most important shortcoming of the NSI literature was that it ignored individuals and assumed that structure is sufficient to generate knowledge flows. The big omission of the entrepreneurship literature has been its failure to treat entrepreneurship as contextually embedded action. As we have highlighted above, both aspects are important, and we maintain that economic development cannot be fully understood without giving attention to both the individual and the context within which this individual is embedded. Consistent with the reasoning above, we propose the following definition of National Systems of Entrepreneurship:

> A National System of Entrepreneurship is the dynamic, institutionally embedded interaction by individuals between entrepreneurial attitudes, abilities, and aspirations, which drives the allocation of resources through the creation and operation of new ventures.

Our definition adds important insight to the conception in Austrian economics of entrepreneurship as a market discovery process (Kirzner 1997). In the Austrian theory, entrepreneurs are ascribed the role of driving market learning; they help markets move toward a state of equilibrium by initiating competitive actions and reacting to such actions that are initiated by others. Our definition adds to this conception the important notion of resource mobilization, which helps connect micro-level entrepreneurial action with growth in total factor productivity. The Austrian school also treats entrepreneurship as a market function rather than an individual-level action; thus, it is assumed that any individual will act as soon as they stumble upon a market inefficiency. We instead emphasize the psychology and

cognition of the entrepreneur, who will not necessarily act unless they perceive the pursuit of opportunity to be feasible and desirable. Because these judgments are regulated by perceived social norms, for example, it follows that a given individual may or may not choose to act, depending on the context they are in. Instead of acting automatically, as the Austrian school assumes, our theory emphasizes the conditioning effect context has on an individual's behavior.

The core assumptions of the National Systems of Entrepreneurship theory are as follows:

1. Economic growth is ultimately driven by a trial-and-error resource allocation process, under which entrepreneurs allocate resources toward productive uses;
2. This process is driven by individual-level decisions, but those decisions are conditioned by contextual factors;
3. The *outcomes* of individual-level entrepreneurial decisions are also conditioned by contextual factors; and
4. Because of the multitude of interactions, country-level entrepreneurship is best thought of as a system, the components of which coproduce system performance.

All these notions are captured by the GEDI methodology, which represents operationalization of the National Systems of Entrepreneurship theory. To illustrate how the GEDI differs from other national-level conceptions of entrepreneurship, we next review country-level indicators of entrepreneurship.

2.3 Measuring Entrepreneurship at the Country Level

Although there is no formal country-level theory of entrepreneurship, attempts to measure the "entrepreneurial character" of countries have been quite numerous. Broadly speaking, measures of country-level entrepreneurship fall into three categories: output, attitude, and framework indicators.

Output indicators track new firms, new incorporations, and the prevalence of self-employment within a given population. These measures are obtained from business registries, employment registries, or survey data. One survey-based output indicator is the Global Entrepreneurship Monitor (GEM), which surveys individuals' attempts to create new ventures by drawing on survey samples of at least 2,000 adult individuals per country to obtain a country's total early-stage entrepreneurial activity rate, which represents the rate of "nascent" and "new" entrepreneurs in the adult population (Reynolds et al. 2005). Registry-based output measures include OECD-Eurostat's Entrepreneurship Indicators Program (Lunati et al. 2010; OECD-Eurostat 2007) and the World Bank's Entrepreneurship Survey (World Bank 2011). The OECD high-growth firm indicator uses business registries to create an index of the prevalence of high-growth firms, relative to the overall population of registered companies. A high-growth firm is a registered firm (trade registry, employment registry, etc.) that has achieved at least 60 % employment

growth during a period of 2 years, with at least 20 % annual growth each year, and which employed at least 10 people at the beginning of the period (OECD-Eurostat 2007). The World Bank Entrepreneurship Survey relies on business registry data to monitor new business incorporations.

Thus, output indicators consider a country to be entrepreneurial if it has a high number of individuals trying to start new ventures or if its business registries report a high number of new incorporations. The strength of such measures is that they register "real" activity, (although many incorporations may not become active operating units). A weakness of such measures, however, is that they tend to focus on aggregates of micro-level activity while ignoring the context in which this activity is embedded. This means that any systemic aspects of the entrepreneurial process are essentially ignored by output indicators.

Attitude measures monitor a country's opinion and behavior toward entrepreneurship. Examples include the Eurobarometer survey (Gallup 2009), the International Social Survey Programme (ISSP 1997), and the GEM survey. Such surveys typically monitor a range of attitudes toward entrepreneurship, such as the preference for being self-employed, reasons for preferring self-employment (or not), and attitudes toward entrepreneurs (including their success and failure). Thus, entrepreneurial countries are those where the population exhibits a positive attitude toward entrepreneurship or a strong preference for self-employment as a career choice. While such surveys provide interesting insight into a country's opinion climate or perhaps its entrepreneurial culture, they tell us little about actual entrepreneurial activity. Attitudes do not always translate into action, and we also do not know whether attitudes drive or are driven by entrepreneurial action.

The third category of entrepreneurship indicators attempts to measure the framework conditions for entrepreneurship. One example is the World Bank Ease of Doing Business Survey, which monitors national regulations for business entry and operation (Djankov et al. 2002). Another is the OECD Entrepreneurship Indicators Program, which has developed a more comprehensive framework measure that distinguishes between framework conditions, entrepreneurship performance, and economic impact (Ahmad and Hoffmann 2008). While useful for tracking the regulatory context for entrepreneurship, including entrepreneurship policy, such measures lack connectivity with entrepreneurial activity. For these measures, an "entrepreneurial country" is one where business regulations favor new business entry and operation. However, it is not certain that a favorable regulatory framework is all that is needed to promote an entrepreneurial economy. If, for example, attitudes toward entrepreneurship are negative, light-touch regulations may not be sufficient to attract the high-quality, ambitious entrepreneurial businesses that are most likely to drive economic growth.

In sum, approaches to measuring entrepreneurship in various countries reflect different conceptions of what it means to be an entrepreneurial country. However, none of the measures fully captures the systemic character of country-level entrepreneurial processes, as emphasized in the theory of National Systems of Entrepreneurship:

- Output indicators are aggregates of micro-level activity that tend to ignore context.
- Attitude indicators reflect attitudes toward entrepreneurship but do not link them to activities or policy frameworks.
- Framework indicators only measure the regulatory and policy context while ignoring individual-level activity.

Each of these approaches is deficient from a systemic perspective. New firm counts tell us little about the processes that drive those outputs. Neither attitude measures nor framework measures tells us much about activity. To consider the system as a whole, a measurement approach is required that recognizes that

- Country-level entrepreneurship is a systemic phenomenon where many components interact to produce system performance;
- Both individuals and contexts matter in this process, and they influence one another; and
- The process itself is complex and comprises many facets.

The GEDI methodology has been designed to capture these core features of the National Systems of Entrepreneurship theory. It approaches country-level entrepreneurship as a systemic phenomenon, which is driven by the interaction between individual-level actions and country-level framework conditions. The systemic features of the theory are captured by the GEDI's:

1. *Contextualization* of individual-level data by weighting it with data describing a country's framework conditions. This approach captures the notion that individual-level activities are regulated by context.
2. Use of *15 context-weighted measures* of entrepreneurial attitudes, abilities, and aspirations, which are further organized into three subindices. This approach captures the notion that country-level entrepreneurial processes are complex and multifaceted.
3. Application of the *Penalty for Bottleneck* algorithm, which captures the notion that system components coproduce system output.
4. Consequent recognition that national entrepreneurial performance may be held back by *bottleneck factors*; for example, poorly performing pillars that may constrain system performance.[1]

As a multifaceted index, the GEDI recognizes that country-level entrepreneurship is a complex phenomenon that cannot be satisfactorily captured by single-item aggregates or by focusing exclusively on attitudes, abilities, or aspirations. Nor can it be captured by considering the framework conditions alone. What is needed, therefore, is an approach that combines all of the above. The GEDI does this by using 15 measures of entrepreneurial attitudes, abilities, and aspirations and by weighting them with descriptors of country-level framework conditions (Fig. 2.1).

[1] See Chap. 5 for a detailed description of the GEDI method.

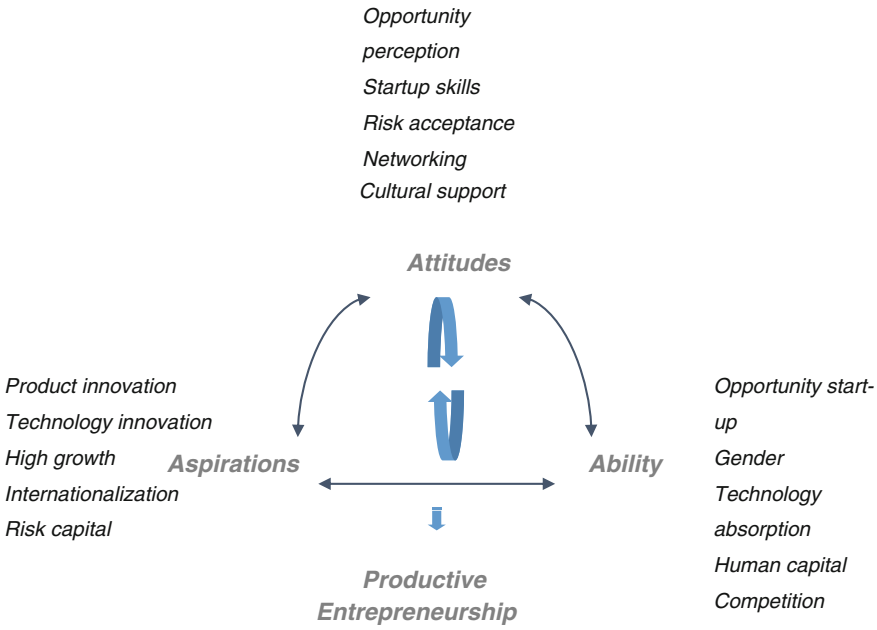

Fig. 2.1 Dynamic of National Systems of Entrepreneurship

The GEDI also captures system dynamics, going beyond traditional, linear additive index approaches. Traditional indices are summative—or, as we like to call them, "cake" indices—simply adding together different component values. As long as the sum of components is greater than some threshold value, all is considered well. This is similar to being advised to compensate for missing sugar when baking a cake by adding more flour. Although the total weight of ingredients is the same, everyone recognizes that it is difficult to bake a good cake without sugar.

By applying the Penalty for Bottleneck approach, the GEDI methodology captures the notion that systems, by definition, comprise multiple components, and that these components coproduce system performance. These are defining characteristics of any system, which simple summative indices fail to capture. In a simple summative index, each system component contributes directly and independently to system performance. In the context of entrepreneurship, this would mean, for example, that a national measure of education would, directly and independent of other system components, contribute to "national entrepreneurship," while in reality, we know that education cannot contribute much to a country's entrepreneurial performance if individuals fail to act. On the other hand, if education was absent, the economic potential of entrepreneurial entries would be severely constrained. Moreover, even if both education and agency were present, country-level entrepreneurial performance would be constrained if, for example, growth aspirations were missing or if there were no financial resources available to feed the growth of

new ventures. A simple summative index would fail to recognize such interactions, thereby ignoring crucial aspects of system-level performance.

As an important methodological innovation, the GEDI captures such system dynamics with the Penalty for Bottleneck method. As explained in more detail in Chap. 5, the GEDI is optimized to produce the highest index value when all individual component (or pillar) values (after normalization) are more or less even —in other words, when there are no major gaps between the pillars. A higher index value reflects the notion that a system's performance is optimized when its individual components are in balance. If there are major performance differences between individual pillars—that is, bottleneck factors exist within the system—the values of well-performing pillars are "penalized" by adjusting them downward. This reflects a situation where some system components constrain system-level performance, much like a chef who cannot make full use of the ingredients of a particular dish if important ingredients are in short supply.

These methodological characteristics can provide important insights into the workings of National Systems of Entrepreneurship. Essential to the notion of bottlenecks is that some factors may unduly constrain system performance beyond their "objective" or stand-alone importance. Returning to the baking analogy, although only a little yeast is required to bake bread, without it the bread will not be good, no matter how much flour is on hand. With the Penalty for Bottleneck methodology, it is possible to identify both where bottleneck factors might lurk in any given system and how much system performance suffers as a result. A corollary would be that by mixing relatively little yeast in with the other ingredients, it is possible to improvement the bread significantly at relatively little cost. These features greatly enhance the utility of the GEDI methodology for entrepreneurship policy analysis and design, as the notion of bottlenecks allows policymakers to hone in quickly on possible constraints that might hold back system performance. We now will illustrate how the GEDI can be used to build a coherent national entrepreneurship policy program with the engagement of all stakeholders.

2.4 Using the GEDI to Analyze National Systems of Entrepreneurship

The Scottish example highlights the usefulness of the GEDI method as a policy analysis, planning, and implementation platform. In 2012, Scotland was participating in a joint effort with other countries to review their entrepreneurship ecosystems. However, while Scotland had access to multiple sources of data, none of them provided the kind of comprehensive systems perspective required for this exercise. It struck the Scottish team that a regionalized GEDI approach could provide just the kind of comprehensive perspective and a rigorous approach to assessing the entrepreneurial capacity in a region, as their purposes required. However, they also recognized first, that the GEDI analysis was only as good as the quality and choice of data, and second, that it could stimulate wider debate on the

health of an innovative entrepreneurial ecosystem without acting like some computerized "policy-creating machine."

Policymakers think increasingly about entrepreneurship support in ecosystem terms. Therefore, they want to know how they can achieve the most leverage in facilitating an entrepreneurial ecosystem. To achieve this, policymakers need comprehensive data on all aspects of the system—that is, on all ecosystem pillars. Importantly, insight is needed not only into how different pillars perform but also on how they are related to one another. Unfortunately, although the GEDI methodology allows system pillars to interact, it does so under the simplifying assumption that all of them interact equally with one another. While this simplifying assumption is necessary and sufficient for generic comparisons between countries, more detail is needed for purposeful policy analysis and design. Therefore, for policy design purposes, the boilerplate GEDI analysis has to be supplemented by expert judgments made by people who know at least some aspects of the system intimately. In Scotland, a series of policy stakeholder workshops was organized to extract this insight from stakeholders within the system.

The Scottish policy stakeholder engagement process was initiated and coordinated by Scottish Enterprise, an economic development agency. The first step was to commission a boilerplate GEDI analysis from the GEDI team, which also involved adjusting the global index pillars to include Scotland-specific pillar measures. For the boilerplate analysis, Scottish Enterprise requested that the GEDI team rank Scotland's pillars in two ways: first, against all countries in the GEDI database; and second, against a subset of high-income economies. It also requested direct benchmarking comparisons against two groups of nations: first, the UK Home Nations (i.e., England, Wales, and Northern Ireland); and second, against the "Arc of Prosperity" countries (i.e., Denmark, Finland, Iceland, Norway, Sweden, and the Republic of Ireland). The first benchmark compared Scotland's performance against peers that were as similar as possible. The second benchmark compared Scotland against small, prosperous, open economies, which were able to offer Scotland aspirational benchmarks in selected domains.

The boilerplate GEDI report contained three analyses:

- GEDI pillar numbers for Scotland: individual-level data, institutional data, and pillar values
- Scotland rankings relative to the world and to high-income countries, respectively, for all pillars (including individual-level and institutional data rankings)
- Benchmarking comparisons in the form of spider-web graphs
- A "policy portfolio optimization" analysis, which identified priority pillars to improve with a view to enhancing the performance of the Scottish National System of Entrepreneurship.

A series of three policy stakeholder engagement workshops was then organized to debate the GEDI analysis. Approximately, a dozen policy stakeholders were invited to each workshop, each representing a different part of the Scottish entrepreneurship ecosystem, including banks, policy agencies, entrepreneurs, universities, and so on. These workshops performed the following activities:

- Debating, challenging, and amending the GEDI analysis
- Debating Scottish bottlenecks, as suggested by the GEDI analysis
- Suggesting insights and perspectives from different parts of the Scottish entrepreneurship ecosystem
- Suggesting follow-on analyses and data to further explore identified bottlenecks
- Debating underlying causes for the bottlenecks
- Identifying and prioritizing actions to alleviate the bottlenecks.

National Systems of Entrepreneurship are inherently complex. This means that no single individual or agency has complete information and insight as to how the system works. This also applies to the GEDI: Although it provides detailed insights, they are inevitably superficial. However, the GEDI also provides a coherent platform that helps focus the attention of various stakeholders and helps them take a system perspective when considering the trade-offs of alternative courses of action. A problem in many policy analyses is that they only provide a "siloed" view into a system—for example, by focusing on funding issues but ignoring other issues that may be linked to funding, which may prevent funding from having a positive impact on the system. The GEDI platform helps policymakers and policy stakeholders debate system issues that are outside their individual policy "silos."

Because insight into what really makes the system work (or not) is distributed across different stakeholders, with no individual or agency having complete information, these insights need to be extracted from within the system. This is what the stakeholder engagement workshops have been designed to do. They use the "hard" facts of the GEDI to extract "soft" insights from within the system on issues that make a real difference. This process can contribute important insights. In Scotland, for example, the GEDI boilerplate analysis suggested that finance was a bottleneck for the Scottish entrepreneurship ecosystem. The stakeholder debates confirmed this and added important nuance—that is, that the supply of funding was not the real bottleneck. Various stakeholders pointed to the fact that equity investments had insufficient exit opportunities. Although equity funding as such was reasonably plentiful, the lack of liquidity meant that this funding got stuck in portfolio companies and was not recycled back to new investments.

More generally, the stakeholder workshops identified five priority themes and underlying causes: "financing for growth," including exits for investors in angel-backed companies, which increased access to institutional and international funds; "effective connections," which included networks but was more fundamental than networking; "skills for growth" for leadership teams within innovation-based research (IBE) ventures; "role of the universities in the IBE ecosystem"; and "role models and positive messages." Chairs and other members of the stakeholder community were identified to participate in high-level task groups charged with implementing solutions to each of the five themes. Two task groups were formed for the universities theme, one internal to the universities and one external. These task forces have continued their work since the conclusion of the workshops, with mandates extending at least 1 year.

2.5 Summary

The above discussion suggests the following heuristic for using the Penalty for Bottleneck approach for policy analysis, design, and implementation:

1. Identify bottleneck factors in the country's National System of Entrepreneurship and compare these against relevant peers (i.e., countries at a similar level of economic development, with similar demographic conditions, and with similar levels of market size and market openness).
2. Examine the bottleneck factors more closely, complementing GEDI indicators with alternative proxies.
3. Conduct policy comparisons in bottleneck areas against relevant peers, with a focus on analyzing the anatomy of individual policy measures and identifying transferable good practices.
4. Design and implement policy programs designed to alleviate bottleneck factors in the country, using the GEDI to help set targets for performance improvement.

Used this way, the GEDI could provide a helpful platform for implementing a systemic approach to entrepreneurship policy analysis, design, and implementation, one that focuses on improving the performance of National Systems of Entrepreneurship.

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Chapter 3
Institutions, Incentives, and Entrepreneurship

3.1 Introduction

Because countries have different institutional structures and provide different incentives for entrepreneurs, we believe it is most useful to think of entrepreneurship as a national system. We therefore present the framework for a National System of Entrepreneurship and the global entrepreneurship and development index (GEDI) as ways to evaluate such a system. We follow with a discussion of the role institutions play in providing an incentive system for entrepreneurs, keeping in mind that while entrepreneurs act in their own self-interest they do not necessarily act in their nation's self-interest. We next discuss formal and informal institutions, and combine incentives, institutions, and entrepreneurship. Finally, we identify what we consider key institutions and bring the discussion back to the GEDI to demonstrate that institutions are indeed more important than individual behavior.

3.2 Institutions and Incentives

The importance of entrepreneurship for economic growth and development is well understood. However, when most people think about entrepreneurship, they tend to conceptualize it as an innate skill or talent, hence the debate on "nurture versus nature" that lies behind the policy question of how to "educate" people to become entrepreneurs. The striking thing about this discussion is that it does not seem to appreciate that entrepreneurial activity will also be highly specific to national context and related to the character of individual institutions (Batjargal 2003; Boettke and Coyne 2009; Hwang and Powell 2005). This is because, as Baumol (1990) has identified, institutions create the incentive structures that determine the

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choice of entrepreneurship over other occupations, and the type of entrepreneurship chosen. Thus, the prevalence and the forms of entrepreneurship that we see in different countries are affected by each country's institutional structures, as well as its level of development and cultural and policy factors. In this chapter we will illustrate how the GEDI methodology allows us to compare levels of entrepreneurial activity across countries while taking institutional differences into account. This includes an exploration of some of the ways entrepreneurial activity may be influenced by institutions in different national contexts, and a consideration of how these differences are addressed within the GEDI methodology.

The pioneering works of Douglass North and William Baumol provide important theoretical insights into entrepreneurial development in differing institutional environments, which form the foundation of this chapter. According to North (1990), entrepreneurs are the main agents of change. Organizations, such as firms set up by entrepreneurs, will adapt their activities and strategies to fit the opportunities and limitations provided through formal and informal institutional frameworks. Indeed, many of the incentives underlying value-adding behavior depend on the quality of institutions. North distinguishes between formal institutions—namely, the laws and rules that define the economic incentives guiding individual and organizational choices—and informal institutions—the social arrangements and norms that influence how formal institutions operate in practice. His argument can be applied to entrepreneurial organizations, which adapt their strategies to fit the opportunities and limitations defined by the institutional context. Thus, a functional business environment provides positive incentives for entrepreneurs, while a weak one is likely to be deleterious (Baumol 1993; North 1990). Ideally, formal rules are designed to facilitate exchange that reduces transaction costs; however, they also are likely to affect individuals or groups in different ways, as we illustrate below.

3.3 Formal and Informal Institutions and Economic Development

For many analysts of developed economies, the existence of an elaborate framework of constraints, created and enforced by institutions, is simply taken for granted and not specifically addressed. Thus, it is possible to largely ignore the impact of institutions in advanced market economies, where market institutions for the most part are present and functioning. However, there is growing recognition of the importance of the institutional environment, not only for entrepreneurship but for fostering national economic growth and stability.

The work of Douglass North has been illuminating in its identification of the differing influences institutions have on economic development. For our purposes, institutions are defined as any form of constraint that human beings devise to shape human interaction, and North makes a clear distinction between formal and informal institutions, as noted above. Put simply, formal institutions are the visible

rules of the game, such as constitutional law, which can be altered quickly to adapt to changing economic circumstances. Moreover, formal rules are generally enforced by governments. In contrast, informal institutions are the invisible rules of the game, which include norms, values, acceptable behaviors, and codes of conduct. Informal rules tend not to be legally enforced, and they most often evolve to complement formal rules. Changes to informal rules occur indirectly and usually as a result of accidents, learning, natural selection, and, most of all, the passage of time (North 1990, p. 88). North has also identified the often conflicting role between formal and informal institutions in both the historical perspective and in transition economies. Within North's framework, organizations such as firms—those existing or potential ones—will adapt their activities and strategies to the opportunities and limitations of formal and informal institutions. Institutional development can be intentionally affected by organizational players, such as entrepreneurs (North 2005).

Interestingly, even inefficient institutions can be maintained for long periods of time (DiMaggio and Powell 1983; North 1990). There are several reasons for inefficient institutional outcomes. First of all, even when they clash with formal rules, informal rules have tenacious survivability because they become part of habitual behavior (i.e., culture), and informal institutions provide a sense of stability. Second, informal institutions may change more slowly due to the influence of historical circumstances. Although the past cannot be used to neatly predict the future, existing incentive structures can illuminate the direction in which institutions will take economic development. This occurs because institutional change is usually incremental and seldom discontinuous (North 1990, p. 10). As a result, unproductive paths may persist, and in that sense history does matter. Third, lock-in can occur as a result of a symbiotic relationship between existing institutions and organizations that have evolved as a result of the incentive structure they have been provided. Even when the formal rules change, organizations that benefited from outdated informal rules would lose those benefits if they adopted new informal practices that complement formal rule changes, thus they will continue to practice detrimental informal rules in order to retain their position of power. Fourth, when formal and informal institutions clash, as when formal rules have changed but informal rules have not, noncompliant behaviors proliferate and can result in the formation of underground economies (Feige 1997, p. 22).

As North (1997) notes, "The performance of an economy is an admixture of the formal rules, the informal norms, and their enforcement characteristics. Changing merely the formal rules will produce the desired results only when the informal norms are complementary to the rule change, and enforcement is either perfect or at least consistent with the expectations of those altering the rule" (p. 16). North's emphasis on the influence formal and informal rules and institutions have on economic outcomes is relevant for emerging economies, especially in situations where formal institutions are weak. If the institutional framework rewards piracy, then piratical organizations will come into existence; and if the institutional framework rewards productive activities, then organizations and firms will come into existence to engage in productive activities (North 1994, p. 361).

A considerable literature argues that weak institutions—in terms of the quality of the commercial code, the strength of legal enforcement, administrative barriers, extralegal payments, and lack of market-supporting institutions—represent a significant barrier to entrepreneurship (see Djankov et al. 2004; McMillan and Woodruff 1999, 2002). In a study comparing new firms in Poland, Slovakia, Romania, Russia, and Ukraine, Johnson et al. (2000) establish that insecure property rights, in addition to weak macroeconomic stability and inadequate financing, inhibit the development of the private sector.

3.4 Incentives, Institutions, and Entrepreneurship

As Baumol (1990) noted in his seminal work that entrepreneurship development is a continuous process. The types of entrepreneurs that will be "activated" (i.e., actually start a business) are largely affected by the existing incentive structure that results from the combination of formal and informal institutions discussed above, such as the rules, norms, and beliefs present in a given environment. He distinguishes between three forms: productive entrepreneurship, which creates economic wealth through innovation and by filling gaps in the market; nonproductive entrepreneurship, where entrepreneurial talent is dissipated by seeking rents from government agencies, such as privileged monopolistic positions or preferential tax and regulatory exemptions; and destructive entrepreneurship, such as illicit drug production and distribution or prostitution. Different institutional arrangements, formal and informal, change the balance of incentives, and individuals must choose between these alternative outlets for their entrepreneurial talents, thereby influencing the pattern of economic growth. Incentives that support productive entrepreneurship result in entrepreneurship that contributes to economic growth, whereas unproductive and destructive entrepreneurship have a neutral or negative effect on economic growth.

Baumol (1990) views an entrepreneur as an individual who engages in innovative activity, and who can be but is not necessarily a business owner. He observes, for example, that wars in Western Europe in the early Middle Ages could be viewed as unproductive entrepreneurship—that is, expressions of violent yet innovative economic activity, primarily rent-seeking. These activities led to a net reduction in social income and wealth but enriched the "entrepreneurs." An example of productive entrepreneurship would be a Dutch merchant in seventeenth-century Europe bringing spices to market. The incentives and subsequent choice to engage in either productive or unproductive entrepreneurial activities seem to depend on the socioeconomic context.

In the current context, an innovative productive entrepreneur might be found starting a high-tech venture in Silicon Valley. An innovative but unproductive entrepreneur could be a government official in an authoritarian regime creating yet another bureaucratic procedure intended to increase his personal wealth.

Clearly, the dynamics of the entrepreneurial process can be vastly different, depending on the incentive structure within a particular economy. As institutions become stronger in terms of supporting market-based economic activity, increased entrepreneurial activity shifts toward productive entrepreneurship, thus strengthening economic growth and development. Therefore, it is important to understand not only the individual characteristics of the entrepreneur but also the context in which he or she operates: the incentives, institutions, and the stage of economic development. The interdependence between incentives and institutions also affects other characteristics, such as quality of governance, access to capital and other resources, and what entrepreneurs perceive as the rules of the game. Institutions are critical determinants of economic behavior and economic transactions in general, and they can have both direct and indirect effects on the supply and demand of entrepreneurs.

In sum, if incentives encourage productive entrepreneurship—that is, contributing to growth—then this form will predominate. Conversely, when the benefits of engaging in

Box 1: Informal Institutions and Unproductive Entrepreneurship

Baumol (1993) described a variety of historical examples where innovation was not used for productive entrepreneurial ends. His example of medieval China appears similar to modern-day Russia. China did not present suitable incentives for productive entrepreneurship to develop and, as a result, unproductive forms of entrepreneurship flourished. One reason for this was the absence of property rights; the Chinese monarch claimed possession of all property in his territories. The enforcement of property rights has also been a major barrier for business development in modern-day Russia, with violations common and the business community often opting to resolve conflicts informally rather than using formal institutions (Puffer and McCarthy 2001). Baumol also highlights the role of corruption as a way of life for civil servants in medieval China, since their official salaries were too low to provide an adequate livelihood. Similarly, the pervasive corruption in today's Russia is attributed to the low wages paid to most civil servants. In terms of informal institutions, Russians have become accustomed to a corrupt and malfunctioning legal environment characterized by corrupt behavior, which occurs in a disorganized way that leads to the personal enrichment of government officials, much to the detriment of the rule of law and private business development.[1]

[1] There is some tradition of this. Even during the Soviet period, the prevailing mentality was how to get around the laws or to enforce them for personal gain, rather than a respect and understanding of the law as something that protects the rights of its citizens and (private) businesses. As Gelman (2004) notes, "In the late Soviet period, informal ties penetrated all levels of government and served as a survival kit in the everyday life of Soviet citizens. Such ties defended ordinary people from the arbitrary state, but they also contributed to a vicious circle of cynicism, clientelism and corruption" (p. 4).

Medieval China was characterized by a negative view toward enterprise. As Baumol (1993) writes, private enterprise was "not only frowned on, but may have been subjected to impediments deliberately imposed by the officials." In Russia, comparable sentiments exist today that were inherited from the Soviet period, when entrepreneurs were equated to "speculators" and deemed criminals for making a profit. The Soviet state was built on an ideology that stifled independent innovative culture and allowed a punishment-oriented "inspection culture" to develop. The economy was run bureaucratically and the concentration on rewarding five year plan attainment suppressed the population's appetite for risk-taking and instead bred habits of obedience and playing it safe.

Baumol might argue that neither country fulfills the preconditions for the existence of a workable free-market economy. However, modern-day China has apparently been able to harness strong economic growth through productive entrepreneurial activity despite its inadequate institutional environment (Hsu 2005). In contrast, Russia has not been able to develop a high level of productive entrepreneurship, and its formal institutional environment has been identified as the main barrier to entrepreneurship development within the country's new institutional environment (Aidis et al. 2008).

illegal entrepreneurial activity outweigh their costs, entrepreneurs are more inclined to engage in destructive entrepreneurship—that is, detrimental to economic development. In each case, entrepreneurs will weigh the incentives in the environment, in terms of both regulations (formal rules, according to North) and the prevailing cultural values and norms (informal rules, according to North). This does not mean that the same individual will engage in productive, unproductive, or destructive entrepreneurship depending on the incentive structure; rather, different individuals will embark on entrepreneurial activities under different incentive structures.

3.5 The Key Institutions for Entrepreneurship: Property Rights and the Size of the State

As we noted above, property rights systems form the backbone of the modern institutions that characterize the market economy (see North and Thomas 1973; Williamson 1985). In essence, legal property rights support the broader development of economic property rights that are defined as "individual ability, in expected terms, to consume the good (or the services of the asset) directly or to consume it indirectly through exchange" (Barzel 1997, p. 3). The protection of property rights

in the U.S. constitution is especially important for entrepreneurs, as they need to rely on the security of their residual claims for the returns from the organizations they have created. Moreover, entrepreneurs must raise capital, bear risks, and enter new markets. Such activities require "transactional trust" over a long-term horizon, and this is strengthened by stable property rights that are effectively enforced. Accordingly, in recent institutional research, the focus has shifted from the assignment of rights and certification to institutions' environmental conditions that make execution of these rights effective, especially exchange and other legal contracts based on property rights. One important issue relates to the accessibility of these rights by the population as a whole, because the property rights system may work well for the economic elite but remain deficient for others.[2] This may in turn have critical implications for the size and performance of the entrepreneurial sector (De Soto 2001). A country's system of formal property rights can also create a basis for financial contracts and a virtuous circle of entrepreneurship, creation of assets, and finance. Thus, property rights and finance form the two key, mutually reinforcing blocks of an effective market economy system that supports entrepreneurial entry.

Turning to the size of the government, when considered from a theoretical perspective, one could argue that a larger government is associated with better conditions for entrepreneurship. For example, extensive government spending may create a basis for stronger institutions by funding law-enforcement systems that protect contracts and supporting infrastructure that may enhance entrepreneurship. Conversely, less government spending might weaken the business environment.

However, this is not the only possible relationship between entrepreneurship and the size of the state. Entrepreneurship may be associated with smaller states because of various forms of crowding out. As a government becomes more active, it needs to absorb a greater proportion of the economic resources and compete for inputs with the private sector. It therefore bids up the cost of key resources needed by entrepreneurs, notably finance and human capital, which may be felt more keenly by entrepreneurs than by existing firms because the former lack networks, contacts, and experience. Greater government activism also requires higher state revenues, and thus it is associated with a more extensive welfare system. These factors are likely to significantly influence both the opportunity cost and the net financial return to entrepreneurship. The higher cost of capital that results from financial crowding out will also affect entrepreneurs, while higher marginal tax rates will weaken the incentives for entrepreneurship by reducing the expected gains. At the same time, higher levels of welfare support provide alternative sources of income, and by increasing the alternative wage may therefore reduce the net expected return. And, last but not least, "countries with generous social security and welfare schemes do not emphasize the responsibility of the individual for their own survival, which may hamper ambitions to strive for innovation and growth" (Hessels et al. 2008, p. 328).

These two key dimensions of institutions have been explored by Aidis et al. (2012). Their approach allows us to categorize countries according to the quality of

[2] This is especially the case for "extractive elites"; see Acemoglu and Robinson (2012).

their property rights institutions and the size of the state, using the GEDI as an indication of entrepreneurial activity. Of course, the quality of property rights institutions and the size of the state are not necessarily distinct; the state has to achieve a certain scale to support institutions. One can distinguish two potential models of institutions that support high levels of entrepreneurial activity. The first is a "Scandinavian" approach, in which a large and active state provides the necessary structural foundations for a thriving entrepreneurial economy. We see examples of such an outcome in Sweden (ranked 3rd), Denmark (ranked 4th), Finland (ranked 7th), and Iceland (ranked 11th). But there is a second model of success for key institutions and entrepreneurship, based on a state sector that supports strong market property rights but is otherwise rather limited.

Examples include the United States (ranked 1st) and Singapore (ranked 10th), where the property rights system is strong but the disincentive effects of a large state sector are relatively modest as compared to, for example, the standards of European Union countries. Economies with large state sectors can perform well despite such disincentive effects if property rights are strong; the Netherlands (ranked 8th) or France (ranked 12th) are two examples. However, weak property rights protection tends to keep people from undertaking productive entrepreneurship, so governments in this situation should attempt to limit spending that often is misallocated. If we consider the GEDI study, examples of this include Uganda (ranked 113th) and Guatemala (ranked 108th), both of which have high levels of governmental spending, weak institutions, and low levels of productive entrepreneurship development.

Box 2: Networks as Informal Institutions

Informal institutions based on networks can positively affect entrepreneurial development. In the absence of strong market-supporting formal institutions, informal structures such as networks can become significant by assisting entrepreneurs in mobilizing resources and coping with the constraints of highly bureaucratic structures and officials. Networks have been found to be important in providing access to resources (such as information, finance, and labor), and to greatly enhance the entrepreneur's opportunity recognition capabilities (Hills et al. 1997). Social networks have also been identified as an antecedent for entrepreneurial alertness, which is a necessary condition for recognizing opportunity (Ardichvili et al. 2003). Some scholars have argued that a cohesive or densely embedded network provides a competitive advantage for entrepreneurs (Ahuja 2000; Coleman 1988, 1990; Walker et al. 1997), but others have proposed that sparsely connected networks full of "structural holes" provide a competitive advantage (Burt 1992). In weak institutional environments, networks between enterprises and officials are paramount for the survival and growth of businesses. New businesses without such connections are, in most cases, destined to fail.

3.6 Institutions and the GEDI Index

The GEDI represents the first attempt to measure productive entrepreneurship at the national level, embedded in a specific institutional context. As such, the rankings generated by the index go beyond those of traditional start-up indicators, such as the Total Entrepreneurial Activity index produced by the Global Entrepreneurship Monitor, which integrates measures of national entrepreneurial activity with country-specific measures of institutional quality. The GEDI framework is based on the idea that entrepreneurship represents the dynamic reaction of three factors—entrepreneurial attitudes, entrepreneurial abilities, and entrepreneurial aspirations—each of which represents the integration of individual behavioral variables and institutions. Individuals' particular talents for entrepreneurship are weighted for each factor by the national institutional context in which the entrepreneurial activity takes place. Thus, for example, entrepreneurial ability is measured by various indicators of start-up activity, derived from the GEM database. However, these are weighted in the GEDI by indicators of institutional quality from internationally recognized organizations, such as the World Economic Forum and the Heritage Foundation. Thus the index builds on Baumol's insight that the effects of entrepreneurial effort on economic growth will depend on the national institutional context in which those efforts take place.

In the GEDI, institutional influences are divided into the three sub-indices: Entrepreneurial Attitudes, Abilities, and Aspirations. Institutional measures for Entrepreneurial Attitudes include market size, level of education, a country's general riskiness for businesses, the population's use of the Internet, and cultural support for entrepreneurship as a good career choice. The institutional variables included in the Entrepreneurial Abilities sub-index measure the business regulatory environment, the capacity to absorb technology, the extent of human resource improvements through staff training, and the dominance of powerful business groups in the domestic market. Finally, the Entrepreneurial Aspirations sub-index includes institutional variables that measure R&D potential, the sophistication of a business and of innovation, the level of globalization, and the availability of risk capital. One main criterion in constructing the GEDI is selecting the key institutional (and individual) variables that affect entrepreneurial performance. Even though property rights and rule of law are considered key factors affecting entrepreneurial development and performance, they tend to cover a wide range of issues, and no internationally acceptable measure currently exists that includes the GEDI's participating countries. The GEDI instead captures aspects of property rights through its variable Freedom, which represents the overall regulatory burden for starting, operating, and closing a business. In general, the institutional variables included in the GEDI tend to be highly correlated with one another.

Entrepreneurial activity will also be closely associated with the level of economic development as measured, for example, by per capita GDP. Moreover, this is highly correlated with the quality of institutions, which makes it hard to distinguish empirically between the impact on entrepreneurial activity of development and of

institutional quality. However, by integrating the measures of entrepreneurial activity with those of institutional quality, the GEDI is able to produce a more credible interpretation of how development level affects entrepreneurship.

This is illustrated in Fig. 3.1, which shows that institutional development is rapid, whereas individual features change more slowly. Thus we see that, while the average values of the institutional and individual variables are about the same, 0.68 and 0.62, respectively, their rates of change are very different. This supports the general wisdom that institutions can be changed relatively easily but people take longer to adjust to or to exploit the opportunities presented by economic progress. The explanatory power of the connection between institutional features and per capita GDP is high ($R^2 = 0.83$); it is much lower between individual variables and per capita GDP ($R^2 = 0.13$). This also implies greater variation in individual entrepreneurial characteristics.

At lower levels of economic development, individual entrepreneurial capabilities are stronger than country-level institutional characteristics. However, institutions improve more rapidly than individual characteristics. As countries move into the efficiency-driven stage of development, the level of institutions reaches that of individual values, as the two curves cross. As institutions become more highly developed in richer countries, the difference between institutional and individual

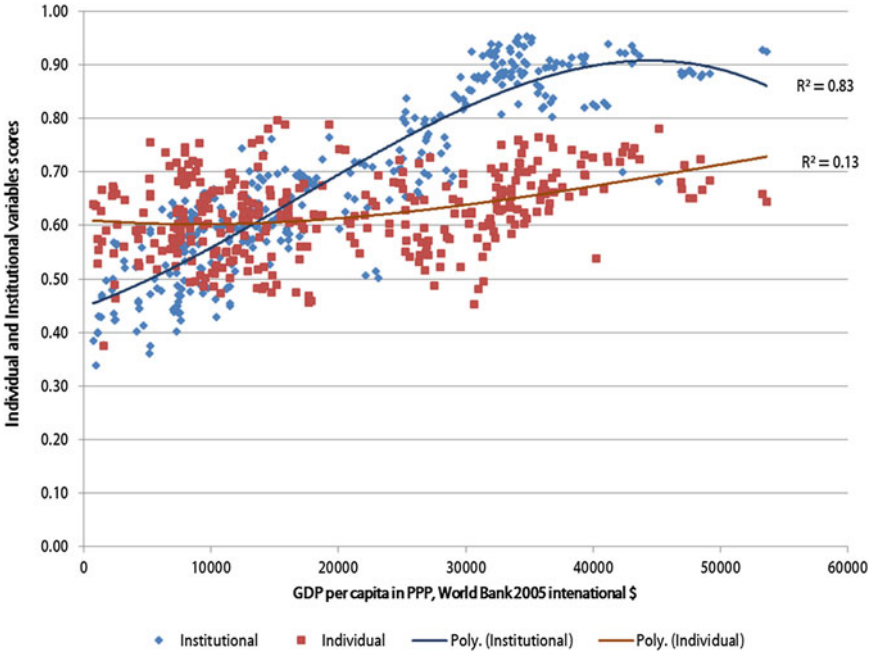

Fig. 3.1 The average values of institutional and individual variables in terms of per capita GDP (The United Arab Emirates' scores were outliers and thus removed from this figure.). Number of countries = 349 (based on the 2006–2012 data)

variables increases. The advantages of well-functioning institutions cannot be exploited if individual capabilities are lagging, which is the challenge most developed countries face. The implication is that less developed factor-driven economies should focus on improving their institutions; efficiency-driven countries should balance improving institutions with improving individual entrepreneurial development; and the most developed countries should focus on maintaining a high level of institutional quality and improving individual entrepreneurial development.

3.7 Summary and Conclusion

In this chapter, we have argued that the level and form of entrepreneurial activity, and therefore its impact on economic growth, will be greatly affected by the national economic context, notably, the quality of institutions. We have summarized the rapidly growing literature on this topic, which has begun to identify the key institutions influencing the incentives for individuals to become entrepreneurs, as well as the complex interrelationship between different forms of institutions, and between institutions and the level of development.

We have noted that the GEDI represents the first attempt to address this complex issue systematically. It does so in an original way, by seeking to integrate measures of entrepreneurial activity in three broad areas with a large variety of indicators of institutional quality that will moderate or enhance the impact of entrepreneurship on economic growth and development.

National governments are increasingly interested in increasing economic growth and overall welfare through enhanced entrepreneurial performance. As pointed out in this chapter, a country's level of economic development is strongly related to its institutional environment. The GEDI is an invaluable tool for providing an overview at the country level for the specific constellation of institutional strengths and weaknesses.

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Chapter 4
The Global Entrepreneurship and Development Index

4.1 Introduction

The modern temple of economic development is like many temples of the ancient world: Both are held up by pillars. Like the pillars of ancient temples—made of sand and limestone held together by cement—the pillars of economic development are made of individuals and institutions that are held together by the "cement" of incentives created by institutions that influence the behavior of people. Economic development rests on these pillars of development, which hold up three large building blocks consisting of attitudes toward entrepreneurship, entrepreneurial abilities, and entrepreneurial aspirations. The pillars must be of similar height and strength for a fully developed economy to flourish, and they need constant attention, continuous improvement, and careful maintenance.

In this chapter, we present the Global Entrepreneurship and Development Index (GEDI). We start by discussing the S-shaped curve and then the 15 pillars of entrepreneurship. Country rankings and values are reported in terms of the GEDI and these 15 pillars. We then present the three subindexes of attitudes, abilities, and aspirations. Finally, we analyze and compare the different countries and country groups included in the GEDI.

4.2 The S-Shaped Curve

Between 1945 and 1980, nearly 100 colonies in Africa, Asia, and the Caribbean gained their independence and began creating a development strategy for their citizens.[1] Sadly, many of those countries have experienced neither significant per capita

[1] For a review of the literature, see Acs and Virgil (2010).

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growth nor economic development.[2] Indeed, moderate to extreme poverty remains a significant concern for many developing countries (Sachs 2005, pp. 22–23).

Hence, after failed attempts at development through import substitution and infant industry protection programs and somewhat mixed results from export promotion strategies, developing countries are beginning to focus on their business environments and on creating economic spaces conducive to private enterprise, both domestic and foreign. Indeed, the promotion of entrepreneurship and the promulgation of small- and medium-sized enterprise policy have become important prescriptions for development in recent years (Ketkar and Acs 2013).

While a focus on entrepreneurship may seem a novel approach to development, it is consistent with and even complementary to older, more traditional development strategies. As these developing economies have moved from centralized economies to market economies, enterprise and entrepreneurship have become increasingly important. "The emerging world, long a source of cheap labor, now rivals the rich countries for business innovation," says Adrian Wooldridge, writing in *The Economist*, "Developing countries are becoming hotbeds of business innovation in much the same way as Japan did from the 1950s onwards."

In his classic text, *The Stages of Economic Growth*, Rostow (1960) suggested that countries go through five stages of economic growth: (1) the traditional society, (2) the preconditions for takeoff, (3) the takeoff, (4) the drive to maturity, and (5) the age of high mass consumption. While these stages are a simplified way of looking at the development of modern economies, they do identify critical events. While Rostow focused on the age of high mass consumption, Michael Porter et al. (2002) followed recent developments in the economics of innovation. Porter has provided a modern rendition of Rostow's approach by identifying three stages of development: (1) a factor-driven stage, (2) an efficiency-driven stage, and (3) an innovation-driven stage.

Entrepreneurship is considered an important mechanism that promotes economic development through employment, innovation, and welfare, but it does not appear like manna from heaven as a country moves through the stages of development. Rather, it plays a role in all the stages and is a process that continues over many years. Economists have come to recognize the "input-competing" and "gap-filling" capacities of entrepreneurial activity in development (Leibenstein 1968). Figure 4.1 shows the relationship between entrepreneurship and economic development.

The S-shaped curve addresses two important questions about development. First, the intersection of the S-curve with the vertical axis suggests that if individuals in a country are very poor, they may be in a poverty trap, where the chances for growing income or wealth are limited. The S-shape of this curve represents the source of poverty. For those in the poverty trap, tomorrow's income will be less than today's, and any attempt to get out of this trap may result in even less future income, which

[2] See Easterly (2001, pp. 141–143), who identifies the slowdowns in the economies of OECD trading partners of LDCs as a possible cause of the disappointing growth performance.

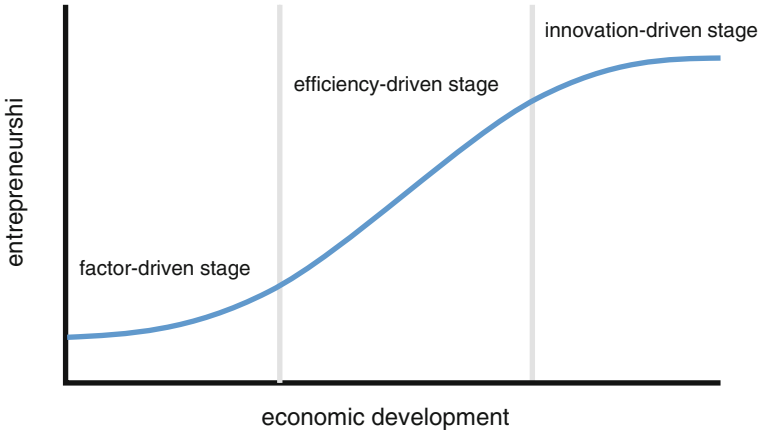

Fig. 4.1 The S-curve of entrepreneurship

helps to explain why the poor, and poor countries, are so little involved in entrepreneurship (Banerjee and Duflo 2012).

The S-shaped curve also addresses the question of how much productive entrepreneurship there is in countries at different stages of development and how rapidly it grows. The other side of the S-curve, where it rises at a decreasing rate until it levels off, represents a situation where tomorrow's income is greater than today's, so entrepreneurial activity is possible (Baumol 1990). How quickly countries modernize depends on the rise of this curve. The area above the curve is the "valley of backwardness," and being able to come out of the valley depends on improving a nation's institutions (Acs 2010). As institutions become stronger, destructive and unproductive activities decline, and more entrepreneurial activity is shifted toward productive entrepreneurship, thus strengthening economic development (Acemoglu and Johnson 2005; Acs et al. 2009).

The valley of backwardness above the S-curve can only be eliminated by building better institutions and changing a society's incentive structure, all of which requires good government and governance. Our assumption of uncertain political economies means that destructive entrepreneurship is most likely to occur in developing countries with some degree of political instability, although it occurs in some form across most countries. As these unstable countries tend to rely on primary and secondary economic industries, inputs for activities in the tertiary and quaternary sector are not of immediate relevance. Therefore, we emphasize the effect productive entrepreneurship can have on the creation of social value as activity shifts out of destructive and unproductive entrepreneurship. In today's interconnected world, we need to improve institutions and be able to measure this progress.

4.3 The 15 Pillars of Entrepreneurship

The characteristics of entrepreneurship are many and complex. While a widely accepted definition of entrepreneurship is lacking, there is general agreement that the concept has numerous dimensions.[3] We take this into account in creating our entrepreneurship index. Some businesses have a larger impact on markets, create more new jobs, and grow faster and larger than others. We also take into account the fact that entrepreneurship plays a different role at different stages of development. Considering all of these possibilities and limitations, we define entrepreneurship as "the dynamic, institutionally embedded interaction between Entrepreneurial Attitudes, entrepreneurial abilities, and entrepreneurial aspirations by individuals, which drives the allocation of resources through the creation and operation of new ventures."

The GEDI is composed of three building blocks or subindexes—the 3As: Entrepreneurial Attitudes, entrepreneurial abilities, and entrepreneurial aspirations. These three subindexes stand on 15 pillars, each of which contains an individual and an institutional variable that corresponds to the micro- and the macro-level aspects of entrepreneurship. Unlike other indexes that incorporate only institutional or individual variables, the pillars of the GEDI include both individual and institutional variables. These pillars are an attempt to capture the open-ended nature of entrepreneurship; analyzing them can provide an in-depth view of the strengths and weaknesses of those listed in the index. We now describe the 15 pillars of entrepreneurship.

4.3.1 The Pillars of Entrepreneurial Attitude

Pillar 1: *Opportunity Perception*. This pillar captures the potential "Opportunity Perception" of a population by considering the size of its country's domestic market and level of urbanization. A population's Opportunity Perception potential is an essential ingredient of entrepreneurial start-ups (Sørensen and Sorenson 2003). Within this pillar is the individual variable, Opportunity Recognition which measures the percentage of the population that can identify good opportunities to start a business in the area where they live. However, the value of these opportunities also depends on the size of the market. The institutional variable Market Agglomeration consists of two smaller variables: the size of the domestic market (Domestic Market) and urbanization (Urbanization). The Urbanization variable is intended to capture which opportunities have better prospects in developed urban areas than they do in poorer rural areas (Acs and Varga 2005). Market Agglomeration is

[3] Gartner (1990), Davidsson (2004), Wennekers and Thurik (1999), and Godin et al. (2008) all identify several dimensions of entrepreneurship.

determined by multiplying the size of the domestic market by the percentage of the population living in urban areas.

Pillar 2: *Start-up Skills*. Launching a successful venture requires the potential entrepreneur to have the necessary Start-up Skills (Papagiannidis and Li 2005). Skill Perception measures the percentage of the population who believe they have adequate Start-up Skills. Most people in developing countries think they have the necessary skills to start a business, but their skills usually were acquired through workplace trial and error in relatively simple business activities. In developed countries, business formation, operation, management, etc., require skills that are acquired through formal education and training. Hence, education, especially post-secondary education, plays a vital role in teaching and developing entrepreneurial skills. Today, there are 150 million students enrolled in some kind of education beyond high school, a 53 % increase in less than a decade. People all over the world see education as a pathway out of poverty.

Pillar 3: *Risk Acceptance*. Of the personal entrepreneurial traits, fear of failure is one of the most important obstacles to a start-up (Caliendo et al. 2009). Aversion to high-risk enterprises can retard nascent entrepreneurship. Risk Perception is defined as the percentage of the population who do not believe that fear of failure would prevent them from starting a business. Business Risk reflects the availability and reliability of corporate financial information, the protection of creditors by law, and the institutional support of intercompany transactions.

Pillar 4: *Networking*. Networking combines an entrepreneur's personal knowledge with their ability to use the Internet for business purposes. This combination serves as a proxy for networking, which is also an important ingredient of successful venture creation and entrepreneurship. Entrepreneurs who have better networks are more successful, can identify more viable opportunities, and can access more and better resources (Shane and Cable 2003). We define the basic networking potential of a possible entrepreneur by the percentage of the population who personally know an entrepreneur who started a business within 2 years (Know Entrepreneurs). However, connecting through cyberspace with the rest of the world adds another dimension to networking and opens up much greater opportunities than before (Internet usage).

Pillar 5: *Cultural Support*. This pillar is a combined measure of how a country's inhabitants view entrepreneurs in term of status and career choice, and how the level of corruption in that country affects this view. Without strong cultural support, the best and brightest do not want to be responsible entrepreneurs, and they decide to enter a traditional profession (Guiso et al. 2006). Career Status is the average percentage of the population age 18–64 who say that entrepreneurship is a good career choice and enjoys high status. The associated institutional variable measures the level of corruption. High levels of corruption can undermine the high status and steady career paths of legitimate entrepreneurs (Baumol 1990).

4.3.2 The Pillars of Entrepreneurial Abilities

Pillar 6: *Opportunity Start-up*. This is a measure of start-ups by people who are motivated by opportunity but face regulatory constraints. An entrepreneur's motivation for starting a business is an important signal of quality. Opportunity entrepreneurs are believed to be better prepared, to have superior skills, and to earn more than what we call necessity entrepreneurs. Opportunity Motivation is defined as the percentage of the Total Entrepreneurial Activity (TEA) businesses started to exploit a good opportunity, to increase income, or to fulfill personal aims, in contrast to those started by people who have no other options for work. The institutional variable applied here is business freedom (Economic Freedom; Bhola et al. 2006), one subindex of the Index of Economic Freedom. The Economic Freedom variable is appropriate for capturing the overall burden of regulation, as well as the regulatory efficiency of the government in influencing start-ups and operating businesses.

Pillar 7: *Gender*. For the first time, we introduce the Gender Pillar, which is a combination of the percentage of women entrepreneurs in the TEA (TEA female) and the institutional variable measuring female economic participation and opportunity (Gender Equality).

Pillar 8: *Technology Absorption*. In the modern knowledge economy, information and communication technologies (ICT) play a crucial role in economic development. Not all sectors provide the same chances for businesses to survive and/or their potential for growth (Klepper 2001). The Technology Level variable is a measure of the businesses that are in Technology Sectors. The institutional variable Tech Absorption is a measure of a country's capacity for firm-level Technology Absorption, as reported by the World Economic Forum. The diffusion of new technology, as well as the capability to absorb it, is vital for innovative firms with High Growth potential (Coad and Rao 2008).

Pillar 9: *Human Capital*. The prevalence of high-quality Human Capital is vitally important for ventures that are highly innovative and require an educated, experienced, and healthy workforce to continue to grow. An important feature of a venture with High Growth potential is the entrepreneur's level of education (Bates 1990). The Educational Level variable captures the quality of entrepreneurs; it is widely held that entrepreneurs with higher education degrees are more capable and willing to start and manage high-growth businesses. The quality of employees also has an impact on business development, innovation, and growth potential. The institutional variable, Staff Training, is a country's level of investment in business training and employee development. It can be expected that heavy investment in employees pays off and that training increases the quality of the employees.

Pillar 10: *Competition*. Competition is a measure of a business's product or market uniqueness, combined with the market power of existing businesses and business groups (Baumol et al. 2007). The variable Competitors is defined as the percentage of TEA businesses that have only a few Competitors offering the same product or service. However, market entry can be prevented or made more difficult

if powerful business groups are dominating the market. The extent of Market Dominance by a few business groups is measured by the variable Market Dominance, a variable reported by the World Economic Forum.

4.3.3 The Pillars of Entrepreneurial Aspiration

Pillar 11: *Product Innovation*. New Products play a crucial role in the economy of all countries. While rich for years, countries were the source of most New Products, today developing countries are producing products that are dramatically cheaper than their Western equivalents. New Product is a measure of a country's potential to generate New Products and to adopt or imitate existing products. In order to quantify the potential for New Product Innovation, an institutional variable related to technology and innovation transfer seems to be relevant. Technology Transfer is a complex measure of whether a business environment allows the application of innovations for developing New Products.

Pillar 12: *Process Innovation*. Applying and/or creating new technology is another important feature of businesses with High Growth potential. New Tech is defined as the percentage of businesses whose principal underlying technology is less than 5 years old. However, most entrepreneurial businesses do not just apply new technology, they create it. The problem is similar to the New Product variable: whereas many developing country businesses may apply the latest technology, they tend to buy or copy it. An appropriate institutional variable applied here is research and development (R&D). Gross Domestic Expenditure on Research and Development (GERD) is the R&D percentage of gross domestic product (GDP) as reported by OECD. While R&D alone does not guarantee successful growth, it is clear that without systematic research activity, the development and the implementation of new technologies—and therefore future growth—will be inhibited (Stam and Wennberg 2009).

Pillar 13: *High Growth*. This is a combined measure of the percentage of high-growth businesses that intend to employ at least 10 people and plan to grow more than 50 % in 5 years (Gazelle Variable) with Business Strategy sophistication (Business Strategy variable; Acs et al. 2008). It might be argued that a shortcoming of the Gazelle Variable is that growth is not an actual but an expected rate. However, a measure of expected growth is in fact a more appropriate measure of aspiration than a measure of realized growth. Business Strategy refers to "the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery." High Growth combines High Growth potential with a sophisticated strategy.

Pillar 14: *Internationalization*. Internationalization is believed to be a major determinant of growth (De Clercq et al. 2005). A widely applied proxy for Internationalization is exporting. Exporting demands capabilities beyond those needed by businesses that produce only for domestic markets. However, the institutional dimension is also important: A country's openness to international

entrepreneurs—that is, the potential for Internationalization—can be estimated by its degree of globalization. The Internationalization pillar is designed to capture the degree to which a country's entrepreneurs are internationalized, as measured by the exporting potential of businesses, controlling for the extent to which the country is economically globalized.

Pillar 15: *Risk Capital*. The availability of risk Finance, particularly equity rather than debt, is an essential precondition for fulfilling entrepreneurial aspirations that are beyond an individual entrepreneur's personal financial resources (Gompers and Lerner 2004). Here, we combine two kinds of Finance, the Informal Investment (Informal Investment) and the institutional depth of capital market (DCM). Informal Investment is defined as the percentage of informal investors in the population age 18–64, multiplied by the average size of individuals' investment in other people's new businesses. While the rate of Informal Investment is high in factor-driven economies, the amount of Informal Investment is considerably larger in efficiency- and innovation-driven countries; combining them balances these two effects. Our institutional variable here is DCM, one of the six subindices of the Venture Capital and Private Equity Index. This variable is a complex measure of the size and liquidity of the stock market, level of IPO, M&A, and debt and credit market activity, which encompass seven aspects of a country's debt and capital market (Groh et al. 2012).

4.4 The Global Entrepreneurship and Development Index, 2014 Rankings

In this chapter, we report the rankings of the 120 countries on the Global Entrepreneurship and Development Index and the three subindexes. The applicability and validity of the GEDI are compared to other important, widely used indexes. The pillar values of the three subindexes are presented later.

We present the GEDI in terms of country development, as measured by per capita GDP. We also report the average bottleneck efficiency (ABE) country values. ABE is a kind of efficiency indicator measuring how close a country's worst pillars are, to a country's best performing pillar, on average. Higher ABE values imply a more balanced performance, while lower ABE values mean substantial imbalances across the 15 pillars of the GEDI.

The overall ranking of the countries on the GEDI is shown in Table 4.1. Like previous years, Anglo-Saxon, Nordic, and Western European countries in the innovation-driven stage of development are in the front ranks. The USA, Australia, Sweden, and Denmark lead the ranking, similar to the previous year. Three of the five Nordic countries, Denmark, Sweden, and Finland, are in the top 10, and Iceland and Finland are 11th and 14th, respectively—still a good performance. Taiwan, the best Asian country, is in 6th place, and Singapore is 10th, the first time it is among the best 10 countries. While the Netherlands lost its 5th place position to

Table 4.1 The Global Entrepreneurship and Development Index rank and the average bottleneck efficiency of the countries, 2014

Rank	Country	GDP 2012[a]	GEDI	ABE[b]	Rank	Country	GDP 2012[a]	GEDI	ABE[b]	Rank	Country	GDP 2012[a]	GEDI	ABE[b]
1	USA	43,063	82.5	91.3	41	Czech Republic	23,763	44.5	53.6	81	Trinidad nad Tobago	22,966	30.3	45.8
2	Australia	35,669	77.8	88.0	42	Hungary	17,033	44.5	61.5	82	Ukraine	6,394	30.2	49.3
3	Sweden	35,134	73.7	84.5	43	Kuwait	47,935	44.2	53.1	83	Morocco	4,475	29.5	48.6
4	Denmark	32,333	72.5	84.8	44	Malaysia	14,775	44.1	62.7	84	Ecuador	8,393	29.2	40.7
5	Switzerland	39,344	70.9	82.8	45	Saudi Arabia	21,430	43.4	56.3	85	Algeria	7,339	29.1	44.5
6	Taiwan	n.a	69.5	79.3	46	China	7,958	41.6	59.4	86	Swaziland	4,522	29.0	31.9
7	Finland	31,810	69.3	76.0	47	Peru	9,429	41.3	48.8	87	Paraguay	5,290	28.8	35.4
8	The Netherlands	36,599	69.0	75.5	48	Italy	26,328	40.9	46.9	88	Angola	5,262	28.7	40.9
9	UK	32,723	68.6	75.8	49	Croatia	16,148	40.9	53.6	89	Philippines	3,803	28.5	30.4
10	Singapore	53,266	67.9	81.0	50	South Africa	9,860	40.3	62.8	90	Zambia	1,475	28.4	34.4
11	Iceland	34,029	67.5	77.3	51	Cyprus	23,475	40.2	70.8	91	Bosnia/ Herzegovina	7,356	27.7	65.4
12	France	29,819	67.2	76.8	52	Montenegro	10,711	39.5	51.0	92	Venezuela	11,613	26.4	30.5
13	Belgium	32,649	66.5	73.2	53	Brunei Darussalam	45,979	39.2	51.5	93	Ghana	1,765	26.2	29.1
14	Norway	47,547	65.1	75.9	54	Lebanon	12,592	38.9	42.2	94	Egypt	5,795	25.2	45.0
15	Chile	15,848	65.0	73.9	55	Barbados	17,564	38.5	49.1	95	Senegal	1,675	24.7	26.9
16	Germany	34,766	64.6	74.3	56	Argentina	15,501	38.4	44.9	96	Benin	1,364	24.6	25.3
17	Austria	36,259	63.9	76.6	57	Mexico	12,617	38.2	51.2	97	Cameroon	2,018	24.6	27.4
18	Ireland	36,755	61.8	74.7	58	Greece	20,922	37.7	46.6	98	Liberia	564	24.5	27.4
19	Puerto Rico	17,300	61.7	75.8	59	Tunisia	8,442	37.2	65.8	99	Iran	10,462	24.1	46.9
20	Israel	26,719	59.6	66.2	60	Costa Rica	11,156	37.2	68.1	100	Honduras	3,614	23.9	31.2

(continued)

Table 4.1 (continued)

Rank	Country	GDP 2012[a]	GEDI	ABE[b]	Rank	Country	GDP 2012[a]	GEDI	ABE[b]	Rank	Country	GDP 2012[a]	GEDI	ABE[b]
21	Estonia	18,722	58.9	68.9	61	Namibia	6,453	36.8	41.2	101	Kenya	1,517	23.8	25.0
22	Slovenia	24,320	52.7	66.8	62	Macedonia	9,323	36.1	56.6	102	Tanzania	1,380	22.5	24.5
23	Qatar	n.a	52.6	68.1	63	Botswana	14,639	35.6	42.5	103	Nicaragua	3,510	22.1	26.9
24	Colombia	9,124	49.8	57.4	64	Thailand	8,459	35.5	41.6	104	Rwanda	1,167	21.0	21.8
25	Lithuania	18,776	49.6	58.4	65	Panama	14,320	34.8	47.1	105	Gambia	1,679	21.0	21.0
26	Poland	18,297	49.0	60.2	66	Dominican Republic	8,794	34.3	65.5	106	Malawi	777	20.8	26.9
27	Latvia	15,946	48.4	54.0	67	Indonesia	4,272	34.2	46.4	107	Guatemala	4,396	20.7	32.8
28	UAE	42,293	48.2	65.7	68	Serbia	9,683	33.9	47.8	108	Mozambique	882	20.6	20.6
29	Oman	25,330	47.6	55.2	69	Russia	15,177	33.2	46.4	109	Burkina Faso	1,304	19.8	19.7
30	Portugal	20,962	46.9	54.5	70	Gabon	13,864	32.7	35.9	110	Ethiopia	981	19.8	29.6
31	Spain	26,545	46.8	62.2	71	Albania	8,059	32.6	65.4	111	Madagascar	843	19.5	19.2
32	Korea	27,991	46.7	70.1	72	Jordan	5,298	31.7	61.4	112	Côte d'Ivoire	1,757	19.4	26.9
33	Hong Kong	44,770	46.5	59.8	73	Nigeria	2,294	31.6	44.7	113	Uganda	1,165	19.3	18.4
34	Slovakia	21,257	46.5	58.7	74	Jamaica	7,839	31.4	33.3	114	Mali	1,047	18.8	24.6
35	Japan	31,425	46.1	58.1	75	India	3,341	31.3	60.2	115	Pakistan	2,491	18.7	46.5
36	Bulgaria	12,178	45.4	54.8	76	Moldova	2,951	31.1	55.4	116	Mauritania	2,244	18.5	30.0
37	Bahrain	21,345	45.4	54.6	77	Bolivia	4,552	31.1	37.0	117	Sierra Leone	1,171	17.6	16.5
38	Uruguay	13,821	45.3	57.2	78	El Salvador	6,093	31.0	48.1	118	Burundi	483	15.5	13.9
39	Turkey	13,737	44.7	55.0	79	Kazakhstan	11,973	30.6	46.2	119	Chad	1,287	15.0	13.0
40	Romania	11,443	44.6	55.9	80	Brazil	10,264	30.4	37.2	120	Bangladesh	1,623	13.8	31.7

[a] Per capita GDP in PPP 2012 or latest available data, in 2005 constant international dollars, World Bank (Hong Kong is from IMF and Puerto Rico is from CIA)
[b] ABG = the average bottleneck efficiency measures the average percentage deviation between the country's best pillar and the other 14 pillars

Switzerland, it is still among the most entrepreneurial nations of the world. Besides their high entrepreneurial performance, these countries also represent high efficiency, according to their ABG values of over 75 %. In this respect, the USA not only is number one in the GEDI rankings, but it also has the highest ABE score, an impressive 91.4 %, implying very efficient use of entrepreneurial resources.

The USA is in first place. Australia, Switzerland, and the Netherlands are good performers, but they all have weaknesses in at least one of the subindexes. Of the most populous EU countries, only the UK, in 9th place, is among the top 10 countries. The other large European countries rank in the middle: France is 12th, Germany is 16th, Poland is 26th, and Spain is 31st, followed by Italy in 48th place. While the UK, France, and Germany are relatively well balanced over the 15 pillars, according to their high ABE values, Poland, Spain, and Italy are entrepreneurially less efficient. A likely explanation for the EU countries' relatively weak economic performance over the last decade is their low level of entrepreneurship; the same applies to Japan, which took 35th place. Factor-driven countries with low GDPs, such as Pakistan, Bangladesh, Uganda, and other poor African countries, are at the bottom of the entrepreneurship ranking, as expected. At the same time, these countries' entrepreneurial performance is the least unbalanced, implying a low efficiency, with ABE values of 13–30 %. However, some countries—including two former socialist countries, Serbia, Russia, innovation-driven Italy, and two South American countries, Brazil and Trinidad and Tobago—should have higher levels of entrepreneurship, as implied by their development trend lines and more efficient use of entrepreneurial resources.

4.5 The Ranking of the 3As

By definition, the GEDI is a three-component index that takes into account the different aspects of entrepreneurship. However, all three components, called subindexes, are in themselves complex measures that include various characteristics of Entrepreneurial Attitudes, entrepreneurial abilities, and entrepreneurial aspirations.

Entrepreneurial Attitudes are societies' attitudes toward entrepreneurship, which we define as a population's general feelings about recognizing opportunities, knowing entrepreneurs personally, endowing entrepreneurs with high status, accepting the risks associated with business start-ups, and having the skills to launch a business successfully. The benchmark individuals are those who can recognize valuable business opportunities and have the skills to exploit them, who attach high status to entrepreneurs, who can bear and handle start-up risks, who know other entrepreneurs personally (i.e., have a network or role models), and who can generate future entrepreneurial activities. Moreover, these people can provide the cultural support, financial resources, and networking potential to those who are already entrepreneurs or want to start a business. Entrepreneurial Attitudes are important because they express the general feeling of the population toward entrepreneurs and entrepreneurship. Countries need people who can recognize

valuable business opportunities and who perceive that they have the required skills to exploit these opportunities. Moreover, if national attitudes toward entrepreneurship are positive, it will generate cultural support, financial support, and networking benefits to those who want to start businesses.

Entrepreneurial abilities refer to the characteristics of the entrepreneurs and their businesses. Different types of entrepreneurial abilities can be distinguished within the realm of new business efforts. Creating businesses may vary by industry sector, the legal form of organization, and demographics—age, gender, and education. We define entrepreneurial abilities as start-ups in the medium- or high-Technology Sectors that are initiated by educated entrepreneurs and launched by those motivated by an opportunity in an environment that is not overly competitive. Entrepreneurial abilities also refer to the equal participation of women in start-ups and other opportunities. In order to calculate the Opportunity Start-up rate, we use the GEM TEA Opportunity Index. TEA captures new start-ups not only as the creation of new ventures but also as start-ups within existing businesses, such as a spin-off or other entrepreneurial effort. Differences in the quality of start-ups are quantified by the entrepreneur's education level—that is, if they have a post-secondary education—and the uniqueness of the product or service as measured by the level of Competition. Moreover, it is generally maintained that Opportunity Motivation is a sign of better planning, a more sophisticated strategy, and higher growth expectations than "necessity" start-ups.

Entrepreneurial aspiration reflects the quality aspects of start-ups and new businesses. Some people just hate their employer and want to be their own boss, while others want to create the next Microsoft. Entrepreneurial aspiration is defined as the early-stage entrepreneur's effort to introduce New Products and/or services, develop new production processes, penetrate foreign markets, substantially increase their company's staff, and Finance the business with formal and/or informal Venture Capital. Product and Process Innovation, Internationalization, and High Growth are considered the key characteristics of entrepreneurship. Here, we added a Finance variable to capture the informal and formal Venture Capital potential that is vital for innovative start-ups and high-growth firms.

Each of these three building blocks of entrepreneurship influences the other two. For example, Entrepreneurial Attitudes influence entrepreneurial abilities and entrepreneurial aspirations, while entrepreneurial aspirations and abilities also influence Entrepreneurial Attitudes.

Figure 4.2 shows the relationship between the GEDI, the three subindices, and national per capita wealth, based on purchasing power parity GDP. In all the figures, we provide the associated trend line and R^2 values. All the trend lines are based on third-degree polynomial equations.

For example, the overall index shows a good fit and a positive relationship between development and entrepreneurship. The two move in the same direction, with an $R^2 = 0.76$, which implies a close, strong relationship between entrepreneurship and economic development. Unlike other entrepreneurship measures that find an L-shaped (self-employment rate) or a U-shaped (Total Early-Phase

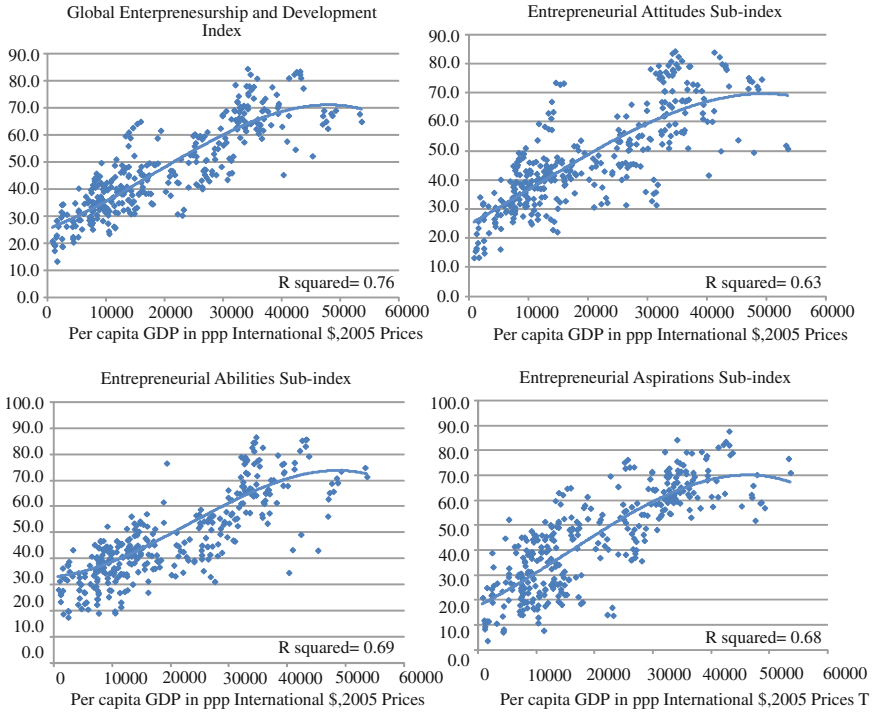

Fig. 4.2 The three subindexes in terms of per capita real GDP (2006–2012, all data included). Number of observations = 349. As an outlier, UAE has been removed from the graphs

Entrepreneurial Activity index) relationship between entrepreneurship and development, we find a mild S-shaped relationship.

The relationship between the Entrepreneurial Attitudes subindex (ATT) and development is shown in the right-hand figure. The relationship is similar to the logarithmic function, implying that the overall entrepreneurship attitude increases as the country develops. The explanatory power, based on the $R^2 = 0.63$, shows a significant, strong correlation between ATT and per capita GDP.

The lower-left figure contains the Entrepreneurial Abilities subindex (ABT) values in terms of economic development. The explanatory power, $R^2 = 0.69$, is the highest among the three subindexes, implying a close and strong relationship between entrepreneurial abilities and development.

The trend of the Entrepreneurial Aspirations subindex (ASP) is probably no surprise. The explanatory power of $R^2 = 0.68$ is significant and strong.

Table 4.2 shows the ranking of the first 25 countries in the GEDI and the rank of the subindex. The subindex points and rankings for all 120 countries can be found in Appendix A. For example, the USA is 1st in the overall index and also in all the three subindexes. Australia is 4th in attitudes, 2nd in abilities, and 5th in aspirations, as it is more interested in high-impact entrepreneurship than in replicative activities.

Table 4.2 The Global Entrepreneurship and Development Index and subindex ranks of the first 25 countries, 2014

Country	GEDI	GEDI rank	ATT	ATT rank	ABT	ABT rank	ASP	ASP rank
USA	82.5	1	79.5	1	84.5	1	83.5	1
Australia	77.8	2	75.5	4	83.8	2	74.2	5
Sweden	73.7	3	78.7	3	76.5	6	65.8	16
Denmark	72.5	4	66.9	8	77.1	4	73.5	7
Switzerland	70.9	5	66	9	75	7	71.8	9
Taiwan	69.5	6	61.7	15	68.2	10	78.6	2
Finland	69.3	7	79.4	2	62.9	18	65.5	17
The Netherlands	69.0	8	73.6	6	64.5	15	68.8	12
UK	68.6	9	62.1	14	77.6	3	66.2	15
Singapore	67.9	10	52	21	73.3	8	78.3	3
Iceland	67.5	11	63	12	65.5	13	74	6
France	67.2	12	64	10	64.4	17	73.2	8
Belgium	66.5	13	62.1	13	66.2	12	71.1	10
Norway	65.1	14	73.9	5	67	11	54.4	33
Chile	65.0	15	73.3	7	54.9	20	67	14
Germany	64.6	16	56.4	17	70.1	9	67.3	13
Austria	63.9	17	63.2	11	65.1	14	63.6	18
Ireland	61.8	18	51	23	64.5	16	69.9	11
Puerto Rico	61.7	19	49.4	26	76.6	5	59.1	24
Israel	59.6	20	50.2	25	53.7	22	75	4
Estonia	58.9	21	53.7	19	59.6	19	63.6	19
Slovenia	52.7	22	48.3	30	54.3	21	55.5	30
Qatar	52.6	23	53.7	20	44.7	34	59.6	22
Colombia	49.8	24	49.1	27	50	27	50.3	39
Lithuania	49.6	25	42.4	44	51.5	24	55	31

Puerto Rico represents a more unbalanced case, ranking 19th in the overall index, 26th in attitudes, 5th in abilities, and 24th in aspirations. Generally, countries that rank at the bottom of the GEDI also rank at the bottom of the three subindices. Note that a small difference at the end may contribute to big differences in ranking.

Tables 4.3, 4.4, and 4.5 list the ranks and the 15 pillar values of the first 25 countries for the three subindices. Each table gives the pillar values for each of the pillars that make up the respective index. The ranks and the pillar values for all the 120 countries can be found in the Appendices.

As stated earlier, Entrepreneurial Attitude is defined as the general attitude of a country's population toward recognizing opportunities, knowing entrepreneurs personally, attaching high status to entrepreneurs, accepting the risks associated with a business start-up, and having the skills to successfully launch businesses.

Table 4.3 Entrepreneurial Attitudes subindex and pillar values for the first 25 countries, 2014

Countries	ATT	Opportunity Perception	Start-up Skills	Risk acceptance	Networking	Cultural support
USA	79.5	1.00	1.00	0.70	0.61	0.83
Finland	79.4	0.86	0.74	0.70	1.00	0.96
Sweden	78.7	1.00	0.62	0.85	1.00	0.88
Australia	75.5	0.91	0.90	0.66	0.66	0.85
Norway	73.9	0.94	0.54	0.87	0.94	0.92
The Netherlands	73.6	0.75	0.60	0.69	0.87	1.00
Chile	73.3	1.00	0.90	0.79	0.60	0.80
Denmark	66.9	0.71	0.53	0.63	0.81	0.90
Switzerland	66.0	0.60	0.47	0.93	0.70	0.87
France	64.0	0.79	0.45	0.58	0.84	0.77
Austria	63.2	0.66	0.75	0.60	0.84	0.64
Iceland	63.0	0.43	0.87	0.41	1.00	0.72
Belgium	62.1	0.74	0.62	0.60	0.53	0.69
UK	62.1	0.67	0.58	0.47	0.71	0.76
Taiwan	61.7	0.68	0.49	0.78	0.65	0.61
Uruguay	57.4	0.67	0.84	0.43	0.51	0.65
Germany	56.4	0.70	0.37	0.52	0.58	0.82
Kuwait	54.3	1.00	0.32	0.65	0.85	0.57
Estonia	53.7	0.39	0.60	0.46	0.79	0.55
Qatar	53.7	0.93	0.15	0.60	0.86	0.88
Singapore	52.0	0.42	0.38	0.79	0.37	0.79
Peru	51.1	0.93	0.65	0.40	0.53	0.42
Ireland	51.0	0.29	0.66	0.37	0.81	0.68
Poland	50.4	0.38	0.86	0.33	0.72	0.56
Israel	50.2	0.53	0.39	0.49	0.56	0.59

Pillar values are the normalized pillar scores after the average pillar correction

Entrepreneurial Attitudes are important because they express the general feelings of the population toward entrepreneurs and entrepreneurship.

The benchmark individuals are those who can (1) recognize valuable business opportunities, (2) have the necessary skills to exploit these opportunities, (3) attach high status and respect to entrepreneurs, (4) handle start-up risk, and (5) know entrepreneurs personally (i.e., have a network or role models). Moreover, these people can provide the cultural support, financial resources, and networking potential to those who are already entrepreneurs or want to start a business. The USA leads the Entrepreneurial Attitudes index, followed by Finland, Sweden, Australia, Norway, the Netherlands, Chile, Denmark, Switzerland, and France. Chile's 7th place is a very strong showing for a South American country. Factor-driven African and Asian countries, including Swaziland, Mali, Sierra Leone, Ethiopia, Bangladesh, Pakistan, Malawi, Chad, and Burundi, are at the bottom.

Table 4.4 Entrepreneurial abilities subindex and pillar values for the first 25 countries, 2014

Countries	ABT	Opportunity Start-up	Gender	Technology Absorption	Human Capital	Competition
USA	84.5	0.75	0.89	0.81	0.95	1.00
Australia	83.8	0.94	1.00	1.00	0.91	0.69
UK	77.6	0.90	0.54	0.93	0.87	1.00
Denmark	77.1	1.00	0.42	0.99	1.00	1.00
Puerto Rico	76.7	0.74	1.00	1.00	1.00	1.00
Sweden	76.5	1.00	0.73	0.95	0.84	0.66
Switzerland	75.0	0.62	1.00	0.80	0.77	1.00
Singapore	73.4	1.00	0.99	0.70	1.00	0.53
Germany	70.1	0.79	0.59	0.99	0.66	0.89
Taiwan	68.2	0.95	0.62	0.85	0.85	0.43
Norway	67.1	1.00	0.42	0.73	0.86	0.72
Belgium	66.3	0.87	0.47	0.47	0.92	0.80
Iceland	65.5	0.95	0.53	0.85	0.69	0.50
Austria	65.1	0.62	0.66	0.99	0.56	0.85
The Netherlands	64.6	0.80	0.54	0.58	0.61	0.79
Ireland	64.5	0.58	0.40	0.92	0.99	0.89
France	64.4	0.79	0.40	1.00	0.65	0.65
Finland	63.0	0.76	0.55	0.77	0.60	0.53
Estonia	59.6	0.65	0.48	0.79	0.52	0.70
Chile	54.9	0.51	0.58	0.62	0.55	0.56
Slovenia	54.3	0.78	0.41	1.00	0.61	0.54
Israel	53.7	0.39	0.71	0.53	0.79	0.40
Spain	53.0	0.58	0.50	0.77	0.51	0.70
Lithuania	51.5	0.54	0.43	0.57	0.84	0.42
Malaysia	51.1	0.78	0.63	0.26	0.50	0.66

Pillar values are the normalized pillar scores after the average pillar correction

High entrepreneurial abilities are associated with start-ups in the medium- or high-Technology Sectors that are initiated by educated entrepreneurs and launched because of Opportunity Motivation in a not-too-competitive environment with equal male and female start-ups. Quality differences in start-ups are quantified by the motivation and education level of the entrepreneur, and the uniqueness of the product or service, as measured by the level of Competition.

The USA ranks number one on the Entrepreneurial Abilities subindex and has a very strong showing in three of the five pillars, including Gender, Human Capital, and Competition. The USA is relatively weak in Opportunity Start-up and Technology Absorption. Australia is stronger than the USA in three pillars: Opportunity Start-ups, Gender, and the Technology Absorption, but weaker in Human Capital and very weak in Competition. The UK ranks 3rd, with significantly lower entrepreneurial abilities score than the USA and Australia. The UK is relatively strong in

Table 4.5 Entrepreneurial aspirations subindex and pillar values for the first 25 countries, 2014

Countries	ASP	Product Innovation	Process Innovation	High Growth	Internationalization	Risk Capital
USA	83.5	0.86	0.90	0.88	0.72	0.97
Taiwan	78.6	1.00	0.78	1.00	0.64	0.99
Singapore	78.3	0.73	1.00	1.00	1.00	0.83
Israel	75.0	0.91	1.00	0.67	0.75	0.90
Australia	74.2	0.52	0.79	0.71	0.92	0.98
Iceland	74.0	0.84	0.98	0.77	0.90	0.60
Denmark	73.5	1.00	0.80	0.76	0.58	0.91
France	73.2	1.00	0.91	0.77	0.66	0.73
Switzerland	71.8	0.88	0.81	0.41	0.91	1.00
Belgium	71.1	0.75	0.80	0.48	1.00	0.78
Ireland	69.9	0.81	0.72	1.00	0.94	0.67
The Netherlands	68.8	0.89	0.68	0.50	0.71	0.82
Germany	67.3	0.67	0.83	0.75	0.65	0.76
Chile	67.0	1.00	0.39	0.77	0.86	0.67
UK	66.2	0.81	0.67	0.60	0.72	0.63
Sweden	65.8	0.69	0.85	0.45	0.73	0.74
Finland	65.5	0.85	1.00	0.51	0.52	0.54
Austria	63.6	0.88	0.75	0.32	0.89	0.79
Estonia	63.6	0.67	0.69	0.73	0.94	0.41
Czech Republic	63.3	0.74	0.85	0.89	1.00	0.63
Poland	60.3	0.94	0.44	0.68	0.89	0.62
Qatar	59.6	0.96	0.44	1.00	0.55	0.87
Hong Kong	59.3	1.00	0.52	0.83	0.77	0.79
Puerto Rico	59.1	0.97	0.31	1.00	0.66	0.50
United Arab Emirates	59.0	0.81	0.50	1.00	0.80	0.99

Pillar values are the normalized pillar scores after the average pillar correction

Competition, implying that fresh entrepreneurs are mainly looking for market niches that do not have many Competitors. The high-share start-ups are initiated in the medium- and high-Technology Sectors, which is also a strong point of the UK. However, the British face a problem with the Gender Pillar, implying a need to improve the equality of opportunity between females and males. The first three countries are followed by Denmark, Puerto Rico, Sweden, Switzerland, Singapore, and Germany.

Entrepreneurial aspiration is the effort of the early-stage entrepreneur to introduce New Products and/or services, develop new production processes, penetrate foreign markets, substantially increase the firm's number of employees, and Finance a business with formal and/or informal Venture Capital. Product and Process

Innovation, Internationalization, and High Growth are considered characteristics of entrepreneurship. The benchmark entrepreneurs are those whose businesses (1) produce and sell products/services considered to be new to at least some customers, (2) use a technology less than 5 years old, (3) have sales from foreign markets, and (4) plan to employ at least 10 people, and (5) have greater than 50 % growth over the next 5 years. The Finance variable captures the informal Venture Capital potential, as well as the development of capital, Venture Capital, and credit markets, which is vital for innovative start-ups and high-growth firms.

Like the two other subindexes, the USA leads in the Entrepreneurial Aspiration index. While showing some weakness in Internationalization, it is very strong in Risk Capital and Process Innovation. Taiwan is second, with a strong showing in High Growth and Product Innovation, followed by Singapore, Israel, Australia, Iceland, Denmark, France, Switzerland, and Belgium, which round out the top 10. The surprise is the Czech Republic, with a very strong showing in Internationalization but a weak performance in Risk Capital.

4.6 Country and Country Group Performance

How well some countries perform relative to others in entrepreneurship is a question of some importance. In this section, we try to answer this question for several country groupings. While the general trend between the GEDI and development is increasing, with a mild S-shape, substantial variations exist even among similarly developed countries. To present the various component configurations in entrepreneurship across different countries and country groups, we conduct a pillar-level analysis.

Figure 4.3 shows a spider diagram for the 15 pillar values, which compares the USA, the European Union, and the rest of the world. As expected, the outer ring, which represents the USA, has higher values than the EU for all but two of the pillar values. At the same time, the EU outperforms the rest of the world for all but two pillars, Opportunity Perception and Gender.

As the number of countries has increased significantly over previous years, the differences become more significant. The US dominant entrepreneurial position seems to be unquestionable. The USA shows real strength in the areas of Opportunity Perception, Start-up Skills, Human Capital, Competition, Process Innovation, and Risk Capital, all of which have pillar scores higher than or equal to 0.90. As a result, within the developed world, the gap between the EU and the USA is considerably greater on pillars like product and Process Innovation. The US pillar values are more than 33 % higher than the EU's in seven of the fifteen pillars: Opportunity Perception, Start-up Skills, Risk Acceptance, Gender, Human Capital, Competition, and Risk Capital. The difference is between 10 and 33 % in five cases: Cultural Support, Opportunity, Product Innovation, Process Innovation, and High Growth. A less than 10 % difference can be seen in Technology Sector, and the EU

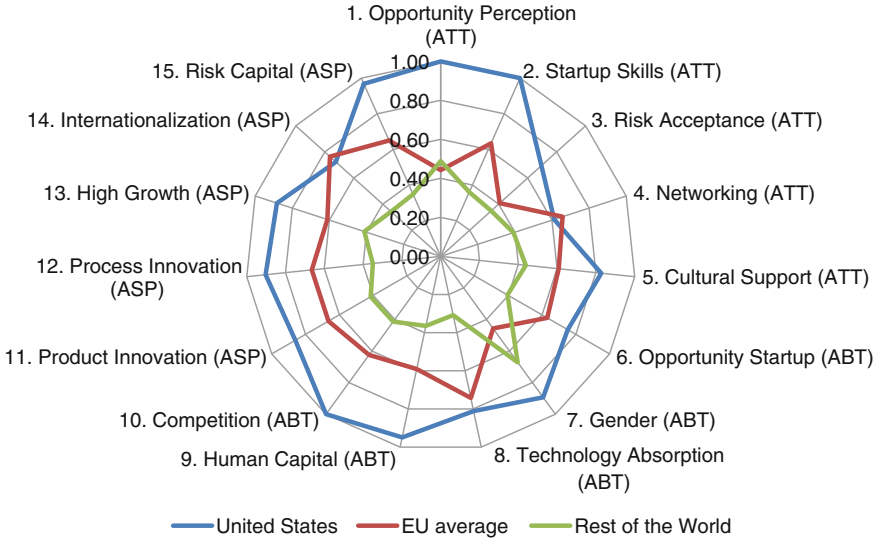

Fig. 4.3 The European Union, the USA, and the rest of the world, 2014

is marginally better than the USA in Networking (by 7 %) and in Internationalization (by 6 %).

The differences between the European Union and the rest of the world are also considerable, and similar in magnitude to the differences between the USA and the European Union. The European Union outperforms the rest of the world by more than 33 % in 11 pillars: Start-up Skills, Networking, Opportunity Start-up, Technology Sector, Human Capital, Competition, Product Innovation, Process Innovation, High Growth, Internationalization, and Risk Capital. The EU is better than the rest of the world by more than 10 % in all but two of the remaining pillars. The exceptions are Opportunity Perception and Gender, implying that the EU lags behind the rest of the world in recognizing good business opportunities and entrepreneurial Gender Equality.

Nothing has engendered as much discussion as the roles of China and India in the new globalization. From the time people argued that the world is flat to today's tales of software expertise in India, the world has been fixated on the emergence onto the world stage of two giant economies, India and China, each of which has a population of about one billion people. Perhaps even more interesting is how entrepreneurial these two countries are, despite having emerged from socialism and communism a relatively short time ago. Or are they?

Figure 4.4 compares the two leading economies of the world, the USA and the European Union, with the BRIC (Brazil, Russia, India, and China) countries. The BRIC countries perform rather as expected or perhaps worse, depending on one's perspective on this issue. The BRIC countries never outperform the USA on any pillar but show some unexpected strength relative to the European Union. On the

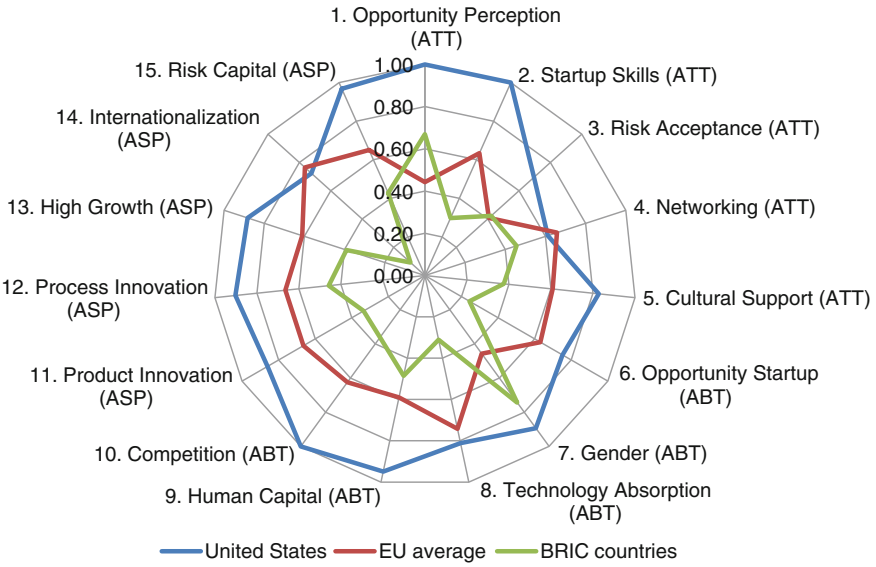

Fig. 4.4 The European Union, USA, and the BRIC countries

Opportunity Perception, Gender, and (marginally) Risk Acceptance pillars, the BRIC countries are better than the European Union. On all other measures, they perform more or less like developing countries. The USA has a dominant advantage in almost all aspects of entrepreneurship over these two country groups. However, the BRIC countries overall are neither as innovative nor as entrepreneurial as some would expect from the views expressed in the literature.

Figure 4.5 looks a little closer at the BRIC countries, which are not well balanced in any respect. They are in fact rather spiky, with one or two strong points and the rest rather weak. Three trends stand out. First, China's prowess in four of the five aspirations pillars, Product Innovation, Process Innovation, High Growth and Risk Capital, is clear. Second, Brazil has huge advantages in Opportunity Perception. Finally, Russia has impressive Human Capital. None of these emerging economies is quickly closing the technology gap with the West. Russia has the lead over India in Human Capital. China performs relatively weakly on attitudes and abilities, with very low scores on Internationalization, Opportunity Start-up, Start-up Skills, Competition, and Technology Absorption. It does much better on the aspirations pillars, particularly Product Innovation and High Growth. India scores extremely low on at least one of the three subindices, such as Networking (attitudes), Opportunity Start-up (abilities), High Growth, and Internationalization (aspirations). It does better on most of the attitudes pillars, despite a low score on Networking. Both China and India have highly divergent pillar scores. Each has built up strength in particular areas, such as Product Innovation or Human Capital, where they are at levels comparable to developed countries. However, both lag

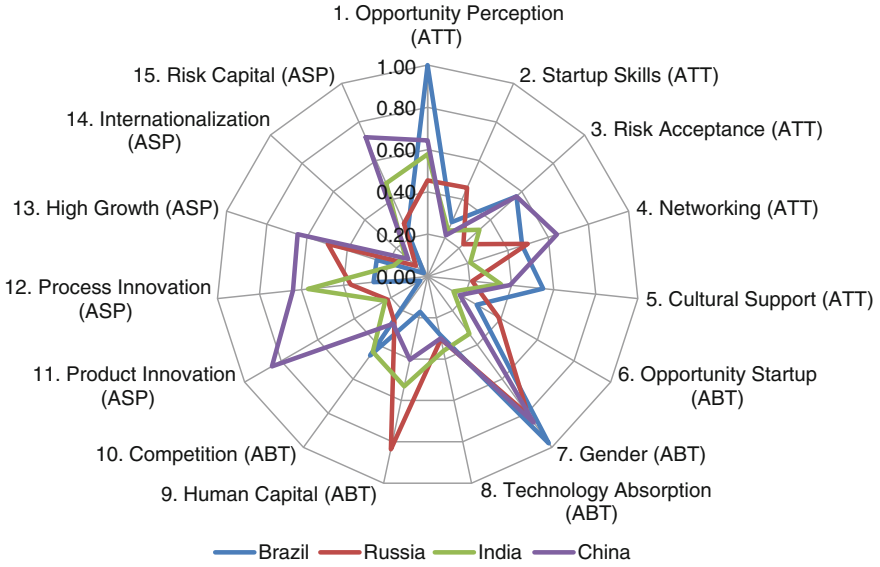

Fig. 4.5 The BRIC countries (Brazil, Russia, India, China)

significantly behind in other areas, which tends to drag down their overall performance on the indexes.

The Americas present an interesting contrast between developed and developing countries. The USA is clearly superior in all aspects of entrepreneurship when compared to Latin America (Fig. 4.6). The largest differences appear to lie in aspirations, with Process Innovation, Venture Capital, and Internationalization showing the greatest differences between the hemispheres. In fact, the differences suggest that Latin America lags so far behind the USA that it might take decades to bridge even the smallest gaps.

Of course, some of the Latin American countries perform much better than the average. Chile ranks 15th on the GEDI, 7th in attitudes, 20th in abilities, and 14th in aspirations. Colombia ranks 24th on the GEDI, 27th in attitudes, 50th in abilities, and 39th in aspirations. Uruguay is 38th, but Argentina and Mexico are 56th and 57th on the GEDI. In the past decade, Latin America has made significant progress toward a more entrepreneurial economy. However, innovation, Internationalization, and Finances present problems, as clearly evidenced by the very low pillar scores. The Latin American nations perform poorly on Innovation and R&D, as is evident in the low Process Innovation score. Financial markets are also underdeveloped, according to the Risk Capital score, and the Internationalization pillar implies problems in export potential. Except for Gender, Latin America appears to have a relatively strong level of Opportunity Perception and Start-up Skills, but it falls short in turning this into a source of innovation and high-growth ventures, and it also is crippled by poor performance on the aspirations and abilities pillars.

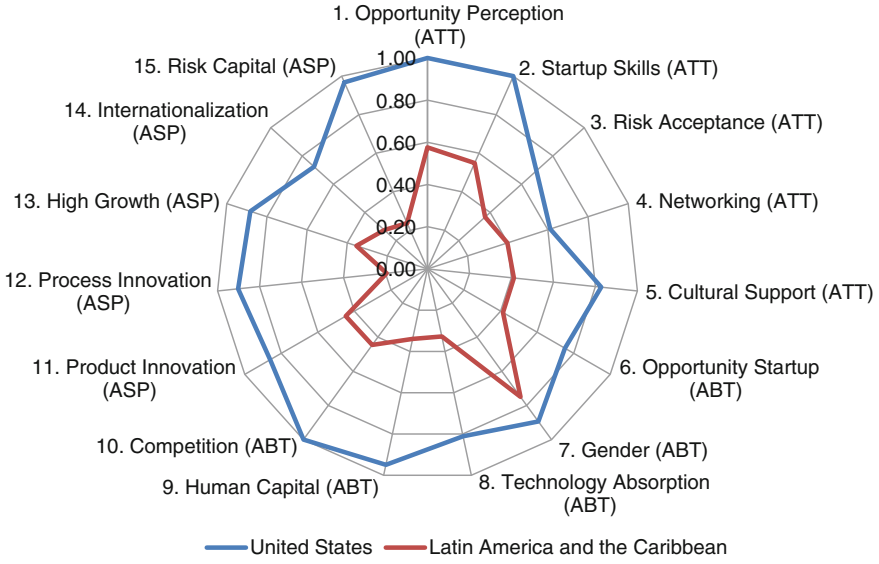

Fig. 4.6 Latin America and the USA

Nothing has captured the imagination of the European Union as much as the financial fate of Portugal, Italy, Greece, and Spain. While Ireland seems to have successfully overcome the banking and the debt crisis, the fate of Greece has been threatening the European monetary union. While the imminent danger of a Greek bankruptcy has been eased, there still is a danger that Greece or Portugal could collapse, which could cause a snowball effect by frightening other countries, such as Spain or Italy. In Fig. 4.7, we compare these countries. What is most striking is that Opportunity Perception has almost collapsed in all of these economies. The great recession clearly has taken a real toll on entrepreneurial opportunity in the European Union.

Of course, there are some real differences among the four countries. The Southern European countries face a much more difficult future, with weaker entrepreneurial and innovative economies, than Northern Europe. The entrepreneurial performance of these Southern European countries is below the development implied trend line. With 46.9 GEDI points, Spain and Portugal tie for 30th and 31st place; Italy ranks 48th with 40.9; and Greece ranks 58th with 37.8. The difference between the GEDI values and the development implied trend line follows the same pattern: Italy is below by 30 %(!), Greece by 25 %, Spain by 20 %, and Portugal by 7 %. Over the last 4 years of the GEDI survey, Greece has been ranked last in the innovation-driven country group. Italy's poor entrepreneurial performance is also alarming; this leading industrial nation's GEDI points are similar to those of China, Peru, Croatia, and South Africa, all of which have significantly lower per capita GDP. Greece, Spain, and Portugal are especially weak in Product Innovation, a lack of high-growth firms characterizes all four Southern European

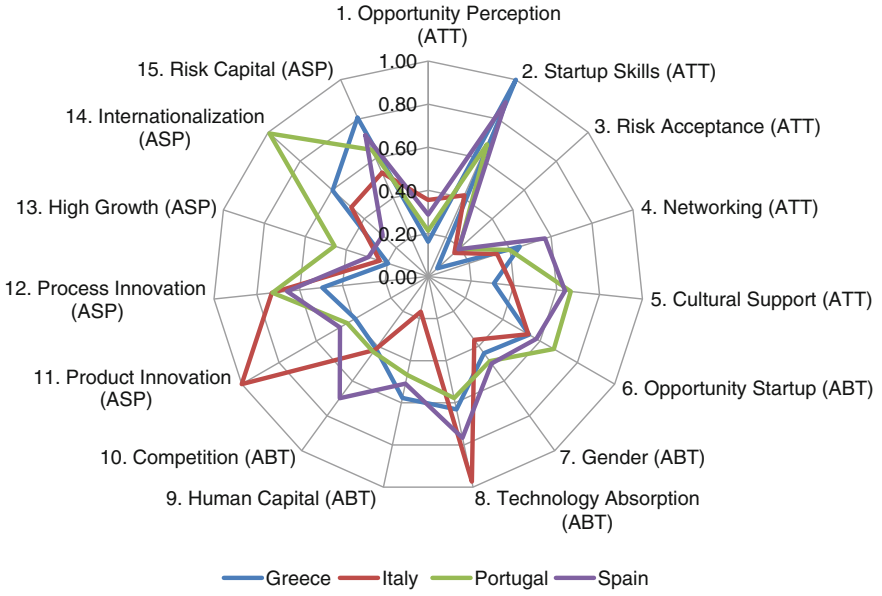

Fig. 4.7 The comparison of Greece, Italy, Portugal, and Spain

countries, and they all have a generally high Fear of Failure. These factors to a large degree explain Southern Europe's poor economic performance relative to France, Germany, and the UK.

Figure 4.8 compares "old Europe" with "new Europe," to borrow terms made famous by former secretary of defense Donald H. Rumsfeld. What is perhaps not surprising is that the two spider diagrams are similar in shape, with old Europe outside stronger than new Europe on 13 of the 15 pillars. Given that they now have similar institutional frameworks and the weakness of the Portugal, Italy, Greece and Spain group, this picture is representative of the situation in the expanded EU. The two exceptions are the High Growth and Internationalization pillars. It seems that the new EU member countries' entrepreneurs consider increasing Internationalization a key to future growth, whereas old EU member country start-ups and young businesses focus on finding market niches in domestic markets. There are three points where Europe is rather weak and should be improved. First is Opportunity Perception. Although not surprising, the lack of opportunity for successful entrepreneurship in new and old Europe is reason for concern. It may stem from the heritage of the former socialist system, wherein individuals were basically discouraged from even considering new business opportunities.

The second area of concern is the low level of Risk Acceptance. After 5 years of the financial crisis, many European citizens still are afraid of starting a business because of high disclosures that undermine even start-ups with High Growth potential. Gender is another problematic area, implying that Gender Equality and equal potential for entrepreneurship among the female population are lacking in

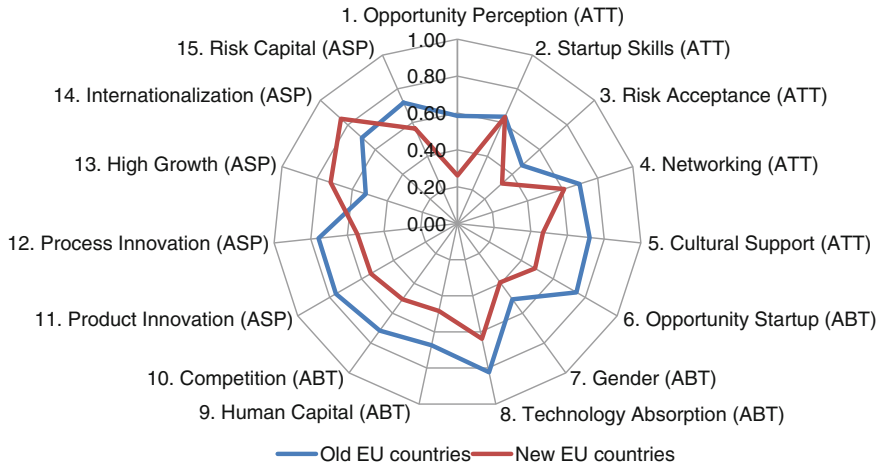

Fig. 4.8 The comparison of the old European Union (EU 15) countries to the new European Union member countries. 15 European Union countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, Spain, Sweden, and UK. New European Union countries: Bulgaria, Croatia, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia

most countries in both old and new Europe. In addition to these three problematic factors, Opportunity Start-ups, Cultural Support, and Human Capital are also weak in the new EU member countries. Given 40 years of communism, this inadequate cultural embedding of entrepreneurship is understandable. High Growth is more problematic in the older part of Europe. Public policy needs to address both issues.

4.7 Summaries and Conclusion

Entrepreneurship is similar to other social creatures, in that it is a multidimensional phenomenon whose exact meaning is difficult to identify. There is only one thing more difficult: how to measure such a vaguely defined creature. Over the decades, researchers have created several entrepreneurship indicators, but none of them has been able to reflect the complex nature of entrepreneurship and provide a plausible explanation of its role in development. The Global Entrepreneurship and Development Index is the first, and presently the only, complex measure of national-level entrepreneurship that reflects the multifaceted nature of entrepreneurship. In this chapter, we presented the entrepreneurial performance of 120 of the world's countries. This included country-level values for the GEDI—Entrepreneurial Attitudes, entrepreneurial abilities, and entrepreneurial aspirations—and for the 15 pillars. We also introduced a new measure of entrepreneurship efficiency, the ABE indicator, and reported values for each country.

While the GEDI represents the contextual features of entrepreneurship, it is also possible to analyze changes in entrepreneurship and its components in terms of development. We presented the relationship between index values and development, as measured by per capita GDP. While previous studies found that entrepreneurship, measured primarily in terms of activities, has a U- or L-shaped relationship with national per capita income, we noticed a linear, mildly S-shaped relationship, which indicates that entrepreneurship is higher in richer countries. This finding fits more accurately with our present knowledge of the nature of economic development than U- or L-shaped relationships between the variables. The final ranking, with Nordic and Anglo-Saxon countries at the top and developing countries at the bottom, also reflects what we expect development trends to look like.

In the final part of the chapter, we compared certain factors between some important countries and country groups. The pillar-level analysis provides a proper tool for showing the real differences and variations in entrepreneurship, which is found to vary substantially not only across countries with different levels of development but also among countries with similar per capita GDP. There is no doubt that the USA is the leading entrepreneurial country: Despite a minimal decline in its GEDI points, the USA is now number one not only in the GEDI but also in all three subindexes for the first time in the history of the GEDI reports. While the leading countries have similar entrepreneurial features, European nations and the European Union lag behind the USA, and this gap is widening. It is evident in the Portugal, Italy, Greece, and Spain group, which lags far behind the larger EU countries and the Nordic fringe. Latin America also requires a substantial increase in entrepreneurship to reach levels comparable to those of North America. Comparing the developing countries shows that the configuration of the 15 pillars is similar in shape but at different levels across the three main parts of the world. A detailed examination of entrepreneurship and the change in its components over the phases of development is the focus of the following chapter.

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Chapter 5
Methodology and Data Description

5.1 Introduction

In this chapter, we are concerned with methodological issues of building the global entrepreneurship and development index (GEDI). Index-building is a complex task that faces several potential pitfalls, starting with the vague and various definitions of a concept like entrepreneurship. We favor a complex perception of entrepreneurship and believe that this complexity requires a complex index, as opposed to the single measures often used.

While we provide an exact description of entrepreneurship, in practical terms it is closer to a permeable frame than a closed box. Our approach to entrepreneurship involves five important aspects.

- First, we view entrepreneurship as a concept of quality rather than quantity.
- Second, we consider both institutional and individual (agency) factors vital in measuring entrepreneurship.
- Third, measuring the pillars of entrepreneurship is based on a benchmark for each pillar. Determining benchmarks are based on annual data for the years 2006–2012.
- Fourth, the averages of each pillar are equalized to provide the same marginal effect. This point is particularly important from the perspective of entrepreneurship policy.
- Fifth, we view the building blocks of entrepreneurship as integrated elements of a system. We believe that the performance of the overall system depends on the weakest pillar and that a good performance in one pillar can only partially compensate for a poorly performing one.

For the 2014 country investigation and ranking, the individual variables are calculated by including 377,648 individuals from 89 countries of the Global Entrepreneurship Monitor (GEM) Adult Population Survey. Individual data from 67 countries are from 2011 to 2012, and individual data from 21 countries predate

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2010. We estimated the individual variables for 33 countries by using data from nearby and similar countries in the GEM Adult Population Survey. All the institutional variables are from surveys other than the GEM; most are from the Global Competitiveness Index (GCI), others from the Doing Business Index or the Index of Economic Freedom, or from multinational organizations such as the United Nations, the Industrial Development Organization, or the Organization for Economic Co-operation and Development (OECD). While we tried to find a single institutional variable for each individual variable, it sometimes was not possible. Therefore, some of these institutional variables are themselves complex "indices." We changed the GCI-related Venture Capital variable from previous versions to the Depth of Capital Market variable (DCM Groh et al. 2012), which is a more proper measure of financial market development.

A critical part of index-building is identifying the proper weights; thus, we provide a novel approach to determining weight that follows the logic of the interaction variables applied in regression technique. Each of our 15 pillars is the result of multiplying an individual variable and an associated institutional variable. In this case, institutional variables can be viewed as particular (country-level) weights of the individual variables. This highlights another potential pitfall, identifying the proper institutional variables, which we discuss in detail.

According to the theory of National Systems of Entrepreneurship (NSE), the 15 pillars interact with one another (Acs et al. 2013). Since we want the index to be suitable for entrepreneurship policymaking, the pillar values should be manipulated in such a way as to equalize the marginal effects. Since normalized pillar averages differ, we developed a new technique for equating the pillar averages across countries—the first time this has been done in the history of index-building, and of the GEDI reports.

Another novelty of our index-building is the way we combine (aggregate) the pillars into sub-indices. Most indices simply use the (weighted) average of the pillars; others apply a dimension-reduction methodology, such as analysis of factors or principal components. We provide a different approach that takes into account the fact that the pillars are only partially substitutable for each other. Relying on the Theory of the Weakest Link (TWL) and the Theory of Constraints (TOC), we developed this new methodology, which we call the Penalty for Bottlenecks. We believe that the basic claim of these theories—that the performance of the system is determined by its weakest performing part and that the pillars are only partially substitutable for one another—is true in the case of entrepreneurship. The PFB relates the pillar values to the lowest pillar value. The penalty depends on the magnitude of the differences; where deviation is greater, the penalty is greater. We applied an exponential penalty function, following Casado Tarabusi and Guarini (2012). In the previous versions of the GEDI, we used a logarithmic penalty function. The PFB provides valuable policy suggestions for enhancing entrepreneurship by improving the weakest pillar in the system.

We next discuss the most important steps of the index-building process by following the composite handbook of the OECD (2008). We start by (a) defining the building blocks of entrepreneurship and the structure of the index; (b) selecting the

variables and the description of the dataset; (c) assigning weights, which involves developing a procedure that incorporates both individual and institutional variables; (d) handling and imputing the missing variables and data; (e) normalizing the data and treating outliers; (f) equating the pillar averages; (g) taking into account the interrelation of the pillars by using the new PFB method, which allows us to dovetail the elements of the index; and (h) analyzing the underlying structure of the data.

In the last section, we introduce a new indicator, the average bottleneck efficiency (ABE) measure. This efficiency indicator measures how well a country's 15 pillars are balanced. We also examine the connection between ABE and the GEDI in terms of economic development.

5.2 Defining Entrepreneurship

All index-building should start with a definition. While a generally accepted definition of entrepreneurship is lacking, there is agreement that the concept comprises numerous dimensions.[1] The most common features of the various definitions include unique traits, risk-taking, opportunity recognition, motivation and exploitation, and innovation. Other characteristics include the output or impact of entrepreneurship, such as value creation, spillover effects, or High Growth (Autio 2005, 2007; Praag and Versloot 2007). Shane and Venkataraman (2000), rather than providing an exact definition, present a conceptual framework that describes the distinctive domain of entrepreneurship research.

While recent theories suggest a multidimensional definition of entrepreneurship, most empirical investigations rely on a simple, one-dimensional approach. Self-employment, the rate of business ownership or new venture creation, and the Total Entrepreneurial Activity (TEA) index are of the same vein; they refer to the level and/or dynamics of entrepreneurship and identify the percentage of the working-age population that is engaged or willing to engage in "entrepreneurial" activity.[2] A major shortcoming of interpreting these measures as entrepreneurship indexes is that they do not capture differences in the quality of entrepreneurial activity, such as opportunity recognition, skills, creativity or innovation, and High Growth. Therefore, such an index would give policymakers guidance only on the quantity of entrepreneurship, not on its quality. Moreover, although the efficiency and quality of an institutional setup could have a major influence on the quality of entrepreneurship, these measures do not take environmental factors into account.

[1] For example, Gartner (1990) describes eight out of ninety themes of entrepreneurship attributes, while Davidsson (2004) lists seven characteristics, Wennekers and Thurik (1999) outline thirteen, and Godin et al. (2008) identify six.

[2] On self-employment, see Acs et al. (1994), Blanchflower et al. (2001), Grilo and Thurik (2008); about business-ownership rate, see Carree et al. (2002), Cooper and Dunkelberg (1986); about new venture creation, see Gartner (1985), Reynolds et al. (1994); about the Total Early-Stage Entrepreneurship Activity Index, see Acs et al. (2005), Bosma et al. (2008).

It is equally important to investigate the contextual nature of entrepreneurship. For one thing, widely interpreted social and cultural factors have a strong effect on a business launch (Aldrich and Fiol 1994; Hofstede et al. 2004). The influence of general institutional factors, such as property rights, the size of government, and regulatory barriers, also play a role in economic development. The recently amended GEM model provides a long list of the contextual features of entrepreneurship that shape new entry, as well as the quality of start-ups, including level of education, infrastructure, government support, R&D transfer, and venture capital (Bosma et al. 2008, 2009).

We believe that any entrepreneurship index should (1) be a complex creature,[3] (2) involve quality differences, and (3) include both individual and institutional/environmental variables. It also should recognize that entrepreneurship is distinct from small businesses, self-employment, craftsmanship, and traditional businesses. It is not a phenomenon associated with buyouts, change of ownership, or management succession. Our index takes into account the degree of contribution entrepreneurship makes, in that some businesses have a larger impact on markets, create more new jobs, and grow faster and larger than others.[4] Finally, like other indices, we consider the availability of the data.

Taking into account all of these possibilities and limitations, we define country-level entrepreneurship as "the dynamic, institutionally embedded interaction between entrepreneurial attitudes, entrepreneurial abilities (ABT), and entrepreneurial aspirations by individuals, which drives the allocation of resources through the creation and operation of new ventures." This approach is consistent with the revised version of the GEM conceptual model (Bosma et al. 2009; Kelley et al. 2012; Xavier et al. 2013).

In accordance with this definition, we propose four-level index-building consisting of (1) variables (2) pillars, (3) sub-indices, and, finally, (4) the super-index. All three sub-indices contain several pillars, which can be interpreted as the quasi-independent building blocks of this entrepreneurship index. In this section, we describe the sub-indices and pillars. In the following, we describe the variables. The three sub-indices of attitudes, abilities, and aspirations constitute the entrepreneurship super-index, which we call the GEDI.

While the abilities and aspirations sub-indices (outlined below) capture actual entrepreneurship abilities and aspirations as they relate to nascent and start-up business activities, the entrepreneurial attitudes (ATT), sub-index aims to identify the attitudes of a country's population toward entrepreneurship. For example, the pillar known as Opportunity Perception potential is essential to recognizing and exploring novel business opportunities. It is also critical to have the proper start-up skills and personal networks to exploit these opportunities. Moreover, fear of failure

[3] Others may think that this statement is generally not true and that a complex phenomenon can be described by a simple indicator or an index that contains only a few variables. Our three-level index building logic allows the application of a simple entrepreneurship measure by analyzing one of the three sub-indices (see later in this chapter).

[4] See Davidsson (2004).

to start a business can have a negative effect on entrepreneurial attitudes, even when opportunity recognition and start-up skills exist. Entrepreneurial attitudes are believed to be influenced by the crucial institutional factors of market size, level of education, the level of risk in a country for new firm formation, the population's rate of Internet use, and culture, all of which are interaction variables of the indicator (Reynolds 2007; Schramm 2008; Uhlaner and Thurik 2007).

The ABT sub-index is principally concerned with measuring some important characteristics of the entrepreneur and of start-ups with high-growth potential. This high-growth potential is approached by quality measures, including opportunity motivation for start-ups that belong to a technology-intensive sector, the entrepreneur's level of education, and the level of competition. The country-level institutional variables include the freedom to do business, the technology adsorption capability, the extent of staff training, and the dominance of powerful business groups. Moreover, gender equality in opportunities and business start-ups is also desirable social and economic goals, so we included the female-to-male TEA ratio and the equal opportunity institutional variable in the ABT sub-index.

The entrepreneurial aspiration (ASP) sub-index refers to the distinctive, qualitative, and strategy-related nature of entrepreneurial activity.[5] Entrepreneurial businesses are different from regularly managed businesses; thus, it is particularly important to be able to identify the most relevant institutional and other quality-related interaction variables. The newness of a product and of a technology, internationalization, high-growth ambitions, and informal finance variables are included in this sub-index. The institutional variables measure the technology transfer and R&D potential, the sophistication of a business strategy, the level of globalization, and the depth of capital market.

5.3 The Selection of Variables and the Dataset

As mentioned previously, an entrepreneurship index should incorporate both individual-level and institutional/environmental variables. All individual-level variables are from the GEM survey. The institutional variables are obtained from various sources.

The full list and description of the applied GEM individual variables can be seen in Table 5.1.

As mentioned previously, individual variables are based on the GEM Adult Population Survey dataset. Of the 120 countries in the GEDI, 72 participated in the GEM survey in either 2011 or 2012, or in both years. Fifteen countries participated in the survey in one of the years from 2006 to 2010. If data were available for both 2011 and 2012, we calculated the individual variable values by averaging the data from these 2 years. In all the other cases, we used single-year, individual data.

[5] For a review of the literature, see Acs (2008).

Table 5.1 The description of the individual variables used in the GEDI

Individual variable	Description
Opportunity recognition	The percentage of the population age 18–64 recognizing good conditions to start a business in next 6 months in area he/she lives
Skill perception	The percentage of the population age 18–64 claiming to possess the required knowledge/skills to start a business
Risk perception	The percentage of the population age 18–64 stating that the fear of failure would not prevent them from starting a business
Know entrepreneurs	The percentage of the population age 18–64 knowing someone who started a business in the previous 2 years
Carrier	The percentage of the population age 18–64 saying that people consider starting a business a good carrier choice
Status	The percentage of the population age 18–64 thinking that people attach high status to successful entrepreneurs
Career status	The status and respect of entrepreneurs calculated as the average of carrier and status
Opportunity motivation	Percentage of the TEA businesses initiated because of opportunity start-up motive
TEA female	The percentage of female TEA to male TEA benchmarked at 50 % to be the best
Technology level	Percentage of the TEA businesses that are active in technology sectors (high or medium)
Educational level	Percentage of the TEA businesses owner/managers having participated over secondary education
Competitors	Percentage of the TEA businesses started in those markets where not many businesses offer the same product
New product	Percentage of the TEA businesses offering products that are new to at least some of the customers
New tech	Percentage of the TEA businesses using new technology that is less than 5 years old average (including 1 year)
Gazelle	Percentage of the TEA businesses having high job expectations (over 10 more employees and 50 % in 5 years)
Export	Percentage of the TEA businesses where at least some customers are outside the country (over 1 %)
Informal investment mean	The mean amount of 3-year informal investment
Business angel	The percentage of the population age 18–64 who provided funds for a new business in past 3 years, excluding stocks and funds, average
Informal investment	The amount of informal investment calculated as INFINVMEAN* BUSANG

Individual variables from 33 countries were estimated by using similar or nearby country data. Since the availability of the institutional data also limited the selection of the countries, we could involve only nations that participated in the 2011–2012 or 2012–2013 World Economic Forum Global Competitiveness Report (GCR) survey. Some GCR countries were left out because of a lack of similar or nearby GEM countries. The size of the sample in different years, the participating

countries, and the calculation of the individual variables, including the 33 non-GEM countries, are also reported in Table 5.2. All analyses of countries having data older than 2010 and based on estimates should be handled with caution.

Since the GEM lacks the necessary institutional variables, we substitute for the index with other widely used relevant data from Transparency International (Corruption Perception Index), UNESCO (tertiary education enrollment, GERD), World Economic Forum (domestic market size, business sophistication, technology absorption and technology transfer capability, staff training, market dominance, female economic participation, and opportunity), International Telecommunication Union (Internet usage), The Heritage Foundation and World Bank (economic freedom), United Nations (urbanization index), KOF Swiss Economic Institute (economic globalization), Coface (business climate risk), and Groh et al. 2012; (depth of capital market).

A potential criticism of our method—as with any other index—is the apparently arbitrary selection of institutional variables and the neglect of other important factors. In all cases, we aimed to collect and test alternative environmental factors before making our selection. Our choice was constrained by the limited availability of data in many countries; this is why, for example, we omitted the World Bank new business registration dataset. The selection criteria for a particular institutional/environmental variable were the following:

1. The potential to link logically to the particular entrepreneurship variable.
2. The clear interpretation and explanatory power of the selected variable; for example, we have had interpretation problems with the taxation variables.[6]
3. Avoiding having the same factor appear more than once in the different institutional variables.

A previous version of the GEDI was accused of incorporating multiple environmental factors. This was particularly problematic in cases when variables were complex—that is, they themselves consisted of many variables (e.g., Doing Business Index, Index of Economic Freedom). In this version, we used simple institutional variables. In eight cases—business climate rate, Corruption Perception Index, business freedom, female economic participation and opportunity, technology transfer, Business Sophistication Index, economic globalization, depth of capital market—application of the complex measure proved to be more useful than the single variable. After carefully checking the components of the potential complex institutional variables, we eliminated all duplication. Moreover, instead of using the whole complex index, we applied only sub-indices that were more

[6] A former version of our index (Acs and Szerb 2009) was criticized because we did not incorporate the taxation effect (A European Paradise, p. 25). While it is true that high taxation can be harmful for entrepreneurship, ceteris paribus, it should not be forgotten that high-taxation countries can provide better public services and an environment favorable to business startups. While Scandinavian countries have high taxation, they also lead the ranks in government effectiveness and regulatory quality, as reported by the World Bank Aggregate Governance Indicator dataset (http://info.worldbank.org/governance/wgi/index.asp).

Table 5.2 Distribution of the sample by countries and calculation of the individual variables

Country/year	2006	2007	2008	2009	2010	2011	2012	Individual variable calculation
Albania								Average of Bosnia and Macedonia
Algeria						3,373	4,984	Average of 2011–2012
Angola							2,489	2012
Argentina						1,687	1,713	Average of 2011–2012
Australia					1,705	1,622		Average of 2010–2011
Austria							4,548	2012
Bahrain								Average of UAE and Saudi Arabia
Bangladesh						1,932		2011 data
Barbados						2,186	2,044	Average of 2011–2012
Belgium						1,839	1,546	Average of 2011–2012
Benin								Average of Nigeria, Ghana, and Malawi
Bolivia					3,524			2010 data
Bosnia and Herzegovina						2,277	2,001	Average of 2011–2012
Botswana							2,003	2012
Brazil						1,999	10,000	Average of 2011–2012
Brunei Darussalam								Average of Malaysia and Singapore
Bulgaria								Average of Romania and Montenegro
Burkina Faso								Average of Ghana, Uganda, and Malawi
Burundi								Average of Ghana, Uganda, and Malawi
Cameroon								Average of Nigeria, Ghana, and Malawi
Chad								Average of Ghana, Uganda, and Malawi
Chile						6,213	1,952	Average of 2011–2012
China						3,689	3,684	Average of 2011–2012
Colombia						10,374	6,471	Average of 2011–2012

(continued)

Table 5.2 (continued)

Country/year	2006	2007	2008	2009	2010	2011	2012	Individual variable calculation
Costa Rica							2,041	2012
Côte d'Ivoire								Average of Ghana, Uganda, and Malawi
Croatia						2,000	2,000	Average of 2011–2012
Cyprus								Same as Greece
Czech Republic						2,005		2011 data
Denmark						2,015	2,217	Average of 2011–2012
Dominican Republic				2,007				2009 data
Ecuador							2,003	2012
Egypt							2,501	2012
El Salvador							1,905	2012
Estonia							1,721	2012
Ethiopia							3,003	2012
Finland						2,011	2,038	Average of 2011–2012
France						1,607	3,210	Average of 2011–2012
Gabon								Average of Namibia and Botswana
Gambia								Average of Ghana, Uganda, and Malawi
Germany						4,260	4,297	Average of 2011–2012
Ghana							2,213	2012
Greece						2,000	2,000	Average of 2011–2012
Guatemala					2,280	2,398		Average of 2010–2011
Honduras								Average of Guatemala and Panama
Hong Kong				2,000				2009 data
Hungary						2,002	2,000	Average of 2011–2012
Iceland					1,684			2010 data

(continued)

Table 5.2 (continued)

Country/year	2006	2007	2008	2009	2010	2011	2012	Individual variable calculation
India			2,032					2008 data
Indonesia	2,000							2006 data
Iran						3,322	3,178	Average of 2011–2012
Ireland						2,002	2,000	Average of 2011–2012
Israel							2,005	2012
Italy							2,000	2012
Jamaica					2,287	2,047		Average of 2010–2011
Japan						2,004	2,010	Average of 2011–2012
Jordan				2,006				2009 data
Kazakhstan		2,000						2007 data
Kenya								Average of Ghana, Uganda, and Malawi
Korea						2,001	2,000	Average of 2011–2012
Kuwait								Same as Saudi Arabia
Latvia						2,000	2,000	Average of 2011–2012
Lebanon				2,000				2009 data
Liberia								Average of Ghana, Uganda, and Malawi
Lithuania						2,003	2,003	2011 data
Macedonia							2,003	2012
Madagascar								Average of Ghana, Uganda, and Zambia
Malawi							1,847	2012
Malaysia						2,053	2,006	Average of 2011–2012
Mali								Average of Ghana, Uganda, and Malawi
Mauritania								Average of Ghana, Uganda, and Malawi
Mexico						2,511	2,516	Average of 2011–2012

(continued)

Table 5.2 (continued)

Country/year	2006	2007	2008	2009	2010	2011	2012	Individual variable calculation
Moldova								Average of Romania and Russia
Montenegro					2,000			2010 data
Morocco				1,500				2009 data
Mozambique								Average of Ghana, Uganda, and Malawi
Namibia							1,959	2012
Netherlands						2,861	2,887	Average of 2011–2012
Nicaragua								Average of Guatemala and Panama
Nigeria						2,056	2,651	Average of 2011–2012
Norway						2,001	1,999	Average of 2011–2012
Oman								Average of Saudi Arabia and UAE
Pakistan						2,002	2,000	Average of 2011–2012
Panama						2,001	1,998	Average of 2011–2012
Paraguay								Average of Bolivia, Ecuador, and Peru
Peru						2,010	2,071	Average of 2011–2012
Philippines	2,000							2006 data
Poland						2,000	2,003	Average of 2011–2012
Portugal						2,011	2,001	Average of 2011–2012
Puerto Rico		1,998						2008 data
Qatar								Average of Saudi Arabia and UAE
Romania						1,739	1,710	Average of 2011–2012
Russia						7,500	3,541	Average of 2011–2012
Rwanda								Average of Ghana, Uganda, and Malawi
Saudi Arabia					1,957			2010 data
Senegal								Average of Ghana, Uganda, and Malawi

(continued)

Table 5.2 (continued)

Country/year	2006	2007	2008	2009	2010	2011	2012	Individual variable calculation
Serbia				1,766				2009 data
Sierra Leone								Average of Ghana, Uganda, and Malawi
Singapore						2,000	2,001	Average of 2011–2012
Slovak Republic						2,000	2,000	Average of 2011–2012
Slovenia						2,009	2,010	Average of 2011–2012
South Africa						2,724	2,655	Average of 2011–2012
Spain						17,500	21,900	Average of 2011–2012
Swaziland								Average of Namibia and Angola
Sweden						2,143	1,740	Average of 2011–2012
Switzerland						1,612	1,587	Average of 2011–2012
Taiwan						2,012	2,009	Average of 2011–2012
Tanzania								Average of Ghana, Uganda, and Malawi
Thailand						2,000	3,000	Average of 2011–2012
Trinidad and Tobago						1,813	1,802	Average of 2011–2012
Tunisia							2,000	2012
Turkey						2,401	2,401	Average of 2011–2012
Uganda							2,343	2,012
Ukraine								Average of Russia and Kazakhstan
United Arab Emirates						3,029		2011 data
United Kingdom						1,650	1,676	Average of 2011–2012
United States						4,699	4,265	Average of 2011–2012
Uruguay						1,658	1,627	Average of 2011–2012
Venezuela						1,888		2011 data
Zambia							2,155	2012
Sum	4,000	3,998	2,032	11,279	15,437	15,4751	184,143	375,640

relevant to entrepreneurship: Business climate rate is a part of country risk rate, business freedom is a component of the Index of Economic Freedom, female economic participation and opportunity is part of the Gender Gap Index, economic globalization is a subset of the KOF Index of Globalization, and the depth of capital market is a sub-index of the Venture Capital and Private Equity Index.

In this version, we apply the most recent institutional variables available on January 30, 2013. The full description of the institutional variables, their sources, and the year of the survey can be found in Table 5.3.

5.4 The Assignment of Weights

Another crucial point about building an index is the application of proper weights. To avoid being accused of using arbitrary methodology, most indices do not use weighting. Without weights, the calculation is relatively easy, and nonprofessionals can interpret it in a straightforward fashion. The Doing Business Index and the Index of Economic Freedom take this approach. However, weighting is very useful when the different components of the index have different influences. A previous version of the GCI assigned different weights to the indicators, based on the stages of a country's development. Nevertheless, this approach had several shortcomings, including the arbitrary choice of the weights and the negation of potential country differences. The GCI currently uses a sophisticated methodology and econometric techniques to merge the indicators and determine the appropriate weights. The new weighting method avoids the arbitrary selection problem but does not handle country differences. Therefore, a different technique should be developed to solve the problem of country-level weighting.

Another reason for developing a new method has to do with the need to work with the potentially different interpretations of entrepreneurship across countries. Moreover, we should combine the institutional/environmental and the individual variables. Since most of these environmental data are not in the GEM survey, we have to rely on other outside sources, as stated in the previous section.[7] This practice is not unique; all previously mentioned indices use data from other sources. For example, the Index of Economic Freedom uses the Doing Business data to derive the Business Index sub-index and the Corruption Perception Index to identify business corruption.

The novelty of our approach is that we consider the institutional variables as interaction variables, not as independent indicators. The interaction variable approach is used in regression analysis, where two independent variables are multiplied by each other to demonstrate their combined effect on the dependent

[7] To be fair, the GEM survey provides measures of these variables; however, it is not conducted in every country. Moreover, it is based on a small sample (18–36) of local experts who might not consider international, comparative aspects of the particular environmental variable.

Table 5.3 The description and source of the institutional variables used in the GEDI

Institutional variable	Description	Source of data	Data availability
Domestic market	Domestic market size that is the sum of gross domestic product plus value of imports of goods and services, minus value of exports of goods and services, normalized on a 1–7 (best) scale data are from the World Economic Forum competitiveness	World Economic Forum	The global competitiveness report 2012–2013, p. 496
Urbanization	Urbanization that is the percentage of the population living in urban areas, data are from the Population Division of the United Nations, 2011	United Nations	http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries
Market agglomeration	The size of the market: a combined measure of the domestic market size and the urbanization that later measures the potential agglomeration effect. Calculated as domestic market urbanization*	Own calculation	–
Tertiary education	Gross enrolment ratio in tertiary education, 2011 or latest available data.	UNESCO	http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=167
Business risk	The business climate rate "assesses the overall business environment quality in a country… It reflects whether corporate financial information is available and reliable, whether the legal system provides fair and efficient creditor protection, and whether a country's institutional framework is favorable to intercompany transactions" (http://www.trading-safely.com/). It is a part of the country risk rate. The alphabetical rating is turned to a seven-point Likert scale from 1 (D rating) to 7 (A1 rating). December 30, 2012 data	Coface	http://www.coface.com/CofacePortal/COM_en_EN/pages/home/risks_home/business_climate/rating_table?geoarea-country=&crating=&brating=

(continued)

Table 5.3 (continued)

Institutional variable	Description	Source of data	Data availability
Internet usage	The number of Internet users in a particular country per 100 inhabitants, 2012 data	International Telecommunication Union	http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
Corruption	The corruption perceptions index (CPI) measures the perceived level of public-sector corruption in a country. "The CPI is a 'survey of surveys', based on 13 different expert and business surveys." (http://www.transparency.org/policy_research/surveys_indices/cpi/2009) Overall performance is measured on a ten-point Likert scale. Data are from 2012	Transparency International	http://cpi.transparency.org/cpi2012/results/
Economic freedom	"Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation, as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The score is based on 10 factors, all weighted equally, using data from the World Bank's *doing business* study." (http://www.heritage.org/Index/pdf/Index09_Methodology.pdf). Data are from 2011	Heritage Foundation/ World Bank	http://www.heritage.org/index/explore.aspx
Gender equality	This is the female economic participation and opportunity sub-index, a part of the Gender gap index, which consists of three parts, the participation gap, the remuneration gap and the advancement gap. The participation gap is captured using the	World Economic Forum	The global gender gap report 2012, pp. 10–11

(continued)

Table 5.3 (continued)

Institutional variable	Description	Source of data	Data availability
	difference in labour force participation rates. The remuneration gap is captured through…the… ratio of estimated female-to-male earned income…and the gap between the advancement of women and men is…the ratio of women to men among legislators, senior officials and managers, and the ratio of women to men among technical and professional workers. "The global gender gap report", 2012, p. 4		
Tech absorption	Firm-level technology absorption capability: "companies in your country are (1 = not able to absorb new technology, 7 = aggressive in absorbing new technology)"	World Economic Forum	The global competitiveness report 2012–2013, p. 489
Staff training	The extent of staff training: "To what extent do companies in your country invest in training and employee development? (1 = hardly at all; 7 = to a great extent)"	World Economic Forum	The global competitiveness report 2012–2013, p. 447
Market dominance	Extent of market dominance: "Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)"	World Economic Forum	The global competitiveness report 2012–2013, p. 451
Technology transfer	These are the innovation index points from GCI: a complex measure of innovation, including investment in research and development (R&D) by the private sector, the presence	World Economic Forum	The global competitiveness report 2012–2013, p. 20

(continued)

Table 5.3 (continued)

Institutional variable	Description	Source of data	Data availability
	of high-quality scientific research institutions, the collaboration in research between universities and industry, and the protection of intellectual property		
GERD	Gross domestic expenditure on R&D (GERD) as a percentage of GDP, year 2011 or latest available data; Puerto Rico, Dominican Republic, United Arab Emirates, and some African countries are estimated	UNESCO	http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=2656
Business strategy	Refers to the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery	World Economic Forum	The global competitiveness report 2012–2013, p. 20
Globalization	A part of the globalization index measuring the economic dimension of globalization. The variable involves the actual flows of trade, foreign direct investment, portfolio investment, and income payments to foreign nationals, as well as restrictions of hidden import barriers, mean tariff rate, taxes on international trade, and capital account restrictions. Data are from the 2013 report and based on the 2010 survey. http://globalization.kof.ethz.ch/media/filer_public/2013/03/25/rankings_2013.pdf	KOF Swiss Economic Institute	Dreher, A. (2006). Does globalization affect growth? evidence from a new index of globalization, *Applied Economics 38*, 10: 1091-1110

(continued)

Table 5.3 (continued)

Institutional variable	Description	Source of data	Data availability
Depth of capital market	The depth of capital market is one of the six sub-indices of the venture capital and Private Equity Index. This variable is a complex measure of the size and liquidity of the stock market, level of IPO, M&A, and debt and credit market activity. Note that there were some methodological changes over the 2006–2012 time period, so comparison to previous years is not perfect. The dataset is provided by Alexander Groh*	EMLYON Business School, France and IESE Business School, Barcelona, Spain	Groh, A, H. Liechtenstein and K. Lieser. (2012). The Global Venture Capital and Private Equity Country Attractiveness Index 2012 Annual, http://blog.iese.edu/vcpeindex/about/

variable.[8] Here, institutional variables enter into the index as a part of a particular pillar. A key task is to find the appropriate institutional variable for a particular entrepreneurship variable. We believe that this methodology can clarify interpretation of the questions in the GEM survey.

Another potential perception of the institutional variables is to view them as weighting variables. A major advantage of this approach is the ability to assign the proper weight to a particular variable on a variable basis; therefore, country differences can be incorporated in the index. Moreover, the arbitrary selection of the weight can also be eliminated.

An alternative solution for incorporating the environmental variables could have been to involve them as independent factors, and we have tested several versions of the model, including this alternative. Whereas the overall rank of the countries is not really sensitive to a few variable changes and rearrangements in the system, the use of the pure measures enlarges the effect of the individual level in comparison to institutions and thus could provide a potentially false policy implication. Similarly, if institutional variables are entered independently, they become more dominant factors. While individual-level measures favor less developed countries, quality and institutional factors favor developed countries. Therefore, the applied interaction method seems to provide a good balance for these opposing development effects.

[8] See Acs and Varga (2005).

5.5 Missing Variables and Data Imputations

Since our basic individual data are provided by the GEM, participation in the GEM survey determines the potential list of countries and sample size. However, there is another potential limitation, the availability of institutional data. Because seven of our fifteen institutional variables are from the GCI, it is particularly important to have these variables. While there were five additional countries in the 2010 and 2012 GEM surveys, we had to cancel out Tonga, Vanuatu, the West Bank and Gaza Strip, Yemen, and Syria because of the lack of proper institutional variables.[9]

There is another problem: How to deal with the 16 countries that were in neither the 2011 nor the 2012 GEM survey? Five countries—Bolivia, Guatemala, Iceland, Montenegro, and Saudi Arabia—participated in the GEM survey in 2010. The remaining 11 countries—the Dominican Republic, Hong Kong, India, Indonesia, Jordan, Kazakhstan, Lebanon, Morocco, Philippines, Puerto Rico, and Serbia—participated in the GEM survey in one of the years between 2006 and 2009.[10] In this case, we applied single-year individual data, as presented in Table 5.2, which were combined with the most recent institutional variable data available.

There are 33 countries that have the necessary institutional data but lack the individual data. In these cases, we estimated the missing individual data by using nearby and similarly developed country data. In the previous GEDI reports, we applied the same methodology. Of these countries, two nations, Botswana and Namibia, first participated in the GEM survey in 2012. By comparing the 2012 calculations with the estimated 2011 data, the deviance was within the acceptable 5 % range. The exact calculation of the individual data for the 33 missing countries can be found in Table 5.2.

A few variables are missing for some countries. Since we did not want to drop any more countries from the sample, we estimated the missing data using expert techniques, as follows: the GERD measure lacked data for Angola, Bahrain, Bangladesh, Barbados, Belize, Benin, Burundi, Cameron, Cameron, Chad, Cote d'Ivoire, the Dominican Republic, Lebanon, Malawi, Mauritania, Namibia, Oman, Qatar, Rwanda, Swaziland, the United Arab Emirates, and Venezuela. In these cases, other government sources and data from similar nearby countries provided adequate estimates. KOF Index of Globalization data for Brunei, Lebanon, Montenegro, Kazakhstan, Hong Kong, Qatar, Puerto Rico, Saudi Arabia, and the United Arab Emirates are estimated similarly to GERD by applying nearby country data points. Puerto Rico's business freedom data are set below the US data, and Brunei's

[9] Some may not consider the West Bank and Gaza Strip an independent country. Tonga and Vanuatu are tiny countries, and Yemen and Syria has been engaged in civil war over the last few years.

[10] We canceled out Canada participating in the GEM APS survey in 2006 because it would have changed the benchmark values and, hence, would change the rank order of the countries.

is equal to the average of Malaysia and Singapore. All the other data are available for all countries; therefore, we believe that these rough estimates do not noticeably influence our results.[11]

5.6 Normalizing the Data and Treating the Outliers

Like other indices, our variables are in different measurement units and magnitudes. Several are in percentages, others are on a seven-point Likert scale, and some are in dollar values or dimensionless numbers. In order to add these different units, the data must be normalized. The normalization problem is closely connected to the problem of benchmarking. All index building is based on a benchmarking principle. The selection of the proper benchmarking considerably influences the index points and also the rank of the countries. In some cases, scale adjustment is suggested to improve the distribution of the pillars.

In the previous version of the GEDI, we used winsorization, that is, adjusting the difference between the highest and the second highest pillars' values to a maximum of 5 % and the difference between the second highest and the third highest pillars' values to a maximum of 5 %. While we could decrease the outlier problem, it proved to be insufficient in some cases (Risk Capital, technology start-up, Process Innovation). There are solutions other than winsorization to handle outliers and extreme distribution. Some outlier handling procedure is taking place during normalization, while others handle the problem independently.[12]

Tarabusi and Palazzi's (2004) metric homogeneity methodology takes the decimal logarithm of the variable data to decrease the differences between the extreme values and the other data points. While it is an efficient way of handling the outliers, it still has a major disadvantage because of the change in the ranking of the normalized pillars, based on the average pillar values (OECD 2008). If we assume that the average of the normalized pillar values reflects the ease or the difficulty of reaching higher pillar scores, then this kind of rearrangement is unacceptable.

While categorization solves the outlier problem, it does not seem to be a proper tool because it decreases the relative differences among the countries significantly. Annoni and Kozovska (2010) suggest a minimal transformation of the data. They applied the Box–Cox transformation in cases where the absolute value of skew—a measure of the asymmetry of distribution—exceeds the value 1. Note that the decimal logarithmic transformation is a special case of the Box–Cox transformation.

[11] In order to check potential bias, the index was calculated without these countries; however, the GEDI values and the rank order of the involved countries were basically unchanged.

[12] For a detailed discussion see Tarabusi and Palazzi (2004), Annioni and Kozovska (2010).

Capping is also frequently used to handle outliers. The question relates to the value of the cap. The Environmental Sustainability Index uses the 97.5 percentile adjustment. It also makes an additional 2.5 percentile adjustment in the bottom (OECD 2008). In our case, we selected the 95th percentile score adjustment, meaning that any observed values higher than the 95th percentile is lowered to the 95th percentile. It also means that over the 2006–2012, time period at least five different countries has reached the maximum value in all of the 15 pillars. Hence, the best value is not a result of an extraordinary effort by one or a few countries, but a reachable benchmark for other countries as well. We have made another adjustment, the equalization of the pillar averages described in the following section. We examined the skewness value of the pillars, which can be seen in Table 5.4.

The magnitude of the distorted distribution of the data can be measured with the skewness. According to Annoni and Kozovska (2010), an accepted skewness of the variables can be in the [−1, 1] range. According to Table 5.4, the skewness of the original data pillars exceed the value 1 in three cases (Process Innovation, High Growth, and Risk Capital). After applying the capping, the absolute skewness values decreased below 1 in all cases. After equalization of the pillar values, the skewness values are all in the acceptable [−1, 1] range. The histograms of the variables are presented in the appendix.

In order to be in exactly the same range, we used to apply the Min–Max normalization technique, which arranges the data within an identical [0, 1] range. The most commonly used z-score, a mean of 0 and variance of 1, cannot be applied because the PFB method requires all variables to be in the same range. This approach has the disadvantage of increasing the differences, even if real deviations are minimal.

Table 5.4 The value of skewness of the original and the capped pillars

Pillar	Original pillars	Capped pillars	Equalization of pillar values
Opportunity Perception	0.60	0.42	0.35
Start-up skills	0.13	−0.03	0.06
Risk acceptance	0.01	−0.07	0.14
Networking	0.82	0.27	0.19
Cultural support	0.44	0.33	0.46
Opportunity start-up	0.14	0.09	0.37
Gender	−0.02	−0.16	0.21
Technology absorption	0.90	0.53	0.16
Human capital	0.47	0.26	0.21
Competition	0.62	0.45	0.62
Product innovation	0.07	−0.14	0.07
Process Innovation	1.64	0.76	0.19
High Growth	1.30	0.20	0.16
Internationalization	0.12	−0.05	−0.01
Risk Capital	1.10	0.90	0.10

This is why we are now using the distance normalization technique that preserves the distance (relative differences) among the countries with respect to the pillars.

$$x_{i,j} = \frac{z_{i,j}}{\max z_{i,j}} \tag{5.1}$$

for all $j = 1,\ldots\ m$ the number of pillars
where $x_{i,j}$ is the normalized score value for country i and pillar j
$z_{i,j}$ is the original pillar value for country i and pillar j
$\max_i z_{i,j}$ is the maximum value for pillar j

Applying the distance methodology, the pillar values are all in the range [0, 1]; however, the lowest pillar value is not 0. In this case, all countries' efforts are evaluated in relation to the benchmarking country, but the worst country is not set to zero.

5.7 Harmonization of the Pillars: Equalize Pillar Averages

The different averages of the normalized values of the 15 pillars imply that reaching the same score requires a different effort and consequently different resources across the pillars. Higher average values—e.g., Opportunity Start-up—could mean that it is easier to reach than lower average value—e.g., Process Innovation. Since we want to use the GEDI for public policy purposes, the additional resources for the same marginal improvement of the pillar values should be the same for all 15 pillars. Therefore, improving Opportunity Start-up by 0.1 unit should require the same additional resources as the other 14 pillars. Therefore, we need a transformation to equate the average values of the 15 pillars.

We have calculated the average values of the 15 pillars after the capping adjustment and the normalization and made the following average adjustment:

Let x_i be the normalized score for country i for a particular pillar j.

The arithmetic average of pillar j for number n countries is

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{i,j}}{n} \quad \text{for all } j \tag{5.2}$$

We want to transform the $x_{i,j}$ values such that the potential values will be in the [0, 1] range,

$$y_{i,j} = x_{i,j}^{k} \tag{5.3}$$

where k is the "strength of adjustment," the kth moment of X_j is exactly the needed average, $\bar{y}_j$. We have to find the root of the following equation for k:

$$\sum_{i=1}^{n} x_{i,j}^{k} - n\bar{y}_j = 0 \tag{5.4}$$

It is easy to see, based on previous conditions and derivatives, that the function is decreasing and convex, which means it can be quickly solved using the well-known Newton–Raphson method with an initial guess of 0. After obtaining k, the computations are straightforward. Note that if

$$\begin{array}{ll} \bar{x}_j < \bar{y}_j & k < 1 \\ \bar{x}_j = \bar{y}_j & k = 1 \\ \bar{x}_j > \bar{y}_j & k > 1 \end{array}$$

then k will be thought of as the strength (and direction) of adjustment.

5.8 The Penalty for Bottleneck Methodology

We have defined entrepreneurship as the dynamic interaction of ABT, aspirations, and attitudes across different levels of development. One issue this definition raises is how to bring dynamism into the model. Configuration theory provides a useful way of thinking about this issue.[13] Configurations are defined as "represent[ing] a number of specific and separate attributes which are meaningful collectively rather than individually. Configurations are finite in number and represent a unique, tightly integrated, and therefore relatively long-lived set of dynamics" (Dess et al. 1993, pp. 775–776).

Two closely related theories, TWL and TOC, provide us another way to view the interrelation of the elements. These theories argue that the performance of the system depends on the element that has the lowest value in the structure. According to the TOC, improvement can only be achieved by removing the weakest link, which constrains the performance of the whole system (Goldratt 1994). The TWL claims that there is no perfect substitution among the elements of the system, only a partial one (Tol and Yohe 2006; Yohe and Tol 2001). Whereas both principles are mainly applied in the production process and operation management, a few are applied in the humanities.[14] According to the popular Six Sigma management theory, the production process can be improved by removing the causes of mistakes (weakest link) and reducing variation in the system (Nave 2002; Stamatis 2004). The notion of constraints is also present in the institutional literature, implying that

[13] See Miller (1986, 1996).

[14] In a public choice paper, Harrison and Hirshleifer (1989) present a model where the individual social composition function is constructed by taking into account the weakest link. The financial system can also be described by the weakest link postulate (Rajan and Bird 2001).

economic development or growth depends on improving the binding institutional barriers (North 1990).

The weakest link postulate in entrepreneurship is also present. According to Lazear (2004), entrepreneurs perform many tasks and therefore must be generalists —"jacks-of-all-trades." Lazear claims that the performance of a venture depends on the entrepreneur's weakest skills; therefore, developing a business can be achieved by improving the entrepreneur's worst skill. We argue that the generalist perspective can be applied not only to entrepreneurial traits but to other aspects of business and entrepreneurship.

A practical application of the TWA and TOC theories is the penalty for bottleneck methodology. A bottleneck is defined as the worst performing link or a binding constraint in the system. With respect to entrepreneurship, bottleneck means a shortage or the lowest level of a particular entrepreneurial pillar, relative to other pillars. This notion of a bottleneck is important for policy purposes. Our model suggests that pillars interact; if they are out of balance, entrepreneurship is inhibited. The pillar values should be adjusted in a way that takes into account this notion of balance. After normalizing the scores of all the pillars, the value of each pillar of a country is penalized by linking it to the score of the pillar with the weakest performance in that country. This simulates the notion of a bottleneck; if the weakest pillar were improved, the whole GEDI would show a significant improvement. Moreover, the penalty should be higher if differences are higher. From the perspective of either the configuration or the weakest link, it implies that stable and efficient configurations are those that are balanced (have about the same level) in all pillars.[15]

Up to now, we have used the natural logarithm penalty function. Tarabusi and Palazzi (2004), Tarabusi and Guarini (2012) developed a family of penalization methodology. We can define the penalty function as the difference between the original and the after-penalty pillar values. Following Tarabusi and Palazzi (2004), Tarabusi and Guarini (2012), Szerb et al. (2011), the required characteristics of the penalty functions are derived. Most importantly, the penalty function should reflect the magnitude of the penalty; lower difference implies lower penalty, while higher imbalance implies higher penalty. The penalty function also reflects compensation for the loss in one pillar for a gain in another pillar.

The marginal rate of compensation (MRC) is defined as:

$$\mathrm{MRC}_{i,j} = \frac{\mathrm{d}y_i}{\mathrm{d}y_j} \tag{5.5}$$

Full compensability means that a loss in one pillar can be compensated by the same increase in another pillar. However, this is not realistic. The MRC is the same concept as the marginal rate of substitution for goods and the marginal rate of

[15] In the previous version of the GEDI, the penalty was calculated in the sub-index level (Acs and Szerb 2011).

technical substitution of inputs (Tarabusi and Guarini 2012), which are reflected in the law of diminishing returns. Therefore, the effect of the change of the penalty should not be proportional, reflecting the increasing rate of MRC. This means that we require higher compensation for the loss in one pillar if the difference between that particular pillar and another pillar value is higher. The required positive value of the second derivative means that the pillars are only partially compensable for each other. Therefore, the penalty should rise at an increasing rate:

$$\frac{\mathrm{dMRC}_{i,j}}{\mathrm{d}y_j} > 0 \tag{5.6}$$

Tarabusi and Palazzi (2004) suggested a correction form that is an exponential function of ae^{-bx}. Tarabusi and Guarini (2012) proposed another adjustment function that referred to the deviation from the mean pillar value. For our purposes, the mean adjustment is not really suitable, so it is better to use the exponential form. Modifying Tarabusi and Palazzi's (2004) original function for our purposes, we can define a penalty function family as

$$h_i = y_{\min} - a\left(1 - \mathrm{e}^{-b(y_i - y_{\min})}\right) \qquad 0 \le a,\, b \le 1 \tag{5.7}$$

a and b are parameters that are calibrated to be between 0 and 1 to provide the penalty from 0 to 1.

With the combination of the two parameters, different kinds of penalty functions can be created. Figures 5.1 and 5.2 show the effects of parameters "a" and "b."

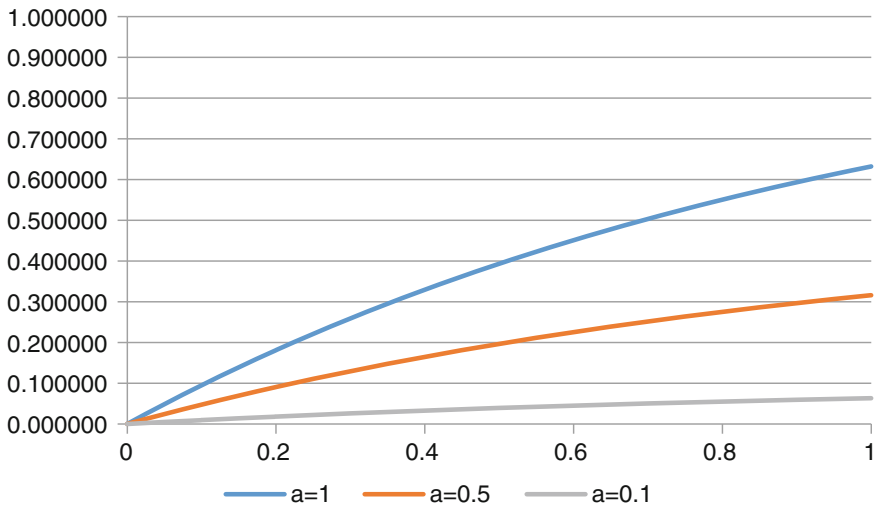

Fig. 5.1 The effect of changing parameter a in the penalty function ($y_{\min} = 0$ and $b = 1$)

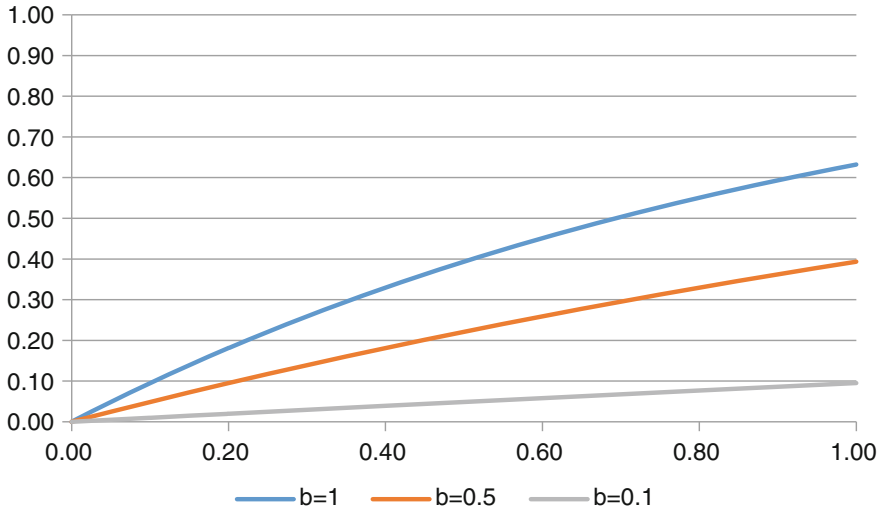

Fig. 5.2 The effect of changing parameter c in the penalty function ($y_{\min} = 0$, $a = 1$, and $b = 1$)

Following Tarabusi and Palazzi (2004), we set parameter $a = 1$ and $b = 1$. The resulting penalty function will be

$$h_{(i),j} = \min y_{(i),j} + \left(1 - e^{-\left(y_{(i)j} - \min y_{(i),j}\right)}\right) \tag{5.8}$$

Note that there presently is no objective criterion about the selection of the size or the calibration of the penalty. An intermediate solution seems to be useful for our purposes. It is shown in Fig. 5.3.

In this case, the maximum penalty is 0.368, or about a one-third loss of the original value, which looks reasonable. Larger penalty values rearrange the ranking of the countries considerably. As a result, the average decrease of the GEDI points is 9 %, from 0.53 to 0.48. The efficiency measured by the ABE improved by about 5 %. Note that it is much more important to include the concept of penalization in the index-building than to determine the size of the penalty.

We suggest that this dynamic index construction is particularly useful for enhancing entrepreneurship in a particular country. Although one could argue that entrepreneurship is a horizontal policy concept with relevance across a number of traditional policy domains (e.g., trade policy, regulatory policy, fiscal policy), the application of the dynamic index construction would allow measurement of the effectiveness of different policy steps toward entrepreneurship. This method could rearrange the ranking of the countries for a particular feature. The level of the rearrangement would depend on the relative position of a country in terms of how its bottlenecks compare to the bottlenecks of the others. If every country has similar

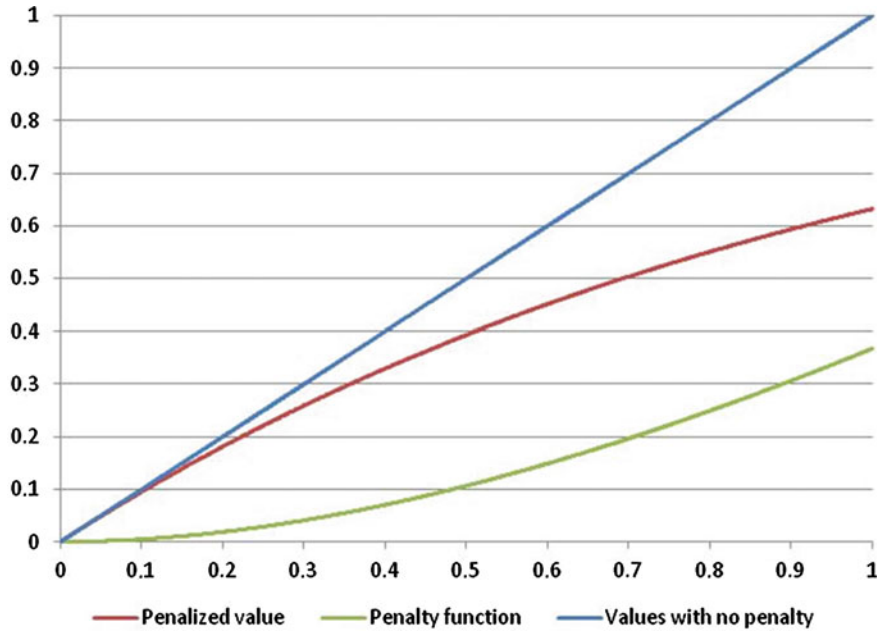

Fig. 5.3 Penalty function, the penalized values, and the pillar values with no penalty ($y_{min} = 0$, $a = 1$, $b = 1$)

differences in terms of the features, then the ranking does not change much; if one country is much less balanced than the others, then a lower rank for that particular country can be expected. The policy message is that a weak performance on a particular feature, such as a bottleneck, should be handled first because it will have the most negative effect on all the other features.

There are two potential drawbacks to the PFB method. One is the arbitrary selection of the magnitude of the penalty. There is no research that can determine how big the penalty should be, which is why we applied a conservative estimate. Comparing the correlation between the per capita GDP and the GEDI, calculated as the simple average of the indicators ($r = 0.89$) and the PFB methodology ($r = 0.89$), provides about the same correlation coefficient, with no statistically significant differences. The other problem is that we cannot fully exclude the possibility that a particularly good feature can have a positive effect on the weaker performing features. While this could happen, most of the entrepreneurship policy experts hold that policy should focus on improving the weakest link in the system. Overall, then, we claim that the PFB methodology is theoretically better than the arithmetic average calculation. However, the PFB-adjusted GEDI is not necessary an optimal solution, since the magnitude of the penalty is unknown.

5.9 The Underlying Structure of the Data (Reflects the Full 2006–2012 Dataset)

While the number of composite indicators has been increasing over the last few decades, some index creators pay little attention to the interrelationship between the different variables. Although the PFB methodology provides a practical solution for how to take this interrelationship into account, it does not save us from examining the underlying structure of the data. It is particularly important to have a well-defined nested structure of the whole index. The arbitrary selection of the variables—in our case the pillars—would cause confusion, false interpretation, and, finally, a misleading policy interpretation. The OECD (2008) handbook of composite indicators suggests analyzing the dataset in two dimensions, pillars and countries. We have already provided detailed analyses at the country level; here, we present a pillar-level analysis by calculating the common (Pearson) correlation coefficients. Since we have only estimated data from 33 countries, it is better not to examine the 120 countries involved in our analysis but the full 2006–2012 dataset, with 355 data points.

We report correlations between the normalized and average equated pillars, shown in Table 5.5, and the correlations between the normalized indicators after applying the PFB methodology, shown in Table 5.6.

In general, significant and medium–to-high correlations exist between the pillars in both cases. The newly created Gender pillar shows the lowest correlation with the other indicators. Sometimes, the correlation is insignificant, sometimes negative significant, with the entrepreneurial aspirations sub-index pillars. However, the correlation coefficient is pretty low. The other "strange" pillar is Opportunity Perception, which has positive and highly insignificant correlation with Human Capital and Process Innovation. Moreover, the correlation between Internationalization and Opportunity Perception is negative significant, but the correlation coefficient is only −0.11, weak.

The PFB pillars, as can be expected, improved the correlation, implying a closer relationship between the entrepreneurial features. The positive connection between the entrepreneurship pillars is vital for proper policy interpretation and suggestions. If the connection between the pillars was negative, it would imply that one pillar can only be improved at the cost of the other pillar. In this case, the improvement of the weakest pillar value would not necessary improve the GEDI value. This is happening only once: the correlation between Gender and High Growth is −0.08, highly insignificant. However, the low correlation coefficients of the Gender pillar with the other pillars, as well as with the GEDI, imply only a moderate influence of females on productive entrepreneurship.

There are other ways to check the consistency of the dataset and the potentially strong connection between the pillars. Both the Kaiser–Meyer–Olkin measure of sampling adequacy and Bartlett's test of sphericity reinforce the fact that the 15 pillars of the GEDI are closely correlated, and it is worth looking for a single complex

Table 5.5 The correlation matrix between the original indicators (2006–2012 dataset)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Opportunity Perception	1.00	**0.22**	**0.13**	**0.14**	**0.28**	**0.20**	**0.18**	**0.15**	0.07	**0.28**	**0.26**	0.00	**0.13**	***−0.11***	**0.14**
2	Start-up skills		1.00	**0.20**	**0.42**	**0.32**	**0.31**	*−0.10*	**0.37**	**0.20**	**0.21**	***0.13***	**0.18**	**0.15**	**0.28**	**0.32**
3	Risk acceptance			1.00	**0.57**	**0.73**	**0.73**	−0.05	**0.60**	**0.63**	**0.61**	**0.55**	**0.65**	**0.38**	**0.53**	**0.60**
4	Networking				1.00	**0.66**	**0.62**	−0.07	**0.52**	**0.47**	**0.50**	**0.41**	**0.50**	**0.29**	**0.56**	**0.57**
5	Cultural support					1.00	**0.72**	−0.04	**0.60**	**0.56**	**0.72**	**0.58**	**0.57**	**0.38**	**0.54**	**0.66**
6	Opportunity start-up						1.00	−0.04	**0.62**	**0.66**	**0.66**	**0.46**	**0.57**	**0.29**	**0.53**	**0.58**
7	Gender							1.00	***−0.13***	***−0.12***	0.05	***−0.12***	**−0.17**	**−0.32**	**−0.15**	**−0.25**
8	Technology absorption								1.00	**0.61**	**0.60**	**0.52**	**0.68**	**0.44**	**0.50**	**0.59**
9	Human capital									1.00	**0.49**	**0.54**	**0.59**	**0.55**	**0.49**	**0.63**
10	Competition										1.00	**0.49**	**0.49**	**0.28**	**0.49**	**0.55**
11	Product innovation											1.00	**0.62**	**0.59**	**0.37**	**0.59**
12	Process Innovation												1.00	**0.46**	**0.52**	**0.65**
13	High Growth													1.00	**0.47**	**0.48**
14	Internationalization														1.00	**0.64**
15	Risk Capital															1.00

Correlation is significant at the 0.01 level (2-tailed)
Correlation is significant at the 0.05 level (2-tailed)
Correlation is significant at the 0.10 level (2-tailed)
Number of observations = 355

Table 5.6 The correlation matrix between the indicators, sub-indices, and the GEDI super-index after normalizing and applying the PFB method (2006–2012 dataset)

		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Opportunity Perception	**0.39**	**0.36**	**0.35**	**0.48**	**0.64**	**0.39**	**0.30**	**0.37**	**0.30**	**0.48**	**0.47**	**0.44**	**0.26**	**0.30**	**0.14**	**0.35**	**0.35**	**0.51**
2	Start-up skills	1.00	**0.40**	**0.57**	**0.50**	**0.72**	**0.48**	**0.10**	**0.53**	**0.41**	**0.42**	**0.51**	**0.33**	**0.38**	**0.36**	**0.44**	**0.48**	**0.47**	**0.60**
3	Risk acceptance		1.00	**0.68**	**0.80**	**0.83**	**0.80**	**0.18**	**0.70**	**0.72**	**0.72**	**0.82**	**0.65**	**0.74**	**0.52**	**0.65**	**0.70**	**0.77**	**0.86**
4	Networking			1.00	**0.75**	**0.85**	**0.72**	**0.14**	**0.65**	**0.61**	**0.64**	**0.73**	**0.56**	**0.63**	**0.46**	**0.66**	**0.68**	**0.71**	**0.81**
5	Cultural support				1.00	**0.90**	**0.78**	**0.18**	**0.71**	**0.68**	**0.80**	**0.82**	**0.70**	**0.69**	**0.53**	**0.65**	**0.75**	**0.79**	**0.89**
6	ATTINDEX					1.00	**0.81**	**0.23**	**0.75**	**0.70**	**0.78**	**0.85**	**0.68**	**0.69**	**0.56**	**0.65**	**0.76**	**0.79**	**0.94**
7	Opportunity start-up						1.00	**0.18**	**0.72**	**0.75**	**0.75**	**0.89**	**0.60**	**0.68**	**0.44**	**0.65**	**0.68**	**0.73**	**0.86**
8	Gender							1.00	***0.12***	***0.11***	**0.25**	**0.39**	*0.09*	0.06	−0.08	0.08	0.00	0.04	**0.22**
9	Technology absorption								1.00	**0.71**	**0.70**	**0.86**	**0.64**	**0.76**	**0.58**	**0.62**	**0.70**	**0.78**	**0.85**
10	Human capital									1.00	**0.63**	**0.85**	**0.65**	**0.69**	**0.65**	**0.62**	**0.72**	**0.79**	**0.83**
11	Competition										1.00	**0.86**	**0.63**	**0.64**	**0.45**	**0.62**	**0.67**	**0.71**	**0.83**
12	ABTINDEX											1.00	**0.69**	**0.75**	**0.55**	**0.68**	**0.73**	**0.80**	**0.94**
13	Product innovation												1.00	**0.71**	**0.66**	**0.52**	**0.69**	**0.84**	**0.79**
14	Process Innovation													1.00	**0.58**	**0.63**	**0.75**	**0.87**	**0.83**
15	High Growth														1.00	**0.58**	**0.61**	**0.80**	**0.69**
16	Internationalization															1.00	**0.72**	**0.83**	**0.77**
17	Risk Capital																1.00	**0.90**	**0.85**
18	ASPINDEX																	1.00	**0.93**
19	GEDI																		1.00

Correlation is significant at the 0.01 level (2-tailed)
Correlation is significant at the 0.05 level (2-tailed)
Number of observations = 355

measure.[16] The most popular test of the internal consistency of the pillars is based on the Cronbach Coefficient Alpha (c-alpha). The c-alpha value for the 15 pillars is 0.90 with the original data and 0.95 after applying the PFB methodology; both are well above the critical 0.7 threshold value.[17] In sum, all of these tests support the internal consistency of the structure as described with the 15 selected pillars.

5.10 The Average Bottleneck Efficiency Measure

The ABE is defined as how close a country's average pillar scores are to a country's best performing pillar score. ABE is expressed in terms of percentages. Higher ABE values imply more balanced performance and therefore more efficient use of the available resources, while lower ABE values mean substantial imbalances over the 15 pillars of the GEDI. An equal alternative indicator of efficiency is to calculate the average bottleneck gap (ABG). ABG also shows how many additional resources, on average, are needed to raise all thirteen pillar values to their maximum pillar value. ABG is just the opposite of ABE, as higher ABG values mean less balanced, and low ABG values mean a more balanced performance of the 15 pillars.[18]

Equations 5.9a and 5.9b technically describe the general form of the calculation:

$$\mathrm{ABG}_i = \frac{100 \times \sum(\max_{i,j} - y_{(i),j})}{(j-1) \times \max x_{i,j}} \tag{5.9a}$$

$$\mathrm{ABE}_i = 100 - \mathrm{ABG}_i \tag{5.9b}$$

for all j, the number of pillars

where ABG_i is the Average Bottleneck Gap for country i
where ABE_i is the Average Bottleneck Efficiency for country i

It is also interesting to view what the connection is between the GEDI and ABE. The Pearson's correlation coefficient with 0.89 value implies a close and significantly positive relationship between the GEDI and ABE. Figure 5.4 pictures this

[16] The Kaiser–Meyer–Olkin measures for the original pillar values are 0.89 and 0.93 for the PFB-adjusted pillars, well above the critical value of 0.50. The Bartlett test is significant at the 0.000 level, excluding the possibility that the pillars are not interrelated.

[17] We have calculated the c-alpha values for each of the three sub-indices. Using the PFB-adjusted pillar values, the c-alpha scores are 0.85 (ATT pillars), 0.84 (ABT pillars), and 0.84 (ASP pillars).

[18] Average bottleneck efficiency appears as Average Bottleneck Gap in the GEDI United Kingdom 2012 report (Autio et al. 2012). However, it is more appropriate to call it efficiency then gap measure because the higher ABE value is associated with better performance not with higher lag.

relationship: The third-degree polynomial trend is almost linear with a high 79 % explanatory power over the variances. The practical implication of this relationship is that low GEDI values are mainly associated with lower ABE values, which means a less efficient use of the available resources. This mainly characterizes the resource-driven economies. Innovation-driven developed countries have both high GEDI values and high ABE values. Efficiency-driven countries fall between the other two country groups. For example, the leading GEDI country, the United States, has a 91 % ABE value, implying that the 15 pillars on average have 91 % value, as compared to the best performing US pillar. Bangladesh, ranked 120th, has 32 % ABE value, indicating that the 15 pillars are significantly unbalanced. Costa Rica, ranked 60th, has an ABE value around 68 %, which falls between the USA and Bangladesh. Looking at Fig. 5.4 more closely, it can also be seen that the ABE variance is much higher at the lower GEDI scores and much lower at the higher GEDI scores. A country can have low GEDI scores for two reasons. First, a country can have generally low but balanced pillar values—for example, Pakistan is 115th with a 47 % ABE score. Second, the GEDI scores are low because the pillars are imbalanced—for example, 113th-ranked Uganda's ABE score is only 19 %. It is also clear that high GEDI rankings cannot be achieved without efficient use of resources: The ABE scores of the first 19 countries are above 75 %.

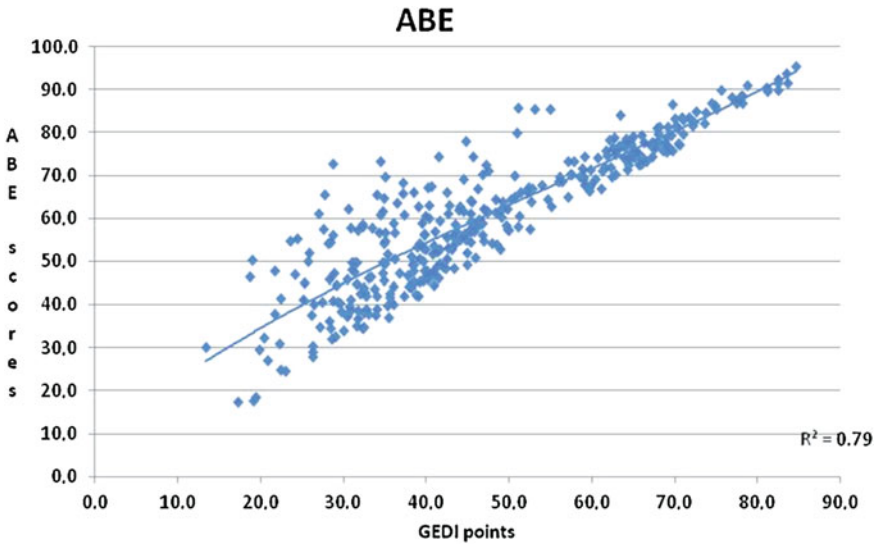

Fig. 5.4 The connection between the GEDI and the ABE indicator (third-degree polynomial trend line; 2006–2012 data) number of observations = 355

5.11 Bottleneck Sensitivity Analysis: The Policy Application of the GEDI Methodology

An important implication of the GEDI analysis is that the best way to increase a country's GEDI ranking is to reduce the differences between the pillars by enhancing the weakest GEDI pillar. However, another pillar may become the weakest link constraining entrepreneurship performance. This system dynamic leads to the problem of "optimal" allocation of the additional resources. In other words, if a particular country were to allocate additional resources to improve its GEDI ranking, how should this additional effort be allocated to achieve an "optimal" outcome?[19]

An important note is that the following simulation has limited potential for interpreting a policy recommendation because it relies on important assumptions that restrain its practical application. First, the applied 15 pillars of the GEDI only partially reflect the NSE. Consequently, maximizing the GEDI of a particular country does not mean maximizing its entire NSE. Second, while we have equalized the different pillar averages for all GEDI pillars and it would require roughly the same effort to improve all the 15 pillars by the same magnitude, this might well not be true for equalizing the marginal cost of improvement. In fact, these costs may vary significantly over pillars (Autio et al. 2012). Third, we set aside the differences in country size by presuming that the same effort is necessary to improve the GEDI in all the countries. Of course, the cost of improving a pillar in large country like Germany could be considerable higher than in a small country like Slovenia.

Let us assume that we would like to increase the average GEDI points by five. The PFB method calculation implies that the greatest improvement can be achieved by alleviating the weakest performing pillar. Once the binding constraint has been eliminated, the remaining available resources should be distributed to improve the next weakest pillar, and so on, until the resources are exhausted. Table 5.7 presents an application of this with three countries: innovation-driven Austria (Europe), efficiency-driven Peru (South America), and resource-driven Malawi (Africa).

Table 5.7 shows the situation before the improvement has taken place, the required increase in the particular pillars (in absolute values and in percentages), and the improved version after adjustment. We also report the GEDI and ABE scores, as well as the increase of the ABE.

Austria has basically one bottleneck, High Growth, which is so binding that even after the adjustment it remains the bottleneck. Austria needs to turn relatively few new resources to improve its GEDI score by 5, from 64.0 to 69.1. As a result, the effectiveness measure ABE improves only slightly, by 1.2 % points.

Efficiency-driven Peru has a lower GEDI score—41.3—and less efficient entrepreneurial performance—ABE score is 48.9—than Austria. Peru's lowest pillar value is Process Innovation, and its entrepreneurial aspirations sub-index

[19] Optimal in the sense of maximizing the GEDI.

Table 5.7 Simulation of "optimal" policy allocation to increase the GEDI score by 5 points

	Austria				Peru				Malawi			
Pillar	1	2	3 (%)	4	1	2	3 (%)	4	1	2	3 (%)	4
Opportunity Perception	0.66	0	0	0.66	0.93	0	0	0.93	0.14	0	0	0.14
Start-up skills	0.75	0	0	0.75	0.65	0	0	0.65	0.01	0.11	22	**0.12**
Risk acceptance	0.60	0	0	0.60	0.40	0	0	0.40	0.09	0.03	6	**0.12**
Networking	0.84	0	0	0.84	0.53	0	0	0.53	0.08	0.04	8	**0.12**
Cultural support	0.64	0	0	0.64	0.42	0	0	0.42	0.43	0	0	0.43
Opportunity start-up	0.62	0	0	0.62	0.50	0	0	0.50	0.13	0	0	0.13
Gender	0.66	0	0	0.66	0.65	0	0	0.65	0.91	0	0	0.91
Technology absorption	0.99	0	0	0.99	0.31	0.05	12	**0.36**	0.11	0.01	2	**0.12**
Human capital	0.56	0	0	0.56	0.35	0.01	2	**0.36**	0.03	0.09	18	**0.12**
Competition	0.85	0	0	0.85	0.38	0	0	0.38	0.46	0	0	0.46
Product innovation	0.88	0	0	0.88	0.64	0	0	0.64	0.68	0	0	0.68
Process Innovation	0.75	0	0	0.75	**0.21**	0.15	35	**0.36**	0.86	0	0	0.86
High Growth	**0.32**	0.15	100	**0.47**	0.32	0.03	7	**0.36**	0.02	0.1	20	**0.12**
Internationalization	0.89	0	0	0.89	0.27	0.09	21	**0.36**	0.09	0.03	6	**0.12**
Risk Capital	0.79	0	0	0.79	0.25	0.1	23	**0.36**	0.04	0.08	16	**0.12**
Sum		0.15	100			0.43	100			0.49	100	
Number of pillars changed		1				6				8		
GEDI score	64.0			69.1	41.3			46.4	20.9			25.9
ABE score	76.7			77.8	48.9			52.4	26.9			31.1
ABE improvement				1.2				3.5				4.2

scores are relatively low compared to its attitudes and abilities sub-index scores: Risk Capital score is 0.25, Internationalization is 0.27, High Growth is 0.32, but Product Innovation is impressive, at 0.64 points. In order to improve its GEDI score by five, Peru needs to enhance the four aspirations pillars, as well as two ability components, Technology Absorption and Human Capital. To achieve the same improvement, Peru should turn almost three times the resources to them as Austria did: 0.43. After the policy intervention, Peru will have six bottlenecks, at 0.36. However, these bottlenecks will now constrain Peru much less, as the ABE score went up by 3.5.

Resource-driven Malawi's GEDI score is the lowest of the three, 20.9. Malawi's entrepreneurial performance is also very uneven, with very high values in Gender (0.91), Process Innovation (0.86), and Product Innovation (0.68). At the same time, its Start-up Skills (0.01), High Growth (0.02), Human Capital (0.03), and formal and informal Risk Capital (0.04) are at critically low levels. Therefore, Malawi really cannot capitalize on its high scores in Innovation and Gender, as captured by the 26.9 ABE score. To increase its GEDI points by five, Malawi should turn a lot of new resources to boost the performance of eight pillars. Altogether, 22 % of its resources are needed to alleviate four moderately binding pillars, Networking, Risk Acceptance, Internationalization, and Technology Absorption. We should not forget that the five-point increase means a 24 % improvement in the GEDI scores because of the low base value. Relatively high improvement (4.2) can be seen in Malawi's ABE score.

5.12 Summary

In this chapter, we have described the index-building methodology and the dataset. The GEDI, a complex index reflecting the multidimensional nature of entrepreneurship, consists of three sub-indices, 15 pillars, and 33 variables. While some researchers insist on simple entrepreneurship indicators, none of the previously applied measures was able to explain the role of entrepreneurship in economic development with a single indicator.

Our index-building logic differs from other widely applied indices in three respects: it incorporates both individual and institutional variables, it equates the 15 pillar values for equalizing the marginal effects, and it takes into account the weakest link in the system. The institutional variables can also be viewed as country-specific weighting factors. Moreover, institutional variables can balance out the potential inconsistency of the GEM data collection. The weakest link refers to the decreased performance effect of the bottleneck. Practically speaking, it means that the higher pillar values are adjusted to the weakest performing pillar value. While the exact measure of the penalty is unknown, meaning that the solution is not necessarily optimal, it still provides a better solution than calculating the simple arithmetic averages. Consequently, the newly developed PFB can be applied in cases where an imperfect substitutability exists among the variables and the

efficiency of the system depends on the weakest performing variable. The method is particularly useful in making policy suggestions.

The GEM survey served as a source for the individual variables, which are calculated mainly from the 2011–2012 individual dataset, except for the 17 countries that only have data from previous years. Altogether, the sample includes 377,678 individuals from 89 countries. Individual data from 33 other countries are estimated by using similar or nearby country individual data. After omitting Canada, our sample involved 120 countries.

The availability of the institutional variables for all the countries has limited our selection possibilities. The proper interpretation of a particular institutional variable has been an important aspect of the selection. For example, the muddled interpretations of the effect of taxes on other entrepreneurship variables led to the exclusion of taxation. The other debated issue used to be the inclusion of the venture capital variable, which has been replaced by the depth of capital market variable, a more sophisticated variable that includes venture capital, capital market, and lending possibilities. In all cases, we used the most recent institutional data available as of January 30, 2013.

The list below is a short summary of the index-building steps described in detail in the sub-chapters.

1. We start with the variables that come directly from the original data sources for each country involved in the analysis. The variables can be at the individual level (personal or business) or the institutional/environmental level.
2. We calculate all pillars from the variables using the interaction variable method; that is, by multiplying the individual variable with the proper institutional variable.
3. Pillar values are capped to the 95 % value by using the 2006–2012 data.
4. Capped pillar values are normalized by using the distance method.
5. The 15 pillar averages are equated to have the same marginal effect.
6. The PFB is applied to get the PFB-adjusted values for all of the 15 pillars.
7. The indicators are the basic building blocks of the sub-index: entrepreneurial attitudes, ABT, and entrepreneurial aspirations. The value of a sub-index for any country is the arithmetic average of its PFB-adjusted pillars for that sub-index, multiplied by 100. The maximum value of the sub-indices is 100, and the potential minimum is 0, both of which reflect the relative position of a country in a particular sub-index.
8. Finally, the super-index, the GEDI, is simply the average of the three sub-indices.

The structure of the methodology can be seen in Table 5.8.

We have analyzed the underlying structure of the dataset in the variable level. The correlation coefficients, the Kaiser–Mayer–Olkin measures, and the Bartlett and c-alpha tests all suggested that the 15 pillars have a close relation to one another and that there is a place to construct a composite indicator. These tests were executed with the normalized original, as well as with the PFB-adjusted variables. As expected, the PFB methodology improved the internal consistency of the dataset.

Table 5.8 The structure of the global entrepreneurship and development index

GLOBAL ENTREPRENEURSHIP AND DEVELOPMENT INDEX														
Entrepreneurial Attitudes Sub-Index					Entrepreneurial Abilities Sub-Index					Entrepreneurial Aspirations Sub-Index				
Pillars														
Opportunity Perception	Start-up Skills	Risk Acceptance	Networking	Cultural Support	Opportunity Start-up	Gender	Technology Absorption	Human Capital	Competition	Product Innovation	Process Innovation	High Growth	Internationalization	Risk Capital
Variables														
Market Agglomeration	***Opportunity Recognition***	**Tertiary Education**	***Skill Perception***	**Business Risk**	***Risk Acceptance***	**Internet Usage**	***Entrepreneurs Know***	**Corruption**	***Career Status***	**Freedom**	***Opportunity Motivation***	***TEA Female***	***Female Opportunity***	**Tech Absorption**	***Technology Level***	**Staff Training**	***Educational Level***	**Market Dominance**	***Competitors***	**Technology Transfer**	***New Product***	**GERD**	***New Tech***	**Business Strategy**	***Gazelle***	**Globalization**	***Export***	**Depth of Capital Market**	***Informal Investment***

Note The GEDI is a super-index made up of three sub-indices, each of which is composed of several pillars. Each pillar consists of an institutional variable (denoted in **bold**) and an individual variable (denoted in ***bold italic***). The data values for each variable are gathered from a wide range of sources

We described a new efficiency indicator of entrepreneurship called the ABE. ABE compares a country's balance of 15 pillars to the best performing pillars. It has clarified the fact that developed countries with high GEDI values also have high ABE scores. This finding implies that the more entrepreneurial, innovation-driven economies use their resources more efficiently than less developed efficiency- and resource-driven economies.

Finally, we provided a policy-oriented application of the GEDI by showing a simulation on how to improve three countries' GEDI points by five. This kind of analysis is particularly suitable for tailor-made policy recommendations, rather than more general policy suggestions. It is important to note that the GEDI has certain limitations that restrict its use as a sole and single tool for public policy. Indeed, the GEDI should be used with other more traditional analytical tools and other results.

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Appendix A
The Global Entrepreneurship and Development Sub-index Rank of Countries in Alphabetical Order, 2014

Country	GEDI	GEDI rank	ATT	ATT rank	ABT	ABT rank	ASP	ASP rank
Albania	32.6	71	29.0	89	36.0	63	32.7	63
Algeria	29.1	85	37.7	59	22.3	112	27.3	79
Angola	28.7	88	23.3	101	26.9	101	35.9	55
Argentina	38.4	56	45.9	34	37.7	57	31.7	67
Australia	77.8	2	75.5	4	83.8	2	74.2	5
Austria	63.9	17	63.2	11	65.1	14	63.6	18
Bahrain	45.4	37	44.9	38	42.8	38	48.6	43
Bangladesh	13.8	120	15.2	116	18.3	118	7.9	120
Barbados	38.5	55	45.3	35	45.3	32	24.9	83
Belgium	66.5	13	62.1	13	66.2	12	71.1	10
Benin	24.6	96	26.9	94	30.0	89	17.0	99
Bolivia	31.1	77	36.5	62	34.4	74	22.4	87
Bosnia and Herzegovina	27.7	91	26.9	93	28.1	95	28.2	75
Botswana	35.6	63	33.6	69	40.8	46	32.4	65
Brazil	30.4	80	43.2	43	33.4	80	14.8	103
Brunei Darussalam	39.2	53	32.7	73	48.4	29	36.6	54
Bulgaria	45.4	36	44.8	39	38.3	53	53.3	37
Burkina Faso	19.8	109	19.1	109	26.6	103	13.8	107
Burundi	15.5	118	8.4	120	26.1	104	12.2	116
Cameroon	24.6	97	25.2	95	30.8	87	17.8	96
Chad	15.0	119	10.8	119	22.1	113	12.1	117
Chile	65.0	15	73.3	7	54.9	20	67.0	14
China	41.6	46	42.2	46	34.7	73	47.9	45
Colombia	49.8	24	49.1	27	50.0	27	50.3	39

(continued)

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Country	GEDI	GEDI rank	ATT	ATT rank	ABT	ABT rank	ASP	ASP rank
Costa Rica	37.2	60	46.4	33	35.1	71	30.1	69
Côte d'Ivoire	19.4	112	22.2	103	22.8	111	13.1	112
Croatia	40.9	49	32.9	72	38.8	52	51.0	38
Cyprus	40.2	51	33.0	71	47.2	31	40.6	51
Czech Republic	44.5	41	33.8	68	36.6	59	63.3	20
Denmark	72.5	4	66.9	8	77.1	4	73.5	7
Dominican Republic	34.3	66	42.3	45	34.4	76	26.2	80
Ecuador	29.2	84	35.3	63	31.9	85	20.6	90
Egypt	25.2	94	31.2	84	16.9	119	27.7	78
El Salvador	31.0	78	29.0	88	34.4	75	29.6	70
Estonia	58.9	21	53.7	19	59.6	19	63.6	19
Ethiopia	19.8	110	15.6	115	28.1	98	15.8	101
Finland	69.3	7	79.4	2	62.9	18	65.5	17
France	67.2	12	64.0	10	64.4	17	73.2	8
Gabon	32.7	70	28.1	91	35.3	69	34.8	57
Gambia	21.0	105	19.5	107	29.6	90	13.8	108
Germany	64.6	16	56.4	17	70.1	9	67.3	13
Ghana	26.2	93	34.2	64	29.2	91	15.4	102
Greece	37.7	58	30.8	85	42.5	41	40.0	52
Guatemala	20.7	107	24.6	98	25.1	106	12.4	115
Honduras	23.9	100	24.5	99	33.7	79	13.6	110
Hong Kong	46.5	33	43.7	42	36.7	58	59.3	23
Hungary	44.5	42	40.5	52	44.1	37	48.9	41
Iceland	67.5	11	63.0	12	65.5	13	74.0	6
India	31.3	75	31.6	78	33.2	82	29.1	71
Indonesia	34.2	67	31.5	81	42.7	39	28.6	73
Iran	24.1	99	28.1	90	21.3	116	23.0	86
Ireland	61.8	18	51.0	23	64.5	16	69.9	11
Israel	59.6	20	50.2	25	53.7	22	75.0	4
Italy	40.9	48	31.5	82	41.9	43	49.3	40
Jamaica	31.4	74	34.1	65	40.7	48	19.4	93
Japan	46.1	35	31.5	83	50.1	26	56.7	28
Jordan	31.7	72	39.2	55	21.9	115	34.1	60
Kazakhstan	30.6	79	34.0	66	38.1	55	19.6	91
Kenya	23.8	101	24.9	96	28.1	96	18.4	94
Korea	46.7	32	45.3	36	38.2	54	56.7	26
Kuwait	44.2	43	54.3	18	31.6	86	46.8	47
Latvia	48.4	27	39.7	54	50.0	28	55.7	29

(continued)

Country	GEDI	GEDI rank	ATT	ATT rank	ABT	ABT rank	ASP	ASP rank
Lebanon	38.9	54	48.6	29	32.9	83	35.3	56
Liberia	24.5	98	27.1	92	28.6	93	17.9	95
Lithuania	49.6	25	42.4	44	51.5	24	55.0	31
Macedonia	36.1	62	31.6	79	35.3	68	41.6	50
Madagascar	19.5	111	18.4	111	27.2	100	13.1	113
Malawi	20.8	106	13.3	118	24.7	108	24.5	85
Malaysia	44.1	44	46.5	32	51.1	25	34.7	58
Mali	18.8	114	17.2	113	24.7	109	14.6	104
Mauritania	18.5	116	18.6	110	21.1	117	15.8	100
Mexico	38.2	57	41.1	48	44.4	35	29.1	72
Moldova	31.1	76	21.4	105	39.6	50	32.5	64
Montenegro	39.5	52	37.8	58	32.5	84	48.1	44
Morocco	29.5	83	38.4	57	22.1	114	28.1	76
Mozambique	20.6	108	19.3	108	28.5	94	14.0	106
Namibia	36.8	61	32.2	75	36.4	61	41.9	49
Netherlands	69.0	8	73.6	6	64.5	15	68.8	12
Nicaragua	22.1	103	22.5	102	30.7	88	13.1	114
Nigeria	31.6	73	32.1	76	34.7	72	27.9	77
Norway	65.1	14	73.9	5	67.0	11	54.4	33
Oman	47.6	29	48.8	28	39.8	49	54.3	34
Pakistan	18.7	115	14.9	117	16.0	120	25.3	82
Panama	34.8	65	40.1	53	42.4	42	21.8	88
Paraguay	28.8	87	31.6	80	35.6	65	19.4	92
Peru	41.3	47	51.1	22	40.8	47	32.1	66
Philippines	28.5	89	36.9	61	34.4	78	14.3	105
Poland	49.0	26	50.4	24	36.5	60	60.3	21
Portugal	46.9	30	38.5	56	47.4	30	54.8	32
Puerto Rico	61.7	19	49.4	26	76.6	5	59.1	24
Qatar	52.6	23	53.7	20	44.7	34	59.6	22
Romania	44.6	40	37.3	60	42.6	40	53.9	36
Russia	33.2	69	32.5	74	41.5	44	25.7	81
Rwanda	21.0	104	20.5	106	28.9	92	13.8	109
Saudi Arabia	43.4	45	47.9	31	35.2	70	47.2	46
Senegal	24.7	95	29.5	87	27.5	99	17.3	98
Serbia	33.9	68	40.6	50	28.1	97	33.2	62
Sierra Leone	17.6	117	16.3	114	25.1	107	11.4	119
Singapore	67.9	10	52.0	21	73.3	8	78.3	3
Slovakia	46.5	34	44.9	37	38.1	56	56.7	27
Slovenia	52.7	22	48.3	30	54.3	21	55.5	30
South Africa	40.3	50	33.6	70	38.9	51	48.6	42

(continued)

Country	GEDI	GEDI rank	ATT	ATT rank	ABT	ABT rank	ASP	ASP rank
Spain	46.8	31	44.4	41	52.9	23	43.3	48
Swaziland	29.0	86	18.1	112	34.4	77	34.6	59
Sweden	73.7	3	78.7	3	76.5	6	65.8	16
Switzerland	70.9	5	66.0	9	75.0	7	71.8	9
Taiwan	69.5	6	61.7	15	68.2	10	78.6	2
Tanzania	22.5	102	24.7	97	25.2	105	17.7	97
Thailand	35.5	64	31.9	77	44.2	36	30.5	68
Trinidad and Tobago	30.3	81	34.0	67	36.4	62	20.7	89
Tunisia	37.2	59	41.9	47	35.7	64	34.0	61
Turkey	44.7	39	44.7	40	35.4	67	54.0	35
Uganda	19.3	113	21.6	104	23.1	110	13.4	111
Ukraine	30.2	82	30.3	86	35.4	66	24.9	84
United Arab Emirates	48.2	28	40.7	49	45.0	33	59.0	25
United Kingdom	68.6	9	62.1	14	77.6	3	66.2	15
United States	82.5	1	79.5	1	84.5	1	83.5	1
Uruguay	45.3	38	57.4	16	41.3	45	37.3	53
Venezuela	26.4	92	40.6	51	26.7	102	11.8	118
Zambia	28.4	90	23.6	100	33.3	81	28.4	74

Appendix B
Entrepreneurial Attitudes Sub-index and Pillar Values of Countries in Alphabetical Order, 2014

Countries	ATT	Opportunity perception	Start-up skills	Risk acceptance	Networking	Cultural support
Albania	29.0	0.19	0.49	0.14	0.43	0.31
Algeria	37.7	0.69	0.38	0.42	0.23	0.37
Angola	23.3	0.64	0.05	0.17	0.30	0.20
Argentina	45.9	1.00	1.00	0.18	0.47	0.33
Australia	75.5	0.91	0.90	0.66	0.66	0.85
Austria	63.2	0.66	0.75	0.60	0.84	0.64
Bahrain	44.9	0.59	0.29	0.34	0.77	0.61
Bangladesh	15.2	0.38	0.05	0.08	0.06	0.29
Barbados	45.3	0.18	0.95	0.38	0.60	0.74
Belgium	62.1	0.74	0.62	0.60	0.53	0.69
Benin	26.9	0.39	0.23	0.38	0.08	0.42
Bolivia	36.5	0.51	0.64	0.18	0.44	0.28
Bosnia and Herzegovina	26.9	0.15	0.39	0.06	0.50	0.45
Botswana	33.6	0.53	0.10	0.51	0.11	0.77
Brazil	43.2	1.00	0.28	0.57	0.47	0.55
Brunei Darussalam	32.7	0.21	0.11	0.67	0.49	0.41
Bulgaria	44.8	0.45	0.69	0.24	0.64	0.41
Burkina Faso	19.1	0.27	0.06	0.23	0.07	0.46
Burundi	8.4	0.08	0.05	0.09	0.03	0.19
Cameroon	25.2	0.59	0.21	0.22	0.11	0.28
Chad	10.8	0.21	0.04	0.09	0.04	0.19
Chile	73.3	1.00	0.90	0.79	0.60	0.80
China	42.2	0.64	0.21	0.57	0.64	0.39
Colombia	49.1	1.00	0.55	0.43	0.36	0.41
Costa Rica	46.4	0.46	0.59	0.38	0.49	0.58

(continued)

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Countries	ATT	Opportunity perception	Start-up skills	Risk acceptance	Networking	Cultural support
Côte d'Ivoire	22.2	0.52	0.14	0.23	0.05	0.32
Croatia	32.9	0.18	0.54	0.22	0.49	0.33
Cyprus	33.0	0.12	0.59	0.10	0.48	0.66
Czech Republic	33.8	0.35	0.54	0.15	0.50	0.31
Denmark	66.9	0.71	0.53	0.63	0.81	0.90
Dominican Republic	42.3	0.60	0.57	0.31	0.56	0.39
Ecuador	35.3	0.66	0.63	0.16	0.32	0.37
Egypt	31.2	0.51	0.40	0.16	0.35	0.37
El Salvador	29.0	0.41	0.28	0.25	0.21	0.37
Estonia	53.7	0.39	0.60	0.46	0.79	0.55
Ethiopia	15.6	0.20	0.10	0.16	0.02	0.38
Finland	79.4	0.86	0.74	0.70	1.00	0.96
France	64.0	0.79	0.45	0.58	0.84	0.77
Gabon	28.1	0.69	0.10	0.31	0.14	0.35
Gambia	19.5	0.30	0.07	0.09	0.22	0.40
Germany	56.4	0.70	0.37	0.52	0.58	0.82
Ghana	34.2	0.64	0.21	0.39	0.24	0.59
Greece	30.8	0.16	1.00	0.06	0.45	0.31
Guatemala	24.6	0.47	0.26	0.18	0.18	0.31
Honduras	24.5	0.38	0.26	0.21	0.21	0.25
Hong Kong	43.7	0.31	0.23	0.99	0.60	0.57
Hungary	40.5	0.17	0.52	0.58	0.48	0.49
Iceland	63.0	0.43	0.87	0.41	1.00	0.72
India	31.6	0.58	0.24	0.33	0.21	0.35
Indonesia	31.5	0.51	0.27	0.40	0.28	0.23
Iran	28.1	0.57	0.53	0.07	0.24	0.23
Ireland	51.0	0.29	0.66	0.37	0.81	0.68
Israel	50.2	0.53	0.39	0.49	0.56	0.59
Italy	31.5	0.36	0.41	0.16	0.34	0.39
Jamaica	34.1	0.35	0.44	0.17	0.46	0.44
Japan	31.5	0.18	0.13	0.69	0.34	0.43
Jordan	39.2	0.52	0.46	0.26	0.43	0.59
Kazakhstan	34.0	0.52	0.35	0.19	0.64	0.31
Kenya	24.9	0.31	0.06	0.23	0.53	0.30
Korea	45.3	0.26	0.60	0.66	0.64	0.52
Kuwait	54.3	1.00	0.32	0.65	0.85	0.57
Latvia	39.7	0.26	0.59	0.25	0.61	0.40
Lebanon	48.6	0.72	1.00	0.20	0.66	0.32
Liberia	27.1	0.21	0.85	0.09	0.07	0.50

(continued)

Countries	ATT	Opportunity perception	Start-up skills	Risk acceptance	Networking	Cultural support
Lithuania	42.4	0.28	0.61	0.32	0.56	0.46
Macedonia	31.6	0.23	0.45	0.13	0.51	0.40
Madagascar	18.4	0.32	0.07	0.23	0.04	0.37
Malawi	13.3	0.14	0.01	0.09	0.08	0.43
Malaysia	46.5	0.55	0.25	0.70	0.74	0.32
Mali	17.2	0.33	0.10	0.09	0.05	0.40
Mauritania	18.6	0.28	0.07	0.23	0.10	0.35
Mexico	41.1	0.84	0.36	0.44	0.46	0.23
Moldova	21.4	0.17	0.28	0.05	0.36	0.31
Montenegro	37.8	0.22	0.75	0.14	0.67	0.43
Morocco	38.4	0.53	0.20	0.51	0.67	0.44
Mozambique	19.3	0.32	0.08	0.23	0.09	0.35
Namibia	32.2	0.32	0.13	0.57	0.24	0.52
Netherlands	73.6	0.75	0.60	0.69	0.87	1.00
Nicaragua	22.5	0.36	0.23	0.21	0.15	0.26
Nigeria	32.1	0.82	0.18	0.07	0.64	0.27
Norway	73.9	0.94	0.54	0.87	0.94	0.92
Oman	48.8	0.62	0.40	0.47	0.69	0.55
Pakistan	14.9	0.35	0.07	0.07	0.10	0.23
Panama	40.1	0.48	0.53	0.62	0.45	0.36
Paraguay	31.6	0.50	0.54	0.17	0.32	0.23
Peru	51.1	0.93	0.65	0.40	0.53	0.42
Philippines	36.9	0.58	0.43	0.27	0.43	0.39
Poland	50.4	0.38	0.86	0.33	0.72	0.56
Portugal	38.5	0.21	0.67	0.19	0.40	0.67
Puerto Rico	49.4	0.50	0.46	0.83	0.28	0.61
Qatar	53.7	0.93	0.15	0.60	0.86	0.88
Romania	37.3	0.39	0.51	0.23	0.38	0.43
Russia	32.5	0.45	0.46	0.23	0.50	0.21
Rwanda	20.5	0.18	0.11	0.09	0.15	0.70
Saudi Arabia	47.9	1.00	0.56	0.37	0.56	0.57
Senegal	29.5	0.42	0.13	0.39	0.34	0.43
Serbia	40.6	0.38	0.76	0.19	0.62	0.34
Sierra Leone	16.3	0.26	0.03	0.23	0.03	0.35
Singapore	52.0	0.42	0.38	0.79	0.37	0.79
Slovakia	44.9	0.21	0.61	0.44	0.92	0.38
Slovenia	48.3	0.15	1.00	0.51	0.76	0.56
South Africa	33.6	0.52	0.12	0.62	0.20	0.44
Spain	44.4	0.29	0.89	0.19	0.57	0.64
Swaziland	18.1	0.13	0.06	0.06	0.36	0.38

(continued)

Countries	ATT	Opportunity perception	Start-up skills	Risk acceptance	Networking	Cultural support
Sweden	78.7	1.00	0.62	0.85	1.00	0.88
Switzerland	66.0	0.60	0.47	0.93	0.70	0.87
Taiwan	61.7	0.68	0.49	0.78	0.65	0.61
Tanzania	24.7	0.34	0.03	0.39	0.24	0.41
Thailand	31.9	0.34	0.45	0.32	0.24	0.39
Trinidad and Tobago	34.0	0.11	0.18	0.77	0.59	0.43
Tunisia	41.9	0.37	0.45	0.56	0.39	0.55
Turkey	44.7	0.62	0.55	0.46	0.36	0.52
Uganda	21.6	0.21	0.16	0.22	0.27	0.32
Ukraine	30.3	0.54	0.62	0.05	0.39	0.24
United Arab Emirates	40.7	0.68	0.07	0.43	0.61	0.78
United Kingdom	62.1	0.67	0.58	0.47	0.71	0.76
United States	79.5	1.00	1.00	0.70	0.61	0.83
Uruguay	57.4	0.67	0.84	0.43	0.51	0.65
Venezuela	40.6	0.88	1.00	0.20	0.48	0.18
Zambia	23.6	0.37	0.07	0.22	0.27	0.36

Appendix C
Entrepreneurial Abilities Sub-index and Pillar Values of Countries in Alphabetical Order, 2014

Countries	ABT	Opportunity startup	Gender	Technology absorption	Human capital	Competition
Albania	36.0	0.24	0.40	0.47	0.42	0.42
Algeria	22.3	0.28	0.18	0.32	0.15	0.21
Angola	26.9	0.21	0.81	0.16	0.26	0.18
Argentina	37.7	0.31	0.53	0.54	0.32	0.43
Australia	83.8	0.94	1.00	1.00	0.91	0.69
Austria	65.1	0.62	0.66	0.99	0.56	0.85
Bahrain	42.8	0.70	0.24	0.29	0.80	0.47
Bangladesh	18.3	0.44	0.07	0.17	0.10	0.24
Barbados	45.3	0.75	0.89	0.16	0.55	0.47
Belgium	66.2	0.87	0.47	0.47	0.92	0.80
Benin	30.0	0.19	1.00	0.15	0.11	0.44
Bolivia	34.4	0.39	0.89	0.14	0.22	0.36
Bosnia and Herzegovina	28.1	0.11	0.41	0.46	0.24	0.38
Botswana	40.8	0.37	0.97	0.29	0.36	0.49
Brazil	33.4	0.27	0.98	0.28	0.17	0.46
Brunei Darussalam	48.4	0.60	0.90	0.44	0.59	0.43
Bulgaria	38.3	0.41	0.46	0.36	0.35	0.40
Burkina Faso	26.6	0.27	1.00	0.10	0.03	0.34
Burundi	26.1	0.25	1.00	0.09	0.03	0.36
Cameroon	30.8	0.20	0.93	0.15	0.14	0.49
Chad	22.1	0.06	1.00	0.10	0.03	0.30
Chile	54.9	0.51	0.58	0.62	0.55	0.56
China	34.7	0.18	0.85	0.30	0.40	0.28
Colombia	50.0	0.86	0.57	0.49	0.43	0.41

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Countries	ABT	Opportunity startup	Gender	Technology absorption	Human capital	Competition
Albania	36.0	0.24	0.40	0.47	0.42	0.42
Costa Rica	35.1	0.39	0.40	0.32	0.23	0.47
Côte d'Ivoire	22.8	0.15	0.74	0.12	0.04	0.33
Croatia	38.8	0.31	0.35	0.62	0.32	0.49
Cyprus	47.2	0.58	0.42	0.71	0.66	0.49
Czech Republic	36.6	0.40	0.25	0.60	0.25	0.52
Denmark	77.1	1.00	0.42	0.99	1.00	1.00
Dominican Republic	34.4	0.26	0.57	0.35	0.39	0.32
Ecuador	31.9	0.22	0.85	0.20	0.23	0.46
Egypt	16.9	0.14	0.06	0.26	0.19	0.23
El Salvador	34.4	0.29	0.70	0.21	0.35	0.36
Estonia	59.6	0.65	0.48	0.79	0.52	0.70
Ethiopia	28.1	0.33	0.71	0.12	0.19	0.36
Finland	62.9	0.76	0.55	0.77	0.60	0.53
France	64.4	0.79	0.40	1.00	0.65	0.65
Gabon	35.3	0.25	1.00	0.27	0.25	0.36
Gambia	29.6	0.26	1.00	0.12	0.05	0.50
Germany	70.1	0.79	0.59	0.99	0.66	0.89
Ghana	29.2	0.36	1.00	0.13	0.04	0.37
Greece	42.5	0.54	0.44	0.63	0.58	0.41
Guatemala	25.1	0.17	0.69	0.10	0.04	0.57
Honduras	33.7	0.30	0.79	0.24	0.23	0.43
Hong Kong	36.7	0.77	0.37	0.28	0.65	0.11
Hungary	44.1	0.48	0.40	0.70	0.42	0.45
Iceland	65.5	0.95	0.53	0.85	0.69	0.50
India	33.2	0.14	0.34	0.36	0.53	0.44
Indonesia	42.7	0.36	0.82	0.69	0.14	0.52
Iran	21.3	0.21	0.11	0.34	0.30	0.19
Ireland	64.5	0.58	0.40	0.92	0.99	0.89
Israel	53.7	0.38	0.71	0.53	0.79	0.40
Italy	41.9	0.54	0.36	0.97	0.17	0.42
Jamaica	40.7	0.42	1.00	0.21	0.30	0.52
Japan	50.1	0.62	0.25	0.79	0.98	0.48
Jordan	21.9	0.33	0.10	0.11	0.27	0.36
Kazakhstan	38.1	0.46	0.78	0.22	0.70	0.22
Kenya	28.1	0.25	1.00	0.12	0.04	0.43
Korea	38.2	0.56	0.12	0.60	0.75	0.23
Kuwait	31.6	0.46	0.15	0.19	0.54	0.38
Latvia	50.0	0.52	0.47	0.57	0.58	0.56

(continued)

Countries	ABT	Opportunity startup	Gender	Technology absorption	Human capital	Competition
Albania	36.0	0.24	0.40	0.47	0.42	0.42
Lebanon	32.9	0.29	0.24	0.27	0.46	0.46
Liberia	28.6	0.24	1.00	0.11	0.04	0.49
Lithuania	51.5	0.54	0.43	0.57	0.84	0.42
Macedonia	35.3	0.28	0.41	0.40	0.38	0.45
Madagascar	27.2	0.29	1.00	0.10	0.04	0.36
Malawi	24.7	0.13	0.91	0.11	0.03	0.46
Malaysia	51.1	0.78	0.63	0.26	0.50	0.66
Mali	24.7	0.20	0.78	0.11	0.03	0.41
Mauritania	21.1	0.15	0.64	0.11	0.03	0.33
Mexico	44.4	0.73	0.70	0.46	0.34	0.32
Moldova	39.6	0.40	0.67	0.39	0.57	0.38
Montenegro	32.5	0.38	0.47	0.27	0.34	0.29
Morocco	22.1	0.56	0.27	0.05	0.07	0.32
Mozambique	28.5	0.30	1.00	0.11	0.03	0.44
Namibia	36.4	0.33	1.00	0.27	0.17	0.39
Netherlands	64.5	0.80	0.54	0.58	0.61	0.79
Nicaragua	30.7	0.22	0.83	0.21	0.20	0.37
Nigeria	34.7	0.27	0.79	0.23	0.35	0.42
Norway	67.0	1.00	0.42	0.73	0.86	0.72
Oman	39.8	0.58	0.20	0.26	0.76	0.40
Pakistan	16.0	0.21	0.01	0.20	0.12	0.36
Panama	42.4	0.51	0.89	0.37	0.43	0.48
Paraguay	35.6	0.35	0.87	0.22	0.25	0.41
Peru	40.8	0.50	0.65	0.31	0.35	0.38
Philippines	34.4	0.18	1.00	0.21	0.54	0.20
Poland	36.5	0.23	0.34	0.45	0.34	0.55
Portugal	47.4	0.67	0.49	0.58	0.47	0.43
Puerto Rico	76.6	0.74	1.00	1.00	1.00	1.00
Qatar	44.7	0.60	0.29	0.30	0.86	0.57
Romania	42.6	0.40	0.44	0.46	0.44	0.50
Russia	41.5	0.39	0.81	0.30	0.84	0.27
Rwanda	28.9	0.31	1.00	0.11	0.04	0.43
Saudi Arabia	35.2	0.61	0.07	0.21	0.63	0.63
Senegal	27.5	0.24	0.99	0.13	0.03	0.41
Serbia	28.1	0.24	0.38	0.27	0.23	0.31
Sierra Leone	25.1	0.20	1.00	0.10	0.03	0.32
Singapore	73.3	1.00	0.99	0.70	1.00	0.53
Slovakia	38.1	0.42	0.33	0.56	0.32	0.38
Slovenia	54.3	0.78	0.41	1.00	0.61	0.54

(continued)

Countries	ABT	Opportunity startup	Gender	Technology absorption	Human capital	Competition
Albania	36.0	0.24	0.40	0.47	0.42	0.42
South Africa	38.9	0.43	0.58	0.24	0.26	0.74
Spain	52.9	0.58	0.50	0.77	0.51	0.70
Swaziland	34.4	0.37	1.00	0.21	0.22	0.37
Sweden	76.5	1.00	0.73	0.95	0.84	0.66
Switzerland	75.0	0.62	1.00	0.80	0.77	1.00
Taiwan	68.2	0.95	0.62	0.85	0.85	0.43
Tanzania	25.2	0.19	0.96	0.10	0.04	0.36
Thailand	44.2	0.58	0.96	0.26	0.51	0.39
Trinidad and Tobago	36.4	0.39	0.78	0.24	0.38	0.39
Tunisia	35.7	0.45	0.19	0.47	0.42	0.40
Turkey	35.4	0.37	0.16	0.46	0.47	0.43
Uganda	23.1	0.15	1.00	0.07	0.04	0.27
Ukraine	35.4	0.22	0.73	0.30	0.73	0.22
United Arab Emirates	45.0	0.64	0.36	0.37	0.99	0.51
United Kingdom	77.6	0.90	0.54	0.93	0.87	1.00
United States	84.5	0.75	0.89	0.81	0.95	1.00
Uruguay	41.3	0.33	0.48	0.49	0.33	0.47
Venezuela	26.7	0.21	0.84	0.18	0.23	0.17
Zambia	33.3	0.33	0.91	0.12	0.33	0.35

Appendix D
Entrepreneurial Aspirations Sub-index and Pillar Values of Countries in Alphabetical Order, 2014

Countries	ASP	Product innovation	Process innovation	High growth	Internationalization	Risk capital
Albania	32.7	0.19	0.26	0.48	0.56	0.30
Algeria	27.3	0.26	0.16	0.24	0.20	0.60
Angola	35.9	0.34	0.51	0.23	0.64	0.43
Argentina	31.7	0.43	0.39	0.44	0.11	0.37
Australia	74.2	0.52	0.79	0.71	0.92	0.98
Austria	63.6	0.88	0.75	0.32	0.89	0.79
Bahrain	48.6	0.56	0.15	1.00	0.57	0.72
Bangladesh	7.9	0.04	0.07	0.13	0.03	0.13
Barbados	24.9	0.22	0.11	0.31	0.58	0.15
Belgium	71.1	0.75	0.80	0.48	1.00	0.78
Benin	17.0	0.31	0.16	0.21	0.14	0.07
Bolivia	22.4	0.28	0.20	0.24	0.16	0.27
Bosnia and Herzegovina	28.2	0.18	0.08	0.45	0.47	0.45
Botswana	32.4	0.31	0.29	0.67	0.45	0.13
Brazil	14.8	0.04	0.26	0.25	0.02	0.23
Brunei Darussalam	36.6	0.35	0.12	0.51	0.49	0.64
Bulgaria	53.3	0.32	0.52	0.68	0.92	0.59
Burkina Faso	13.8	0.23	0.21	0.11	0.12	0.07
Burundi	12.2	0.16	0.26	0.10	0.09	0.05
Cameroon	17.8	0.32	0.16	0.23	0.14	0.08
Chad	12.1	0.21	0.15	0.11	0.11	0.06
Chile	67.0	1.00	0.39	0.77	0.86	0.67
China	47.9	0.85	0.64	0.65	0.12	0.72
Colombia	50.3	0.96	0.25	1.00	0.37	0.38
Costa Rica	30.1	0.28	0.32	0.39	0.27	0.27

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Countries	ASP	Product innovation	Process innovation	High growth	Internationalization	Risk capital
Côte d'Ivoire	13.1	0.21	0.15	0.12	0.13	0.08
Croatia	51.0	0.30	0.54	0.65	0.86	0.64
Cyprus	40.6	0.39	0.45	0.22	0.71	0.64
Czech Republic	63.3	0.74	0.85	0.89	1.00	0.63
Denmark	73.5	1.00	0.80	0.76	0.58	0.91
Dominican Republic	26.2	0.25	0.14	0.49	0.41	0.12
Ecuador	20.6	0.71	0.16	0.14	0.05	0.16
Egypt	27.7	0.22	0.26	0.62	0.19	0.28
El Salvador	29.6	0.54	0.14	0.49	0.15	0.30
Estonia	63.6	0.67	0.69	0.73	0.94	0.41
Ethiopia	15.8	0.15	0.39	0.21	0.02	0.10
Finland	65.5	0.85	1.00	0.51	0.52	0.54
France	73.2	1.00	0.91	0.77	0.66	0.73
Gabon	34.8	0.30	0.48	0.40	0.48	0.28
Gambia	13.8	0.28	0.06	0.14	0.14	0.10
Germany	67.3	0.67	0.83	0.75	0.65	0.76
Ghana	15.4	0.09	0.15	0.28	0.16	0.13
Greece	40.0	0.39	0.49	0.20	0.60	0.81
Guatemala	12.4	0.34	0.07	0.13	0.03	0.10
Honduras	13.6	0.33	0.09	0.08	0.10	0.11
Hong Kong	59.3	1.00	0.52	0.83	0.77	0.79
Hungary	48.9	0.44	0.49	0.72	0.84	0.35
Iceland	74.0	0.84	0.98	0.77	0.90	0.60
India	29.1	0.23	0.57	0.17	0.14	0.48
Indonesia	28.6	0.41	0.22	0.16	0.18	0.58
Iran	23.0	0.09	0.26	0.31	0.09	0.54
Ireland	69.9	0.81	0.72	1.00	0.94	0.67
Israel	75.0	0.91	1.00	0.67	0.75	0.90
Italy	49.3	1.00	0.73	0.24	0.48	0.53
Jamaica	19.4	0.16	0.14	0.15	0.45	0.13
Japan	56.7	0.76	0.99	1.00	0.35	0.57
Jordan	34.1	0.43	0.38	0.46	0.28	0.33
Kazakhstan	19.6	0.06	0.19	0.43	0.24	0.14
Kenya	18.4	0.29	0.30	0.14	0.13	0.13
Korea	56.7	0.84	0.83	0.62	0.48	0.85
Kuwait	46.8	0.49	0.27	1.00	0.44	0.61
Latvia	55.7	0.56	0.37	1.00	0.80	0.48
Lebanon	35.3	0.25	0.31	0.43	0.61	0.28
Liberia	17.9	0.28	0.33	0.14	0.09	0.13

(continued)

Countries	ASP	Product innovation	Process innovation	High growth	Internationalization	Risk capital
Lithuania	55.0	0.36	0.47	0.94	0.77	0.54
Macedonia	41.6	0.32	0.36	0.47	0.72	0.50
Madagascar	13.1	0.23	0.18	0.12	0.11	0.05
Malawi	24.5	0.68	0.86	0.02	0.09	0.04
Malaysia	34.7	0.50	0.49	0.27	0.27	0.26
Mali	14.6	0.24	0.23	0.11	0.12	0.07
Mauritania	15.8	0.21	0.33	0.12	0.13	0.07
Mexico	29.1	0.55	0.23	0.32	0.16	0.28
Moldova	32.5	0.22	0.38	0.67	0.40	0.25
Montenegro	48.1	0.30	0.73	0.47	0.89	0.49
Morocco	28.1	0.10	0.43	0.32	0.73	0.11
Mozambique	14.0	0.20	0.21	0.11	0.13	0.08
Namibia	41.9	0.64	0.46	0.32	0.62	0.36
Netherlands	68.8	0.89	0.68	0.50	0.71	0.82
Nicaragua	13.1	0.32	0.10	0.07	0.09	0.10
Nigeria	27.9	0.33	0.28	0.43	0.30	0.20
Norway	54.4	0.47	0.66	0.37	0.43	1.00
Oman	54.3	0.63	0.31	1.00	0.51	0.78
Pakistan	25.3	0.46	0.39	0.40	0.16	0.09
Panama	21.8	0.54	0.25	0.05	0.24	0.16
Paraguay	19.4	0.36	0.10	0.22	0.15	0.18
Peru	32.1	0.64	0.21	0.32	0.27	0.25
Philippines	14.3	0.19	0.20	0.11	0.12	0.10
Poland	60.3	0.94	0.44	0.68	0.89	0.62
Portugal	54.8	0.43	0.73	0.46	0.99	0.64
Puerto Rico	59.1	0.97	0.31	1.00	0.66	0.50
Qatar	59.6	0.96	0.44	1.00	0.55	0.87
Romania	53.9	0.42	0.46	0.88	0.84	0.50
Russia	25.7	0.22	0.37	0.50	0.08	0.27
Rwanda	13.8	0.29	0.13	0.14	0.10	0.07
Saudi Arabia	47.2	0.79	0.23	1.00	0.38	0.71
Senegal	17.3	0.27	0.33	0.14	0.14	0.06
Serbia	33.2	0.23	0.64	0.36	0.23	0.31
Sierra Leone	11.4	0.17	0.15	0.11	0.10	0.07
Singapore	78.3	0.73	1.00	1.00	1.00	0.83
Slovakia	56.7	0.49	0.47	0.60	0.90	0.88
Slovenia	55.5	0.64	0.78	0.64	0.80	0.52
South Africa	48.6	0.78	0.65	0.58	0.65	0.29
Spain	43.3	0.47	0.66	0.29	0.28	0.72
Swaziland	34.6	0.38	0.32	0.30	0.51	0.49

(continued)

Countries	ASP	Product innovation	Process innovation	High growth	Internationalization	Risk capital
Sweden	65.8	0.69	0.85	0.45	0.73	0.74
Switzerland	71.8	0.88	0.81	0.41	0.91	1.00
Taiwan	78.6	1.00	0.78	1.00	0.64	0.99
Tanzania	17.7	0.25	0.31	0.12	0.10	0.17
Thailand	30.5	0.58	0.27	0.33	0.11	0.41
Trinidad and Tobago	20.7	0.11	0.06	0.35	0.40	0.22
Tunisia	34.0	0.64	0.47	0.42	0.16	0.19
Turkey	54.0	0.82	0.45	0.94	0.37	0.70
Uganda	13.4	0.11	0.26	0.07	0.15	0.12
Ukraine	24.9	0.14	0.35	0.50	0.19	0.23
United Arab Emirates	59.0	0.81	0.50	1.00	0.80	0.99
United Kingdom	66.2	0.81	0.67	0.60	0.72	0.63
United States	83.5	0.86	0.90	0.88	0.72	0.97
Uruguay	37.3	0.37	0.34	0.45	0.37	0.34
Venezuela	11.8	0.16	0.13	0.17	0.05	0.10
Zambia	28.4	0.30	0.30	0.15	0.74	0.16

Appendix E
GEDI Methodology

In the constructing the index we followed eight points:

1. *The selection of variables:* We start with the variables that come directly from the original sources for each country involved in the analysis. The variables can be at the individual level (personal or business) that are coming from the GEM Adult Population Survey or the institutional/environmental level that are coming from various other sources. Altogether we use 16 individual and 15 institutional variables. Individual data are calculated from the 2006–2012 years, using the two-year moving average principle. In the lack of proper data, single-year value is applied. In the case of the institutional variables we applied single-year data. Altogether, we have data for 7 years for 87 countries. Since we do not have data for all the years and countries, the dataset consists of 355 observation units.
2. *The construction of the pillars:* We calculate all pillars from the variables using the interaction variable method; that is, by multiplying the individual variable with the proper institutional variable. This results in pillar values for all the 355 observations.
3. *Normalization:* pillars values were first normalized to a range from 0 to 1:

$$x_{i,j} = \frac{z_{i,j}}{\max z_{i,j}} \tag{E.1}$$

   for all $j = 1 \ldots k$, the number of pillars
   where $x_{i,j}$ is the normalized score value for country i and pillar j
   $z_{i,j}$ is the original pillar value for country i and pillar j
   $\max z_{i,j}$ is the maximum value for pillar j
4. *Capping:* All index building is based on a benchmarking principle. In our case we selected the 95th percentile score adjustment, meaning that any observed values higher than the 95th percentile are lowered to the 95th percentile. Since this calculation includes all 355 observation units, the change of the pillar values of a particular county over years can be tracked.
5. *Average pillar adjustment:* The different averages of the normalized values of the indicators imply that reaching the same indicator values requires different effort and resources. Since we want to apply the GEDI to public policy purposes, the additional resources for the same marginal improvement of the indicator values should be the same for all indicators. Therefore, we need a

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transformation to equate the average values of the components. Equation E.2 shows the calculation of the average value of pillar *j*:

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{i,j}}{n}. \tag{E.2}$$

We want to transform the $x_{i,j}$ values such that the potential minimum value is 0 and the maximum value is 1:

$$y_{i,j} = x_{i,j}^{k} \tag{E.3}$$

where k is the "strength of adjustment," the k-th moment of X_j is exactly the needed average, $\bar{y}_j$. We have to find the root of the following equation for k

$$\sum_{i=1}^{n} x_{i,j}^{k} - n\bar{y}_j = 0 \tag{E.4}$$

It is easy to see, based on previous conditions and derivatives, that the function is decreasing and convex, which means it can be quickly solved using the well-known Newton-Raphson method with an initial guess of 0. After obtaining k, the computations are straightforward. Note that if

$$\begin{aligned} \bar{x}_j < \bar{y}_j \quad & k < 1 \\ \bar{x}_j = \bar{y}_j \quad & k = 1 \\ \bar{x}_j > \bar{y}_j \quad & k > 1 \end{aligned}$$

then k will be thought of as the strength (and direction) of adjustment.

6. *Penalizing:* After these transformations, the PFB methodology was used to create indicator-adjusted PFB values. We define our penalty function as:

$$h_{(i),j} = \mathrm{min}y_{(i),j} + \mathrm{a}\left(1 - e^{-\mathrm{b}\left(y_{(i)j} - \mathrm{min}y_{(i),\mathrm{j}}\right)}\right) \tag{E.5}$$

where $h_{i,j}$ is the modified, post-penalty value of pillar j in country i
$y_{i,j}$ is the normalized value of index component j in country i
$y_{\min}$ is the lowest value of $y_{i,j}$ for country i.
i = 1, 2,…, n = the number of countries
j = 1, 2,…, m = the number of pillars
0 ≤ a, b ≤ 1 are the penalty parameters, the basic setup is a = b = 1

7. *Sub-index calculation:* The value of a sub-index for any country was then calculated as the arithmetic average of its PFB-adjusted indicators for that sub-index, multiplied by 100, to get a 100-point scale.

$$ATT_i = 100 \sum_{j=1}^{5} h_j \tag{E.6a}$$

$$ABT_i = 100 \sum_{j=6}^{10} h_j \tag{E.6b}$$

$$ASP_i = 100 \sum_{j=11}^{15} h_j \tag{E.6c}$$

where $h_{i,j}$ is the modified, post-penalty value of pillar j in country i
i = 1, 2,……n = the number of countries
j = 1, 2,…….14 = the number of pillars

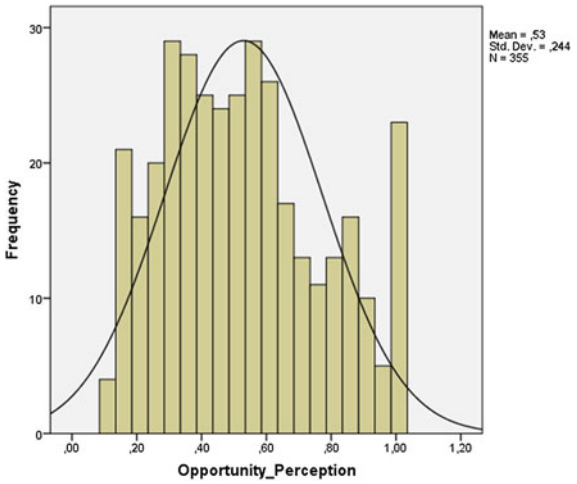
8. *GEDI point calculation:* Finally, the GEDI index was calculated as the simple arithmetic average of the three sub-indices. Since 100 represents the theoretically available limit, the GEDI points can also be interpreted as a measure of efficiency of the entrepreneurship resources.

$$GEDI_i = \frac{1}{3}(ATT_i + ABT_i + ASP_i) \tag{E.7}$$

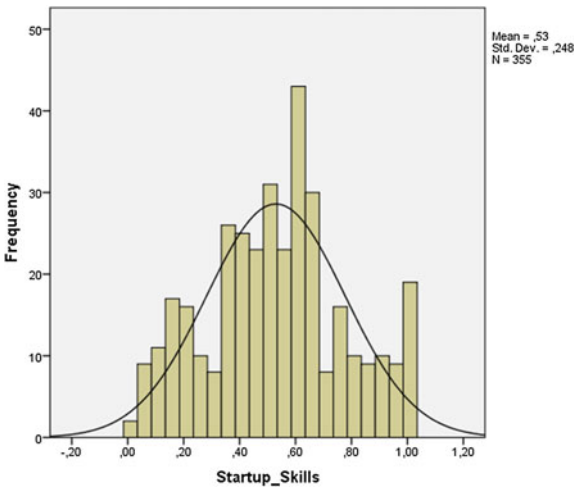
where i = 1, 2,……n = the number of countries

Appendix F
Pillar Distributions

Opportunity Perception

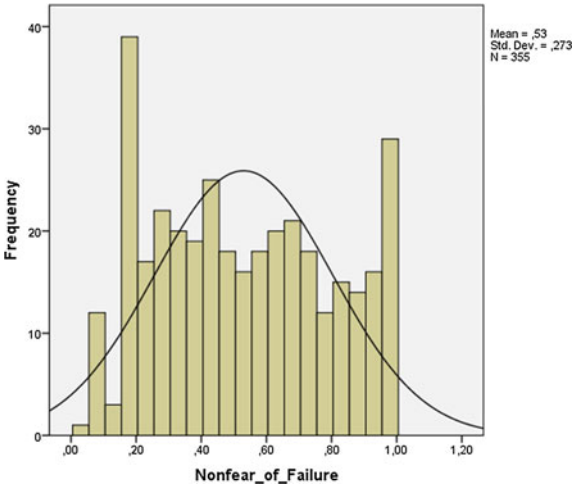


Start-up Skills

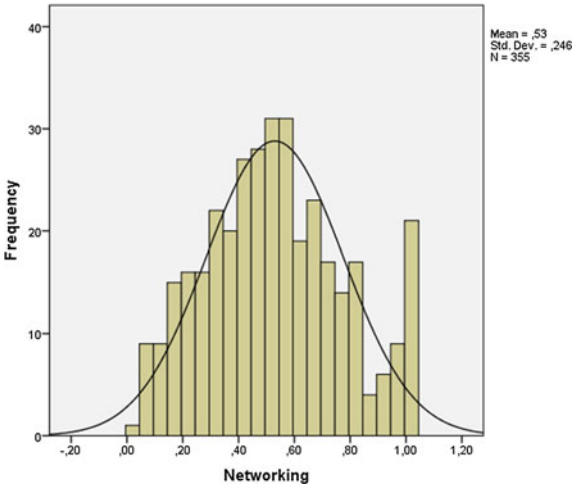


Z.J. Acs et al., *Global Entrepreneurship and Development Index 2014*,
SpringerBriefs in Economics, DOI 10.1007/978-3-319-14932-5

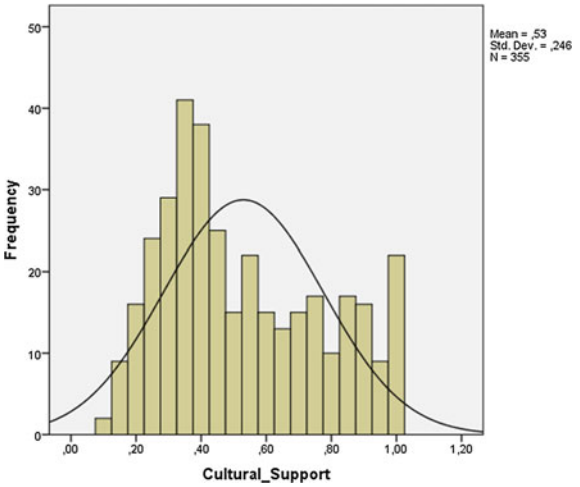
Risk Acceptance



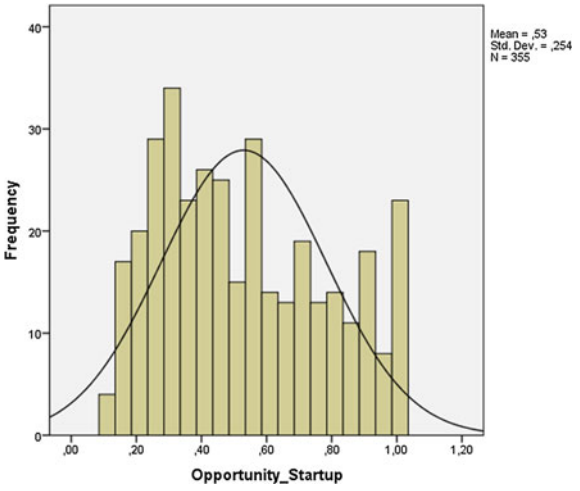
Networking



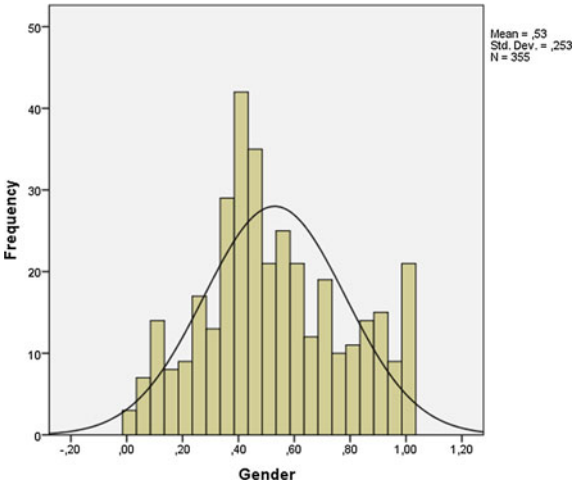
Cultural Support



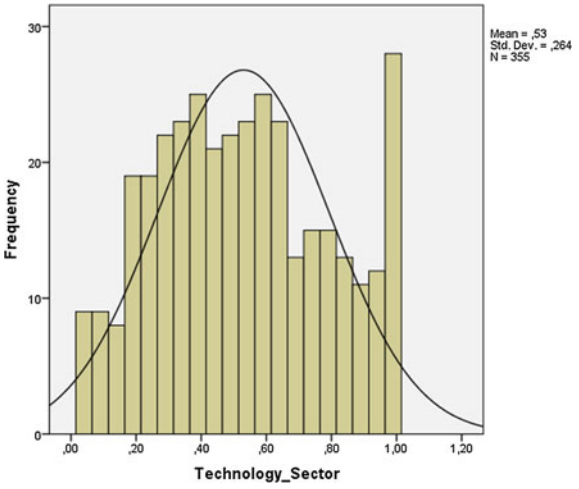
Opportunity Start-up



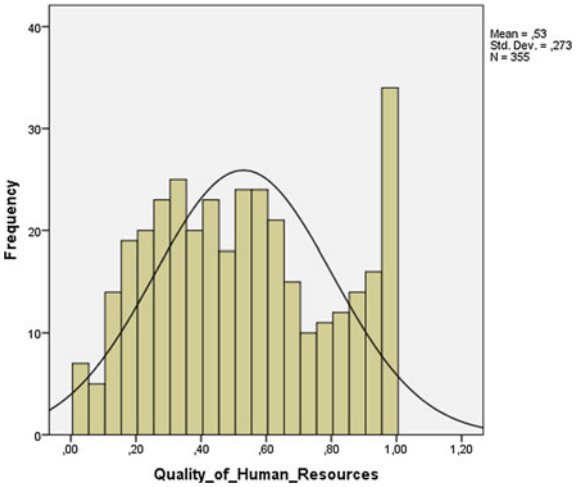
Gender



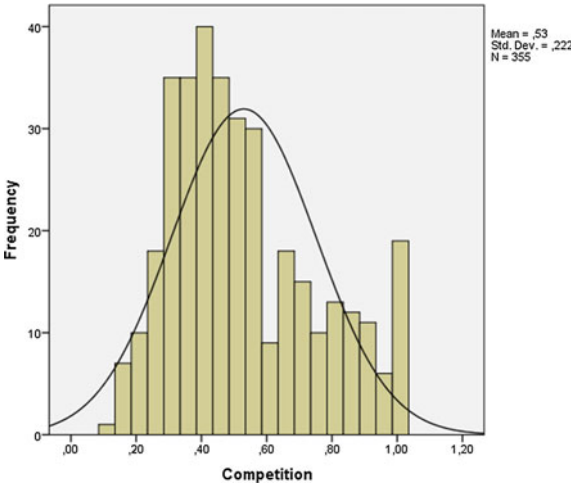
Technology Sector



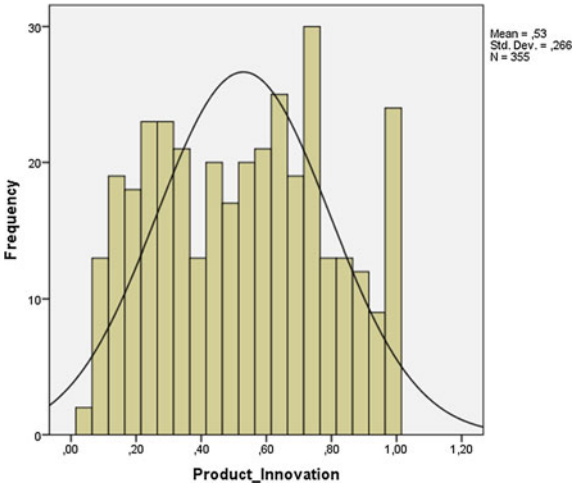
Human Capital



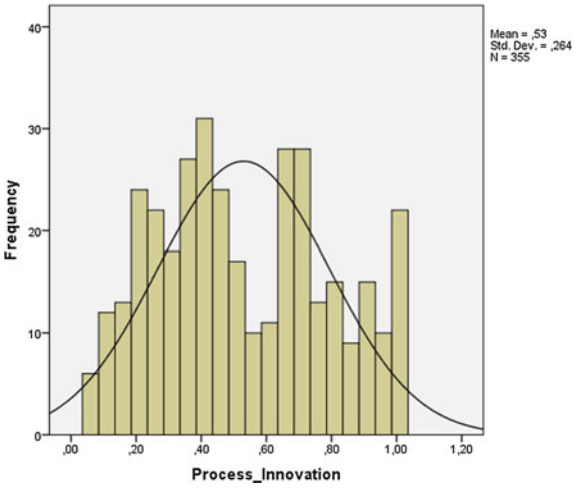
Competition



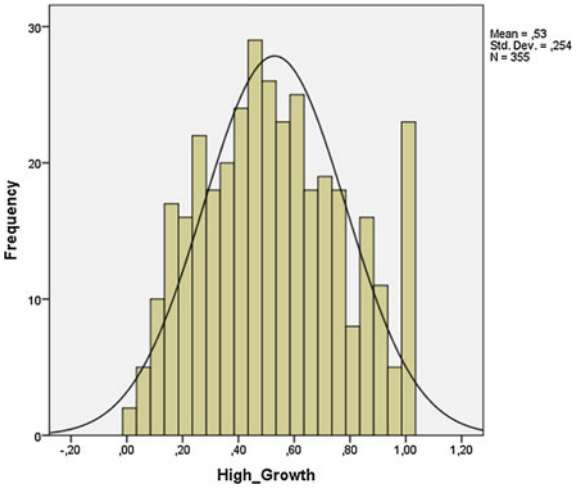
Product Innovation



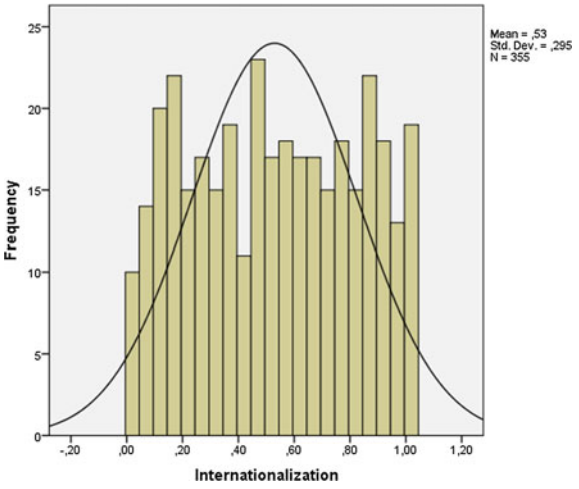
Process Innovation



High Growth



Internationalization



Risk Capital