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Configurational conditions of national innovation capability: A fuzzy set analysis approach

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ABSTRACT

Building upon the national innovation system perspective and using a fuzzy set qualitative comparative analysis approach (fsQCA), we propose an integrating framework to determine the conditions that lead to high levels of national innovation capability outcomes. We discriminate between five conditions, *viz.*, building national institutions, developing human capital and research systems, improving infrastructures, and facilitating business and market conditions. We do so by analyzing data collected from the Global Innovation Index database containing 74 indicators and 133 countries between 2012 and 2015. The results show no singular path leading to high levels of innovation capability but there are three configurations of conditions. Two configurations highlight that the combination of three distinct conditions is *sufficient* for a country to reach a *high* innovation capability (one in which market conditions 'are not necessary' and one in which institutions 'are not necessary' conditions). The third configuration highlights that the combination of all five conditions is *necessary* for a country to reach a *very high* innovation capability. Some crucial implications of these findings for theory and practice are discussed.

1. Introduction

The importance of national innovation capability for economic development has been widely addressed in the literature (Archibugi et al., 2009; Filippetti and Archibugi, 2011; Freeman, 1995; Khayyat and Lee, 2015). Understanding how countries can enhance their innovation capabilities may help them to catch up with the highest performing countries (Abramovitz, 1986; Archibugi et al., 2009).

National innovation capability refers to the ability of a country to manage resources and skills to transform existing knowledge into new knowledge, technology, and creative outputs for the benefit of firms, industries, and the entire economy (Fagerberg and Srholec, 2008; Furman et al., 2002; Lopez-Carlos and Mata, 2009). National innovation capability is an evolutionary learning process that occurs within institutional structures (Nelson, 1988; Nelson and Winter, 1982; Freeman, 1987). Indeed, effective learning requires institutional structures with appropriate legal institutions that develop human capital through appropriate education and research systems, build common infrastructures to enable knowledge sourcing and transfer, and facilitate business and market conditions to absorb, adopt and implement advanced technologies (Nelson and Winter, 1982; Reddy, 1997). The so-called national innovation system perspective addresses the importance of all these five conditions (Freeman, 1995; Lundvall, 1992; Lundvall et al., 2002).

Despite substantial research on national innovation capability using the national innovation system perspective, little is known about which specific configurations of conditions lead to higher levels of national innovation capability (Fagerberg and Srholec, 2008; Pustovrh and Jaklič, 2014). The *first* reason is that the literature on national innovation capability is fragmented—various theoretical studies have been developed—and an integrating framework is lacking (Fagerberg and Srholec, 2008; Lundvall et al., 2002). For instance, reviews of studies on national innovation capability show that individual studies only cover a fraction of the innovation conditions that are considered to be important in other studies (Fagerberg and Srholec, 2008; Filippetti and Archibugi, 2011; Khayyat and Lee, 2015). This is striking because the national innovation system perspective stresses the systemic nature of national innovation capability and the fact that it is an evolutionary learning process leading to coherent outcomes (Nelson, 1988; Freeman, 1995; Lundvall et al., 2002).

The *second* reason for the lack of knowledge about configurations of conditions is that research on national innovation capability suffers

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from a mismatch between theory and methods (Fagerberg and Srholec, 2008). This is because theory suggests that the explanation of national innovation capability is best understood in terms of combinations of conditions, also known as configurational conditions, whereas methods primarily use individual and 'independent' conditions (Pustovrh and Jaklič, 2014). Proponents of the configurational approach take a systemic view (Fiss, 2007, 2011). By reducing national innovation capability to a small number of individual conditions, a large number of studies do not grasp the complex interaction effects between various conditions that influence innovation capability (Pustovrh and Jaklič, 2014).

To address this gap in the literature, we propose a framework based on the national innovation system perspective (Lundvall, 1992; Lundvall et al., 2002) and a configurational approach based on fuzzy set Qualitative Comparative Analysis (fsQCA: Ragin, 2008) to determine configurational conditions leading to high levels of national innovation capability. The fsQCA approach offers a pragmatic way to organize multiple interdependent relationships among conditions into a coherent framework explaining the outcomes (Ragin, 2000). In the present research, fsQCA is applied to a sample of 133 countries and 74 indicators are retrieved from the database of the Global Innovation Index 2012–2015.

Our results demonstrate that no single path leads to high levels of national innovation capability. Instead, they show the existence of three distinct configurations of conditions. The *first* configuration of conditions shows that building national institutions, developing human capital and research systems, improving infrastructures, and facilitating business are sufficient conditions for a high level of innovation capability. The *second* configuration of conditions shows that developing human capital and research systems, improving infrastructures, and facilitating business and market conditions are also sufficient to reach a high level of innovation capability. The two configurations point to a situation of "*equifinality*", where the combination of three distinct conditions is *sufficient* for a country to reach a *high* innovation capability. The *third* configuration shows that the combination of all five conditions is *necessary* for a country to reach a *very high* innovation capability. All of these configurations consist of twenty high-income countries that are obviously not entirely the same across the three configurations.

Our study is novel in that it proposes a comprehensive framework based on the national innovation system perspective and a holistic approach based on fsQCA to determine the configurations of conditions that lead a country to reach high levels of innovation capability. From a theoretical perspective, our study holds considerable promise for closing the abovementioned gap between theory and methods and enables a detailed analysis of the sufficient and necessary conditions for reaching high and very high innovation capability. From a practical perspective, our research provides useful insights for understanding how countries can improve their innovation capabilities in order to catch up with performing economies.

In the next section, we present our framework from the national innovation system perspective and we put forward the fuzzy set approach as theoretical background of the empirical analysis. Section 3 presents the data source and the methodology. Section 4 presents the results of a fuzzy set approach. Section 5 contains the discussion and the conclusion.

2. National innovation capability from the national innovation system perspective

2.1. Innovation capability conditions

The national innovation system perspective considers innovation capability as an evolutionary learning process (Nelson, 1988; Nelson and Winter, 1982) that occurs within institutional structures "in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies" (Freeman, 1987: 1). Institutional structures encompass not only prevailing institutions with legal rules but also organizations and their activities, practices and policies (Edquist and Johnson, 1997). For countries aiming to enhance their innovation capabilities, the basic challenge is to develop institutional structures with strong absorptive capacity in order to assimilate existing knowledge and generate new knowledge, technology, and creative outputs (Nelson, 2008). In this perspective, the key driving force of innovation capability "is assimilation, learning to do effectively what countries at the frontier have been doing, often for some time" (Nelson, 2008: 16). Indeed, effective learning requires institutional structures with appropriate legal institutions that develop human capital through appropriate education and research systems, build common infrastructures to enable knowledge sourcing and transfer, and facilitate business and market conditions to absorb, adopt and implement foreign advanced technologies (Nelson and Winter, 1982; Reddy, 1997).

Our framework builds on this perspective and considers innovation capability as the result of the interplay between five institutional conditions, *viz.*, institutions, human capital and research, infrastructure, market and business conditions (Fig. 1). Originally, the framework was developed by the global innovation index (GII, 2015) as a key tool to measure innovation capability under the assumption that if a country aims to achieve high levels of innovation capability, it should improve all of its individual conditions. In our research, we assume that innovation capability is an evolutionary learning process that emerges from the mutual interactions and complementarities between several and not necessarily all institutional conditions (Nelson and Winter, 1982; Nelson, 2008). The entire evolutionary learning process leads to outcomes which are relatively stable and coherent per country, but not necessarily similar across countries.

At the core of the definition of the national innovation system perspective resides the neo-Schumpeterian theory of innovation that stresses the role of *institutions* in fostering innovation activities (Nelson and Winter, 1982). Institutions capture policy, legal and institutional framework of a country related to its political, regulatory, and business environments (Edquist and Johnson, 1997). Indeed, institutions are considered as the rules of the game that regulate political, economic and social interactions within a national system (Edquist and Johnson, 1997; Nelson and Winter, 1982). According to Edquist and Johnson (1997: 51), institutions, by their nature, regulate the relations between economic actors at different levels within a national innovation system. For instance, at the firm level, institutions influence innovation by affecting the relations between R & D, production, and marketing. At the market level, institutions influence innovation processes through the feedback mechanisms for consumer reactions on new products. Relations between government agencies and private firms and technology policies are examples at a third level in which institutions influence innovation. The set of communications and interactions in relation to innovation activities are thus shaped by the institutional framework of the economy. Indeed, institutions are needed to cope with the high levels of uncertainty that characterize innovation activities (Nelson, 2008). A political environment that favors political stability and government effectiveness reduces uncertainty about doing business and encourages innovation activities (Feng, 1997). A business environment that helps new entrants to easily start a business, resolve insolvency, and pay taxes reduces uncertainty about doing business and encourages competitiveness necessary for innovation (Djankov et al., 2002; Lopez-Carlos and Mata, 2009). It is also common to say that institutions control and regulate conflicts and cooperation between economic actors (Edquist and Johnson, 1997). Conflict has argued to be a very serious problem in relation with innovation activities (Nelson, 2008). A regulatory environment that shapes the government's ability to promote private-sector development and to evaluate the extent to which rule of law prevails reduces conflicts and increases cooperation necessary for innovation processes (Furman et al., 2002). Another

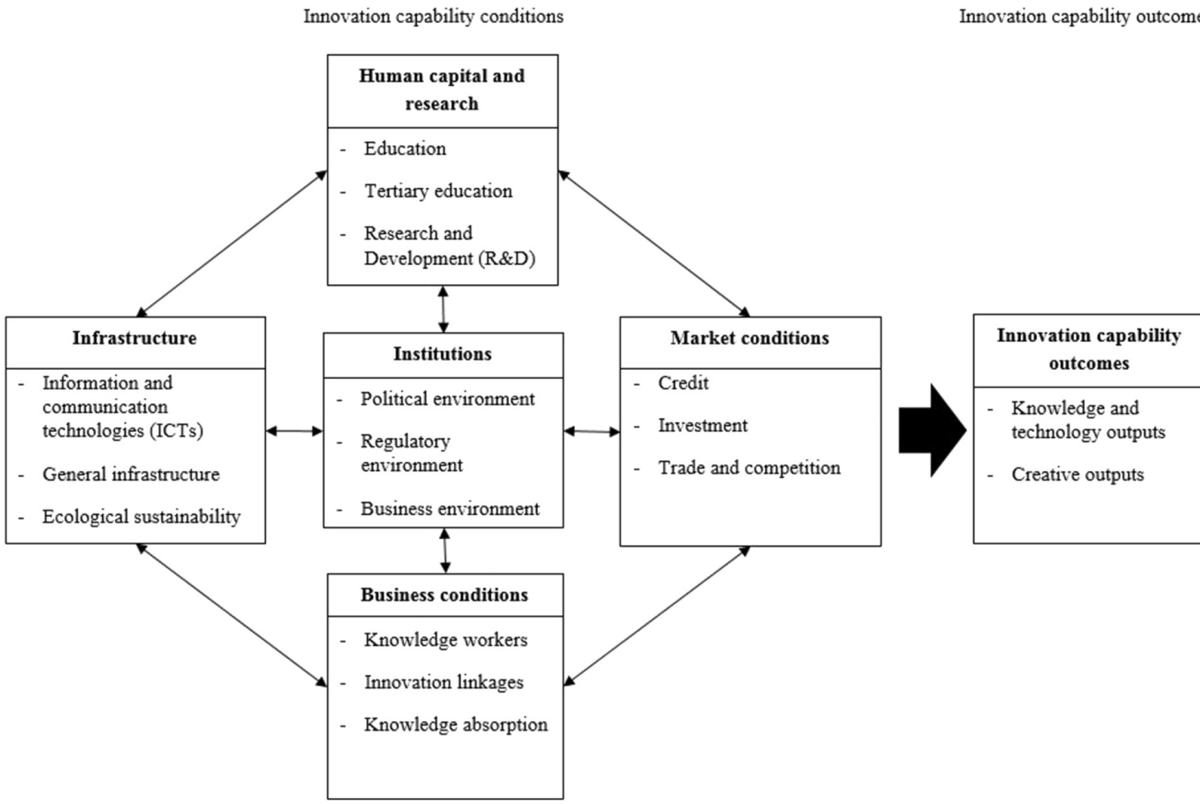

Fig. 1. National innovation capability framework.
(Adapted from GII, 2015: 9).

function of institutions is to provide incentives necessary to engage learning processes and to participate in innovation activities (Nelson and Winter, 1982). Salary and wages, income taxes, and tax allowances are important incentives that affect innovative efforts. Laws and rules concerning patents, copyrights, and trademarks are also other important incentives, since they allow adoption of temporary technological rents, and affect the transfer of knowledge (Edquist and Johnson, 1997: 53). Nurturing an institutional framework that attracts business by providing good governance and the correct levels of protection and incentives is essential to foster innovation capability (Nelson, 1988).

The national innovation system perspective reflects the increasing attention given to the role of *human capital and research* development through education, tertiary education, and scientific research institutions (Lundvall, 1992). Education is considered to be the backbone of a nation and it is quite obvious that the education system has an important role in enhancing innovation processes and the overall development of a country through knowledge creation. The case of China case is a good example that witnesses the crucial role of education. In the past, the percentage of illiteracy in China was around 50% (Zhang et al., 2005). Consequently, many people had low skills and low incomes. To overcome these inconvenient conditions, the China's government has improved the education system over time. Some of the programs were giving free education for children and providing scholarships for students. As a result, the country has significantly increased its innovation capability to be today one of the world's best performing economies (GII, 2015). Of course, there may be other interactive conditions explaining China's economic growth but it is obvious that a well-developed education system plays a significant role in enhancing national innovation capability. Porter (1990: 628) argues that "education and training constitute perhaps the single greatest long-term leverage point available to all levels of government in upgrading industry. Improving the general education system is an essential priority of government and a matter of economic, not just social policy". Indeed, government should allocate more attention to tertiary education by giving priority to high level learning in science, engineering, manufacturing, and construction in order to help students develop specific knowledge and skills (Filippetti and Archibugi, 2011). Encouraging international tertiary student mobility also plays a crucial role in acquiring new technological knowledge (Lopez-Carlos and Mata, 2009). Moreover, favoring R & D activities within research laboratories and improving the quality of scientific and research institutions play important roles in knowledge assimilation and creation (Furman et al., 2002).

National innovation capability also depends on the presence of a strong common infrastructure (Lundvall, 2004; Lee et al., 2016). Infrastructure refers to technical structures providing commodities and services essential to enable technological knowledge transfer and diffusion (Castellacci and Natera, 2013). One common innovation infrastructure includes the adoption and use of information and communication technologies (ICTs) (Fagerberg and Srholec, 2008). ICTs can be essential to trigger innovation processes as new ideas are disseminated more widely and put to new uses (OECD, 2012). ICTs considerably reduce the cost of accessing information and enable scientists to easily access scientific knowledge from all around the world (OECD, 2012). It is also common to say that electricity infrastructure and transport-related infrastructure reduce illiteracy by facilitating access to better quality of education and high level leaning systems (Lopez-Carlos and Mata, 2009). Moreover, ecological sustainability infrastructure such as ecological public transport systems and renewable energy infrastructure are crucial to well-functioning innovation systems as they ensure conditions of well-being, reduce economic costs and save financial resources that can be allocated elsewhere (Hekkert et al., 2007; Lopez-Carlos and Mata, 2009). Although earlier studies on innovation capability did not emphasize the role of infrastructural dimension, a well-developed infrastructure is increasingly seen as a requirement for innovation and economy development (Fagerberg and Srholec, 2008).

The level of *market conditions* is another factor that influences national innovation capability. It reflects the availability of credit and investment funds, and the intensity of competition in local markets that are essential for businesses to innovate (Filippetti and Archibugi, 2011). A robust financial system plays a crucial role in innovation processes by providing firms with required resources (O'Sullivan, 2005). The robustness of a financial system can be captured by the amount of credit (to the private sector) explaining the degree to which collateral and bankruptcy laws facilitate lending by protecting the rights of borrowers and lenders, along with the rules and practices affecting the scope and accessibility of credit information (O'Sullivan, 2005). Investment funds can also drive innovative activities and create highly skilled jobs in emerging markets where there are significant growth opportunities (Fagerberg and Srholec, 2008). Intense competition is another important driver of innovation from the realm of market conditions. It increases competitiveness and drive firms to innovate in order to achieve a competitive advantage on the market (Furman et al., 2002).

The final driver of national innovation capability captures the level of *business conditions* related to knowledge workers, the quality of business clusters and networks, and the absorptive capacity of businesses (Furman et al., 2002). As the global economy has become more complex, achieving a competitive advantage requires human resources with high-level skills and abilities to foster innovation (Lundvall et al., 2002). Indeed, the employment of highly qualified workers and training of underqualified employees within a business strategy oriented towards R & D activities are important to accumulate knowledge and initiate learning processes necessary for innovativeness (Filippetti and Archibugi, 2011). Innovation linkages and partnerships between public, private and academic partners are other key drivers required to accelerate innovation through knowledge diffusion and transfer (Furman et al., 2002). Moreover, the development of knowledge absorption through the openness of a national system on international markets is crucial to learn from foreign advanced technological knowledge (Castellacci and Natera, 2013).

A country's innovation capability is the result of a learning process evolving over time and largely depends on how all five of these conditions interact (Lundvall et al., 2002; Nelson and Winter, 1982). This evolutionary process does not necessarily lead to one uniform configuration of conditions for innovation capability (Pustovrh and Jaklič, 2014). This means that there is no single path leading to innovation capability, but there are complementarities between conditions that influence innovation capability (Lundvall, 2007).

2.2. National innovation capability outcomes

It is important to note that the innovation capability outcomes developed here differ from the more narrowly defined "innovative capacity outcomes", for instance, in terms of the number of patents, as suggested by Furman et al. (2002) and Furman and Hayes (2004). The problem with assessing national innovation capability solely based on patents is that patents are usually granted for globally novel inventions. Minor innovations and adaptations, which arguably comprise the bulk of innovative activities, will not be counted by this approach because such innovations are not patentable (Fagerberg and Srholec, 2008). Thus, most of the innovative activities in developing countries would not be recognized by this approach (Fagerberg and Srholec, 2008).

To overcome this issue, in this research, national innovation capability outcomes include not only technical knowledge, such as patents and published scientific articles (Furman and Hayes, 2004; Furman et al., 2002; Pavittt, 1985), but also creative outputs, such as trademark applications, copyrights, cultural and creative services exports, and online creativity activities (Castellacci and Natera, 2013; GII, 2015; Khayyat and Lee, 2015).

2.3. A fuzzy set approach to understand national innovation capability

Numerous studies have used the innovation system perspective to understand the conditions leading to innovation capability outcomes (Furman et al., 2002). However, the above-mentioned mismatch between theory and methods has frustrated researchers' ability to fully grasp the systemic nature of innovation capability conditions (Fagerberg and Srholec, 2008). Although there have been some attempts to obtain such an understanding, the approaches used are limited to account for complex interactions (Furman et al., 2002; Furman and Hayes, 2004). Most of these studies use the "net-effects" approach to estimate the effects of "independent" conditions on outcomes (Ragin and Fiss, 2008). In the "net-effects" approach, estimates are based on the assumption that standing alone, each condition is capable of producing the probability of the outcome regardless of the values of other conditions—regardless of the varied contexts defined by these conditions (Ragin, 2006b). This is the purpose of "net-effects" approach—computing the non-overlapping contribution of each condition to explain variations in the outcome (Ragin, 2006b: 15). Ragin (2006b: 14-15) posits that "this way of conducting quantitative analysis is the default procedure in the social sciences today – one that researchers fall back on time and time again, often for lack of a clear alternative … The use of the net effects approach thus may create the appearance of theory adjudication in research where such adjudication may not be necessary or even possible".

The "net-effects" approach, while powerful and rigorous, is restrained by its own rigor because its strength is also its weakness (Ragin and Fiss, 2008). It is particularly disadvantaged in cases involving overlapping inequalities (Ragin, 2006b). Given these drawbacks, it is reasonable to explore an alternate approach, one with strengths that differ from the "net-effects" approach.

The fsQCA approach offers a pragmatic way to study cases (countries in this study) as configurations and to explore the connections between combinations of causally relevant conditions and outcomes (Ragin, 2006b). By studying combinations of conditions, it is possible to unravel the configurational conditions that enable innovation capability outcomes (Pustovrh and Jaklič, 2014).

The premise of fsQCA is that cases can be viewed in terms of combinations of causally relevant conditions (Ragin and Fiss, 2008). It relies on case comparisons, set-theoretic analysis of set-subset relationships, and the application of Boolean algebra to identify combinations that systematically discriminate members of the set that exhibit various levels of outcomes (innovation capability outcomes in this study) (Ragin, 2000). With this focus on combinations of causal conditions, fsQCA is uniquely suited to seizing complex complementarities among conditions, as is the case in our framework of innovation capability conditions.

3. Data source and methodology

3.1. Sample

For our analysis, we need a data set that is comprehensive with respect to innovation indicators, time and country coverage. Typically, most developed market economies figure prominently among those with good coverage, whereas developing countries lack data on many potentially useful indicators (Fagerberg and Srholec, 2008). The Global Innovation Index (GII)[1] provides a rich database of detailed metrics for 141 economies around the world (representing 95.1% of the world's population and 98.6% of global GDP) and uses 79 innovation indicators to identify and analyze global innovation trends (GII, 2015). Launched by INSEAD in 2007, the GII is primarily concerned with improving the journey towards a better way not only to measure and understand innovation but also to identify targeted policies, good practices, and other levers that foster innovation capability (GII, 2015: 41).

The GII rests on innovation input and output sub-indexes (Appendix

[1] See https://www.globalinnovationindex.org/content/page/GII-Home/.

1). The sub-indexes have constituents, which this study calls conditions. Each condition is divided into three sub-conditions, each of which is composed of two to five individual indicators. There are five conditions of innovation capability: (1) institutions, (2) human capital and research, (3) infrastructure, (4) market conditions, and (5) business conditions. The Innovation Output Sub-Index provides information about outputs capturing innovative capability outcomes. There are two output dimensions: (6) knowledge and technology outputs and (7) creative outputs.

Indicators fall within three categories[2]: (1) quantitative data (drawn from a variety of public and private sources, such as United Nations agencies), (2) qualitative data (drawn from the World Economic Forum's Executive Opinion Survey), and (3) composite indicators data (calculated as the weighted average of each sub-condition's individual indicators).

All of the indicators were normalized into the (0 − 100) range, with higher scores representing better outcomes. Normalization was performed according to the min-max method.[3]

Based on an initial screening of GII data from 141 countries, we limited our sample to 133 countries and 74 indicators for the period between 2012 and 2015. A larger sample and a longer time period would clearly be desirable, but the unavailability of many indicators made it difficult. To limit the influence of shocks occurring in specific years, we computed the indicators as 4-year averages for the time period between 2012 and 2015.[4] Table 1 summarizes the main indicators' average scores per income group for the sample of 133 economies that we classified according to the World Bank classifications.[5]

3.2. Data transformation and calibration

Analysis with fsQCA requires variables to be transformed into sets that are calibrated according to three substantive thresholds (Ragin, 2008: 30): full membership (1.0), full non-membership (0.0), and the crossover point (0.5), "the point of maximum ambiguity (*fuzziness*) in the assessment of whether a case is more in or out of a set". The crossover point qualitatively anchors the fuzzy set's midpoint between full membership and full non-membership (Ragin, 2000: 158). Full membership and full non-membership are understood as qualitative states that are not arbitrary (*e.g.*, the highest and lowest observed scores) (Ragin, 2006a). Thus, the calibration of membership in a fuzzy set involves both quantitative and qualitative assessments and must be grounded in theoretical and substantive knowledge (Ragin, 2000).

Following this approach, we calibrated our primary dependent variable (innovation capability outcomes) by "benchmarking" it to the overall innovation output sub-index provided by GII (2015) instead of using only a sample-dependent anchor, such as the mean in the sample. The mean of the global innovation output sub-index in 2015 was set at 30.68 (see GII, 2015: 30), which is close to the median of our sample. We then created two fuzzy set measures of above-average innovation capability outcomes: the first, membership in the set of countries with "*high innovation capability*", was coded as 0 if a country showed an average or below-average innovation output sub-index (≤ 30.68; *i.e.*, about the 50th percentile) and as 1 if the country showed an above-average innovation output index (> 30.68). The crossover point was set at 30.68. The second, membership in the set of countries with "*very high innovation capability*", was again coded as 0 for an average or below-average innovation output sub-index (≤ 30.68; *i.e.*, about the 50th percentile) and as 1 if the country showed a very high innovation capability (innovation output sub-index ≥ 39.87; *i.e.*, about the 75th percentile or higher). As the crossover point, we chose the halfway mark of 35.27.

Finally, we assessed our independent variables using the five innovation input conditions (institutions, human capital and research, infrastructure, market and business conditions). Drawing on three scale values (25th, 50th and 75th percentiles), we created a measure of membership in the set of countries with *high innovation capability conditions*, coding membership as fully out of the set if a country showed input values of the 25th percentile or below and fully in the set if a country showed input values of the 75th percentile or higher. The crossover point was set at the medium (*i.e.*, the 50th percentile).

Given the three qualitative anchors (full membership, full non membership, and crossover point), one can transform raw scores into set measures using the direct method of calibration described by Ragin (2008). The calibration method allows the rescaling of an interval variable using the crossover point as an anchor from which deviation scores are calculated, taking the values of full membership and full non-membership as the upper and lower bounds.[6] The rescaled measures range from 0 to 1 and the calibrated scores are tied to the thresholds of full membership (fuzzy score = 0.95), the crossover point (fuzzy score = 0.50), and full non-membership (fuzzy score = 0.05). In the current version of fsQCA software, the calibration is automated and easily executed once the three thresholds are defined.

Table 2 summarizes our uncalibrated data before its transformation into sets and after its calibration using the fsQCA approach.

3.3. Data analysis

To identify configurational conditions, the fsQCA approach proceeds in three main steps (Fiss, 2011). *First*, after transforming data into sets, the process creates a data matrix called a "truth table" with 2^k rows, where k is the number of causal conditions ($2^5 = 32$ rows in this study).

Second, two conditions help reduce the number of rows: (1) the acceptable consistency level for the solution, which measures the degree to which membership in causal conditions is a subset of the outcome (Ragin, 2006a), and (2) the minimum number of cases required for a solution to be considered. In this study, we set the lowest acceptable consistency for the solution at (≥ 0.80), which is higher than the minimum recommended threshold of 0.75 (Ragin, 2008). At this consistency level, 42 cases fell into configurations exceeding the minimum solution frequency set at three. Of these cases, 27 exceeded the minimum consistency threshold of 0.80 for "*high innovation capability*" and "*very high innovation capability*".

Third, an algorithm based on Boolean algebra logically reduces the truth table rows to simplified combinations. The truth table algorithm provides parsimonious, intermediate, and complex solutions based on both easy and difficult counterfactuals.[7] A parsimonious solution includes all of the simplifying assumptions regardless of whether they are based on easy or difficult counterfactuals, whereas an intermediate

[2] For more details see GII (2015).

[3] The following formula was applied: Goods: $\left[\frac{\text{economy value} - \min}{\max - \min} {}^{*}100\right]$ and Bads: $\left[\frac{\max - \text{economy value}}{\max - \min} {}^{*}100\right]$.

[4] We make use of panel analysis data (rather than time series data) to examine changes and differences in variables between countries.

[5] Available at: http://data.worldbank.org/.

[6] An intermediate step of the direct method of calibration involves the transformation of these deviation scores into the metric of log odds, which is advantageous because this metric is centered at 0 and has no upper or lower bound (Fiss, 2011). For a detailed description of the calibration procedure, see Ragin (2008: 86-94). One issue related to transforming data into fuzzy sets is the difficulty of analyzing cases with scores of exactly 0.5. Ragin (2008) recommends avoiding the use of a precise 0.5 membership score by adding a constant of 0.001 to the causal conditions below full membership scores of 1. Adding this constant to all conditions does not affect the results, but does assure that no cases are dropped from the fuzzy set analyses (Fiss, 2011).

[7] Easy counterfactuals refer to situations in which a redundant condition can be removed from causal conditions—based on substantive knowledge—without affecting the outcome. In contrast, difficult counterfactuals refer to situations in which a redundant condition cannot be dropped from causal conditions without any theoretical and substantive knowledge (Ragin, 2008; Fiss, 2011).

Table 1
Sample demographics of innovation capability conditions and outcomes indicators.

Indicators	Average scores by income group (0–100) (n = 133 economies)				Mean (2012–2015)
	High income (2012–2015)	Upper-middle income (2012–2015)	Lower-middle income (2012–2015)	Low income (2012–2015)	
Innovation capability conditions	56.33	40.38	33.56	31.02	40.32
Institutions	79.27	57.33	48.25	48.03	58.22
Human capital and research	48.63	31.38	22.62	16.87	29.88
Infrastructure	51.02	35.22	26.94	21.70	33.72
Market conditions	57.19	44.44	40.94	39.34	45.48
Business conditions	45.56	33.55	29.04	29.16	34.34
Innovation capability outcomes	43.07	28.92	25.18	21.26	29.63
Knowledge and technology outputs	39.15	25.90	22.68	20.47	27.05
Creative outputs	46.98	32.12	27.67	22.04	32.20

Table 2
Uncalibrated and calibrated data statistics.

Variables	Statistics									
	Min		25th percentile		50th percentile		75th percentile		Max	
	Un-calib. data	Calib. data	Un-calib. data	Calib. data	Un-calib. data	Calib. data	Un-calib. data	Calib. data	Un-calib. data	Calib. data
Institutions	18.73	0	48.18	0.05	59.80	0.50	74.09	0.95	94.80	1
Human capital and research	8.43	0	20.67	0.05	30.80	0.50	42.99	0.95	66.75	1
Infrastructure	13.68	0	26.11	0.05	35.38	0.50	46.32	0.95	65.18	1
Market conditions	24.93	0	39.07	0.05	44.83	0.50	53.33	0.95	83.20	1
Business conditions	16.10	0	28.82	0.05	33.68	0.50	42.97	0.95	68.98	1
High innov. capability	8.38	0	23.20	0.05	30.68	0.51	39.87	0.95	66.73	1
Very high innov. capability	8.38	0	30.68	0.05	35.27	0.54	39.87	0.95	66.73	1

solution includes only those simplifying assumptions based on easy counterfactuals. A complex solution includes neither easy nor difficult counterfactuals; however, this solution is usually unnecessary because it provides little insight (Fiss, 2011). In this study, we focus our interpretation on the causal conditions that are part of the intermediate solution, as recommended by Ragin (2008: 160-175).

4. Results

Table 3 presents descriptive statistics and correlations for all of the measures after calibration. All of the variables are highly and positively correlated.

It is obvious that the overlap between the components explains the high correlations between conditions. In conventional methods using the net-effects approach this overlap makes it difficult to tell which of the five institutional conditions is crucial for high levels of innovation capability outcomes (Ragin, 2006b). The fsQCA approach addresses issues related to cases involving overlap to determine combinations of conditions that are likely to associate with high levels of innovation capability (Woodside, 2013).

Table 3
Descriptive statistics and correlations after calibration.

	Mean	S.D.	1	2	3	4	5	6
1. Institutions	0.49	0.41						
2. Human capital and research	0.51	0.40	0.74**					
3. Infrastructure	0.50	0.41	0.80**	0.85**				
4. Market conditions	0.50	0.41	0.65**	0.60**	0.63**			
5. Business conditions	0.49	0.40	0.66**	0.73**	0.73**	0.60**		
6. High innov. Outcomes	0.47	0.40	0.76**	0.82**	0.84**	0.68**	0.75**	
7. Very high innov. Outcomes	0.33	0.43	0.73**	0.77**	0.77**	0.67**	0.73**	0.91**

** Correlation significance at 0.01.

4.1. Configurations for high national innovation capability outcomes

We started our analysis by testing whether any of the five conditions can be considered as necessary for high innovation capability. Conventionally, a condition is "necessary" if its consistency score exceeds the threshold of 0.90 (Schneider et al., 2010). Table 4 shows no condition that exceeds the threshold of 0.90.

We then conducted a fuzzy set analysis for sufficient conditions leading to high innovation capability. The results are shown in Table 5.

The table shows that the solution (high innovation capability) results in two configurations exhibiting a high overall solution consistency of 0.96 (> 0.80 threshold). This means that the causal conditions present in the two configurations are highly consistent subsets of the solution. The overall solution coverage indicates that these causal conditions account for 74% of membership in the solution.

The presence of two configurations points to a situation of "*equifinality*" for which the two combinations of conditions (treated as substitutable) lead to high innovation capability. Each configuration is a combination of sufficient conditions. It is important to note that no

Table 4
Analysis of necessary conditions for high innovation capability.

Conditions	Consistency
Institutions	0.84
Human capital and research	0.88
Infrastructure	0.89
Market conditions	0.81
Business conditions	0.84

Table 5
Configurations for achieving high innovation capability outcomes.

Configurations	Intermediate solution[a]	
	1	2
Institutions	●	
Human capital and research	●	●
Infrastructure	●	●
Market conditions		●
Business conditions	●	●
Raw coverage	0.70	0.68
Unique coverage	0.05	0.03
Consistency	0.96	0.97
Overall solution consistency	0.96	
Overall solution coverage	0.74	

Black circles ("●") indicate the presence of a condition, and blank spaces indicate "don't care" (Ragin and Fiss, 2008).

[a] The intermediate solution (high innovation capability outcomes) = (institutions ∗ human capital and research ∗ infrastructure ∗ market sophistication ∗ business sophistication) + (human capital and research ∗ infrastructure ∗ market sophistication ∗ business sophistication).

condition alone is sufficient to account for high innovation capability.

Configuration 1 shows that the presence of formal institutional frameworks within national innovation systems combining appropriate human capital and research systems, advanced infrastructures, and conductive business conditions is sufficient for achieving high innovation capability. High innovation capability was achieved regardless of whether market conditions are supportive for investments and trade within national systems, as indicated by the blank space that signals a "don't care" situation.

Configuration 2 shows that appropriate human capital and research systems in combination with advanced infrastructures, relevant market and business conditions are sufficient for leading to high innovation capability. In this configuration, high innovation capability was reached regardless of whether formal institutional frameworks are present or absent within national innovation systems (the "don't care" situation).

As shown in Appendix 2, the common countries belonging to the two configurations are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong (China), Japan, the Netherlands, New Zealand, Norway, Singapore, Sweden, Switzerland, and the United States. Countries such as Estonia, Luxembourg, and the United Kingdom are only present in configuration 1, and Israel and Korea are only present in configuration 2. All of these countries have high-income economies (Appendix 2).

We note that the two configurations can be considered empirically important. Empirical importance refers to the degree to which the outcome is covered by either particular causal conditions or a combination of conditions. Table 4 displays two scores—raw coverage and unique coverage—that assess empirical importance (Ragin, 2006a). Raw coverage measures the proportion of memberships in the outcome covered by causal conditions that are assumed to be present in a configuration; unique coverage measures the contribution proportion to the outcome of causal conditions present in a configuration that are not covered by other causal conditions present in the solution (Ragin, 2006a). In Table 5, the raw coverage values emphasize that the causal conditions present in configuration 1 account for 70% of membership in the outcome, whereas the causal conditions present in configuration 2 account for 68% of membership in the outcome. Unique contributions to the outcome of causal conditions that are solely present in each configuration are 5% in configuration 1 and 3% in configuration 2, which are considered to be significant contributions to the outcome (Schneider et al., 2010).

Finally, Table 5 indicates the existence of three possible necessary conditions for achieving high innovation capability that are shared across the two configurations, namely, human capital and research,

Table 6
Analysis of necessary conditions for very high innovation capability.

Conditions	Consistency
Institutions	0.93
Human capital and research	0.97
Infrastructure	0.96
Market soph.	0.91
Business soph.	0.94

infrastructure, and business conditions. Nevertheless, because no condition exceeded the consistency score threshold of 0.90 (Table 4), our results emphasize the existence of two combinations of sufficient but not necessary conditions leading to high innovation capability.

4.2. Configuration for very high national innovation capability outcomes

We first tested whether any of the causal conditions can be considered to be necessary for a very high innovation capability. As explained above, conventionally, a condition is called "necessary" if the consistency score exceeds the threshold of 0.90 (Schneider et al., 2010). Table 6 shows that all of the conditions achieved consistency scores exceeding 0.90 and can be considered to be necessary conditions for very high innovation capability.

We then conducted a fuzzy set analysis for sufficient conditions leading to very high innovation capability. The results are shown in Table 7.

The results indicate the existence of one combination of necessary conditions leading to very high innovation capability. Indeed, formal institutional frameworks within national systems combining the presence of appropriate human capital and research systems, relevant market and business conditions are necessary to enable a very high innovation capability. This configuration exhibits a high overall consistency of 0.86 (> 0.80 threshold) and highlights that memberships in the outcome are highly consistent subsets of causal conditions. In terms of overall coverage, the causal conditions account for 83% of membership in the solution (very high innovation capability). The countries that are explained by causal conditions leading to very high innovation capability (Appendix 2) include the top ten most-innovative economies (GII, 2015: 30): Switzerland, the United Kingdom, Sweden, the Netherlands, the United States, Finland, Singapore, Ireland, Luxembourg, and Denmark.

4.3. Analysis of the robustness of results

As recommended by Ragin (2006a), to test the robustness of our results, we repeated the fsQCA procedure with small changes to the data calibration process and small changes in the raw consistency value thresholds. Both methods showed that our results were relatively robust. In most cases, using slight different thresholds yielded relatively similar fuzzy scores.

Furthermore, we conducted the PRI test (proportion reduction in consistency) to assess the influence of irrelevant cases (countries that

Table 7
Configuration for achieving very high innovation capability outcomes.

Configurations	Intermediate solution
Institutions	●
Human capital and research	●
Infrastructure	●
Market soph.	●
Business soph.	●
Overall solution consistency	0.86
Overall solution coverage	0.83

Black circles ("●") indicate the presence of a condition (Ragin and Fiss, 2008).

Table 8
The PRI-test.

Solution	Presence of the outcome (Y) PRI consistency	Absence of the outcome (∼Y) PRI consistency
High innovation capability (Y)	0.97	0.03
Configuration 1	0.95	0.03
Configuration 2	0.96	0.03
Very high innovation capability (Y)	0.84	0.16

are not part of causal conditions) on the consistency and coverage of necessary and sufficient conditions (Schneider and Wagemann, 2012). Although there are no established thresholds, based on the very conservative nature of the measure and the example provided by Schneider and Wagemann (2012: 243), a tentative assumption is that a PRI value of at least 0.6 should be considered to be sufficiently high. A configuration should be considered to be a jointly sufficient condition for the outcome (Y) if it reaches the 0.6 threshold or higher while showing a considerable lower PRI score for the absence of the outcome (∼Y). The results are shown in Table 8.

The PRI test shows the unproblematic nature of each solution and the reliability of our findings because PRI is very high for the presence of the outcome (exceeding 0.6 threshold) and very low for its absence.

5. Discussion and conclusion

As a contribution to bridge the gap between theory and methods due to the fragmentation in the literature on innovation capability, we propose an integrating framework bringing together the national innovation system perspective and the qualitative comparative analysis approach to determine the configurations of conditions leading to high levels of national innovation capability. Unlike previous studies (Furman and Hayes, 2004; Furman et al., 2002), we do not assume that one singular path leads to high levels of innovation capability. Instead, our results identify three configurations of conditions. Two configurations highlight that some conditions can be *sufficient* for a country to show a *high* innovation capability, while a third configuration posits that all conditions are *necessary* for a country to reach a *very high* innovation capability.

The *first* configuration shows that building appropriate institutions, developing human capital and research, improving infrastructures, and facilitating business conditions are *sufficient* for a country to reach a *high* innovation capability, regardless of whether its market conditions are met within a national system (*i.e.*, market conditions are not *necessary* conditions). Three countries, which are seemingly very different, are representative of this configuration such as the United Kingdom (UK), Luxembourg, and Estonia.

For instance, the innovation capability of the UK, being the 2nd strongest innovative country in the world (GII, 2015), is not necessarily attributed to its stabilized market conditions that have known many regulations but mostly to its economic freedom over the past five years (Miller and Kim, 2016). With an efficient legal system that enforces the rule of law and guarantees security of intellectual property rights, the UK benefits from open-market policies. The relatively efficient regulatory environment encourages entrepreneurship with no minimum capital required and with less than a week to set up a business (Miller and Kim, 2016: 440). The quality of its infrastructure and a well-established R & D system leaves room to improve productivity and encourage foreign and domestic investors (OECD, 2015). Similarly, the Luxembourg is in the top ten innovative countries in the world (9th according to GII, 2015) and its capability is not necessarily attributed to its stabilized market conditions where the financial system has known many regulations but mostly to its well-functioning institutions (Miller and Kim, 2016). The legal framework remains among the world's best, providing effective protection of property rights (OECD, 2010). The efficient regulatory system and well-developed infrastructure support entrepreneurship and business creation takes place without much bureaucratic interference (Miller and Kim, 2016: 289). Another example is Estonia. Despite its undeveloped market conditions due to its underdeveloped banking system, the country has considerably improved its innovation capability to achieve a position in the top 25 of innovative countries in the world (23rd according to GII, 2015). The Estonian economy benefits from the government's strong commitment to economic freedom (Paasi, 2000). The rule of law is enforced by an independent judicial system. With an effectively institutionalized legal system, regulatory efficiency, and dynamic commitment with global commerce, the Estonian economy supports entrepreneurship activities (Miller and Kim, 2016). The quality of infrastructure and a well-established R & D system have gradually favored direct foreign investment, which enhanced the diffusion of technological knowledge and skills to local firms (Paasi, 2000).

The *second* configuration shows that developing human capital and research systems, improving infrastructures, and facilitating business and market conditions can also be *sufficient* for a country to reach a *high* innovation capability, regardless of whether the institutional environment is supportive for business. South Korea and Israel are two countries, again seemingly different, but representative of this configuration.

For instance, South Korea has gradually improved its innovative capability ranking over the past years to achieve position of 14th in 2015 (GII, 2015). Its capability is not necessarily due to its political stability and regulatory environment, but mostly to uninterrupted progress in economic freedom (OECD, 2014). South Korea's dynamic private sector, nurtured by a well-developed infrastructure, well-educated, and hard-working labor force, continues to capitalize on the country's openness to global trade and investment (Miller and Kim, 2016). In Israel, despite its political instability[8] and its constraining business environment to start a business, the country has considerably improved its innovation capability to achieve position in the top 25 innovative countries in the world (22rd ranking) and to be the innovation leader in the Middle-East region (GII, 2015). According to OECD (2014) the innovation capability of Israel is mainly due to its high R & D intensity with gross domestic R & D expenditures in excess of 4% of GDP while the OECD average stands at 2.3%.

It is important to note that the two configurations point to a situation of "*equifinality*", where the combination of conditions is *sufficient* to reach the same outcome (Fiss, 2007), *i.e.*, a *high* innovation capability.

The *third* configuration shows that the combination of the five conditions is *necessary* for a country to reach a *very high* innovation capability. This configuration involves obviously the top ten most-innovative economies, such as Switzerland, the United Kingdom, Sweden, the Netherlands, the United States, Finland, Singapore, Ireland, Luxembourg, and Denmark (GII, 2015: 30). Economic institutions[9] are necessary conditions of a *very high* innovation capability and play crucial roles in influencing investments in physical and human capital and technology (OECD, 2014). This supports the idea that economic institutions are the major source of cross-country differences in innovation superiority and economic growth (Acemoglu et al., 2005).

Our fsQCA approach holds considerable promise for closing the gap between theory and method in the literature and enables a detailed analysis of the *sufficient* and *necessary* conditions of *high* and *very high* innovation capability. By combining a theoretical approach (a systemic

[8] http://www.theglobaleconomy.com/rankings/wb_political_stability/#Israel

[9] Economic institutions refer to structures that are part of a national system including institutions, infrastructures, human capital and research, business and market conditions (Acemoglu et al., 2005).

view using the national innovation system perspective) with a novel methodology (a set-theoretic fsQCA approach), our study also overcomes the mismatch between theory and methods (Fagerberg and Srholec, 2008), thus representing a step towards building a better understanding of the crucial role of configurational conditions in studying innovation capability.

Furthermore, our study constitutes an important contribution for evaluating the methodology background of the Global Innovation Index (GII) and previous studies on innovation capability. For instance, according to the GII (2015), if a country aims to achieve a *high* innovation capability, it should increase all of its individual conditions. Instead, our fsQCA analysis shows that countries such as Estonia, the republic of Korea, and Israel used distinct combinations of conditions to reach the same outcome — a *high* innovation capability — even if some conditions are restricted. Thus, a *high* level of innovation capability can be reached through the mutual interactions and complementarities between several and not necessarily all conditions (Lundvall, 2007). Similarly, according to the GII (2015), restricted individual conditions can impede the achievement of a *high* level of innovation capability even if countries continue to improve other innovation capability conditions. Our study shows that limited market conditions did not impede a country such as Estonia to reach a high level of innovation capability because the combination of complementary conditions such as national institutions, human capital and research systems, infrastructures, and business conditions is *sufficient* to achieve this result (O'Sullivan, 2005). Of course, the combination of all five conditions is *necessary* for a country to reach a *very high* innovation capability.

This study has some limitations that should be overcome in future research. Its limited sample size—we only have data for approximately two-thirds of the world's countries—did not permit further statistical testing for the fuzzy set analyses. Although fsQCA generally produces significance tests to examine, for instance, the consistency of a solution that includes viable configurations, in our case it resulted in too few countries to permit statistical testing for each configuration. This limits our ability to draw reliable conclusions from our data set and calls for further studies to verify our results.

Another limitation is the short period of our analysis. In the present research we make use of panel data of 133 countries and 74 indicators for the period between 2012 and 2015. A longer time period would clearly be desirable, but the unavailability of many indicators made it difficult even if we would select less countries. A longer time period would clearly be desirable, but the unavailability of many indicators made it difficult. For the time being we are inclined to stress the 'proof of approach' idea: if even using a short time period we are able to discriminate between three configurations it makes sense to invest in longer time series.

Moreover, our investigation does not focus on evaluating particular and individual innovation capability conditions. This was not its purpose: our prime goal was to determine whether configurational conditions lead to high levels of innovation capability. However, such an evaluation would be useful to better understand various complex processes that lead to high levels of innovation capability. The OECD database, with its information on national innovation policies (OECD, 1997, 2014), represents a perfect laboratory for innovation capability research based on our fuzzy set approach.

Despite these limitations, our integrating framework and fsQCA approach hold considerable promise because it closes an important gap in the literature and enables a detailed analysis of the configurational conditions that lead to high levels of innovation capability.

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Appendix 1. Structure of the Global Innovation Index.

Innovation input sub-indexes	Innovation output sub-indexes
1st pillar: Institutions	6th pillar: Knowledge and technology outputs
A. Political environment	A. Knowledge creation
1.01 Political stability	6.52 Domestic resident patent app/bn PPP$ GDP
1.02 Government effectiveness	6.53 PCT resident patent app/bn PPP$ GDP
B. Regulatory environment	6.54 Domestic res utility model app/bn PPP$ GDP
1.03 Regulatory quality	6.55 Scientific & technical articles/bn PPP$ GDP
1.04 Rule of law	B. Knowledge impact
1.05 Cost of redundancy dismissal, salary weeks	6.56 Growth rate of PPP$ GDP/worker, %
C. Business environment	6.57 New businesses/th pop. 15–64
1.06 Ease of starting a business	6.58 Computer software spending, % GDP
1.07 Ease of resolving insolvency	6.59 ISO 9001 quality certificates/bn PPP$ GDP
1.08 Ease of paying taxes	C. Knowledge diffusion
2nd pillar: Human capital and research	6.60 Royalty & license fees receipts, % total trade
A. Education	6.61 High-tech exports less re-exports, % total trade
2.09 Current expenditure on education,% GNI	6.62 Comm., comp. & info. Services exp., % tot. Trade
2.10 Public expenditure on education/pupil, % GDP/cap	6.63 FDI net outflows, % GDP
2.11 School life expectancy, years	7th pillar: Creative outputs
2.12 PISA scales in reading, maths, & science	A. Intangible assets
2.13 Pupil-teacher ratio secondary	7.64 Domestic res trademark app/bn PPP$ GDP
B. Tertiary education	7.65 Madrid trademark applications/bn PPP$ GDP
2.14 Tertiary enrolment, % gross	7.66 ICTs & business model creation
2.15 Graduates in science & engineering, %	7.67 ICTs & organizational models creation
2.16 Tertiary inbound mobility, %	B. Creative goods and services
C. Research and development (R & D)	7.68 Cultural & creative services exp., % total trade
2.17 Researchers, FTE/mn pop	7.69 National feature films/mn pop. 15–69
2.18 Gross expenditure on R & D, % GDP	7.70 Creative goods exports, % total trade
2.19 Quality of scientific research institutions	C. Online creativity
3rd pillar: Infrastructure	7.71 Generic TLDs/th pop. 15–69

A. Information and communication technologies (ICTs)
3.20 ICT access
3.21 ICT use
3.22 Government's online service
3.23 *E*-participation
B. General infrastructure
3.24 Electricity output, kWh/cap
3.25 Quality of trade & transport infrastructure
3.26 Gross capital formation, % GDP
C. Ecological sustainability
3.27 GDP/unit of energy use, 2000 PPP$/kg oil eq.
3.28 Environmental performance
3.29 ISO 14001 certificates/bn PPP$ GDP
4th pillar: Market conditions
A. Credit
4.30 Ease of getting credit
4.31 Domestic credit to private sector, % GDP
4.32 Microfinance gross loans, % GDP
B. Investment
4.33 Ease of protecting investors
4.34 Market capitalization, % GDP
4.35 Total value of stocks traded, % GDP
4.36 Venture capital deals/tr PPP$ GDP
C. Trade and competition
4.37 Applied tariff rate, weighted mean, %
4.38 Intensity of local competition
5th pillar: Business conditions
A. Knowledge workers
5.39 Knowledge-intensive employment, %
5.40 Firms offering formal training, % firms
5.41 R & D performed by business, %
5.42 R & D financed by business
B. Innovation linkages
5.43 University/industry research collaboration
5.44 State of cluster development
5.45 R & D financed by abroad
5.46 JV-strategic alliance deals/tr PPP$ GDP
5.47 Patent families filed in 3 + offices/bn PPP$ GDP
C. Knowledge absorption
5.48 Royalty & license fees payments, % total trade
5.49 High-tech imports less re-imports, % tot. Trade
5.50 Comm., comp. & info services imp., % tot. Trade
5.51 FDI net inflows, % GDP
7.72 Country-code TLDs/th pop. 15–69
7.73 Wikipedia monthly edits/mn pop. 15–69
7.74 Video uploads on YouTube/pop. 15–69

Source: The Global Innovation Index Reports (2012–2015).

Appendix 2. Cases with memberships > 0.5 in causal conditions and the outcome[a].

Configurations	Income level	High innovation capability outcomes		Very high innovation capability outcomes
Country		1	2	
Australia	HI	(0.99, 0.98)	(0.99, 0.98)	(0.99, 0.99)
Austria	HI	(0.99, 0.99)	(0.98, 0.99)	(0.98, 1)
Belgium	HI	(0.97, 0.99)	(0.97, 0.99)	(0.99, 1)
Canada	HI	(0.99, 1)	(0.99, 1)	(0.99, 1)
Denmark	HI	(0.99, 1)	(0.99, 1)	(0.99, 1)
Estonia	HI	(0.98, 1)		
Finland	HI	(1, 1)	(1, 1)	(1, 1)
France	HI	(0.99, 0.99)	(0.99, 0.99)	(0.99, 1)
Germany	HI	(0.99, 1)	(0.99, 1)	(0.99, 1)
Hong Kong (China)	HI	(0.99, 0.99)	(0.99, 0.99)	(0.99, 1)
Ireland	HI			(1, 1)
Israel	HI		(0.99, 1)	
Japan	HI	(0.99, 0.98)	(0.99, 0.98)	(0.99, 0.99)
Korea	HI		(0.98, 1)	

Luxembourg	HI	(0.99, 1)		(0.97, 1)
Netherlands	HI	(1, 1)	(0.99, 1)	(0.99, 1)
New Zealand	HI	(0.98, 1)	(0.98, 1)	(0.98, 1)
Norway	HI	(0.98, 1)	(0.98, 1)	(0.98, 1)
Singapore	HI	(1, 1)	(1, 1)	(1, 1)
Sweden	HI	(1, 1)	(1, 1)	(1, 1)
Switzerland	HI	(1, 1)	(1, 1)	(1, 1)
United Kingdom	HI	(1,1)		(1, 1)
United States	HI	(1, 1)	(1, 1)	(1, 1)

[a] Fuzzy set coordinates (X, Y) with X = membership in the causal condition and Y = membership in the outcome; HI = High Income.

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