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Impact of GEM's Business Environment Factors On Business Innovation: Panel Data Analysis For 100 Economies

Kateryna SAVOSH

Instituto Politécnico de Bragança(IPB), Bragança, Portugal
katesavosh5@gmail.com

Alcina NUNES

Unidade de Investigação em Gestão Aplicada (UNIAG), Instituto Politécnico de Bragança (IPB), Bragança, Portugal
alcina@ipb.pt

Abstract

Innovation policy is a significant element of sustainable development by finding new solutions in response to existing problems. A key to a successful increase in innovation is to identify and understand what are the main business environment factors that impact on business innovation. So, the objective of this research work is to identify and quantify which business environment elements impact on business innovation activity, in the last ten years. Such goal will be reached using fixed and random panel data methods applied to data provided by the Global Entrepreneurship Monitor (GEM). This study concludes that worldwide factors as financing, government support, lower taxes and bureaucracy, entrepreneurship education in primary and secondary levels and the country's economy openness present an important positive impact on innovation.

Keywords: Innovation, Global Entrepreneurship Monitor (GEM), business environment factors, panel data methodology.

Introduction

Nowadays, the economic development cannot be understood without the contribution of innovation. According to seminal work of Drucker (2006), innovation was considered as an idea converted into a business in order to create a value that would raise both the economic cost as well as the satisfaction of the customers. However, trends and demand are changing rapidly, requiring new ideas as well as new solutions for emerging problems. Indeed, innovation is consider vital for the organizations as well as the fundamental component of the economic progress (Drucker, 2006; Freeman & Soete, 2017). The level of innovation activity in an organization, either public or private, forecasts the scope of its development, growth, improvement, and new experience. Moreover, and in particular, companies benefit from successfully implemented innovations by the creation of new markets and needs, improvement of the product, process or organizational structure, and establishment of a new source of supply. So, the study of the innovation activity foresees observing the influencing environment of innovation which includes drivers and barriers. Therefore, there is the need to identify the key impacts for innovation activity in the companies (namely in the ones that have a small and medium-size), and later accordingly, strengthen or reduce them. Studying factors which influence innovation allows to promote innovation activity in organizations, in general, and business companies in particular.

Considering the abovementioned, the current paper intends to bring some contribution as well as increase value of the GEM-based publications regarding the topic of innovation activity as, according to Bergmann, Mueller, and Schrettle (2014), there is a lack of GEM-based works covering the topic of innovation. The purpose of the study is to inspect the impact on innovation activity all around the world during the period of 2011-2017 (period for which comparable statistical information is available). The mission of the current work is to find out which business environmental factors - inside and outside of the companies - are presenting an effect on the innovation made and/or introduced by companies.

Moreover, it is aimed to measure in which degree such factors influence the innovation made and/or introduced.

Data about the innovation activity and business factors in the organizations all over the world during the period of time from 2011 to 2017 years, which will be used and applied in this work was exported from Global Entrepreneurship Monitor (GEM). GEM is international collaborative study on entrepreneurship, which provides a primary data based measurement and assessment tool regarding all forms of entrepreneurship as well as other socio-economic renewal derivatives (GEM, 2018a). A consortium of national teams which is building a unique data set and direct their social survey at individuals who are starting and doing the business, in order to measure entrepreneurial activity in different phases of the businesses existence (Bosma, Jones, Autio, & Levie, 2008). Panel data econometric methods have been selected for the current study since it includes both individual (in this countries) and time dimensions.

The paper is divided in 5 section. This one makes the introduction to the topic while the next one presents some important facts related with innovation and the factors that may influence it and the barriers that it also may face. Section 3 presents the methodology followed in the research work and which allows to obtain the results presented in section 4. Section 5 concludes.

Innovation barriers and factors that influence it

Implementation of innovation in the companies brings significant changes (Baldwin & Gellatly, 2003; Bessant & Tidd, 2011; European Union & Eurostat, 2017). For example, Brown and Ulijn (2004) believe that, basically, innovation is all about the ability to manage knowledge creatively in response to market demand as well as other social needs. They argue that firstly, innovation depends on effective interaction between the science and the business sector. Secondly, some factors like competitive markets and technological change may force firms to innovate more rapidly. By innovating, the organization is able to improve its overall performance as well as increasing demand or reducing costs. In addition, new organisational practices can help to improve the firm's ability to gain and create new knowledge that can be used in the elaboration of other innovations. Organization need to evaluate the communication between stakeholders, knowledge flows and other aspects of the innovation process in order to develop policies that support innovation (OECD & Statistical Office of the European Communities, 2005). Recently, Rauter, Globocnik, Perl-Vorbach and Baumgartner (2018) show evidence that involving stakeholders such as universities, customers and non-governmental organization (NGO) into the process of open innovation activity could be beneficial for the companies.

The process is not an easy one. Organizations engaged in innovation activity are often facing many problems and barriers. The obstacles which hamper the implementation of innovation could originate from both external and internal environments (Joachim, Spieth & Heidenreich, 2018). Pikkemaat, Peters, and Chan (2018), mention the following list of problems and barriers causing the failure of innovation: (1) the unprofessionalism of entrepreneurs, (2) the attitude of locals toward innovation, (3) policies, (4) bureaucracy, (5) environmental issues and natural protection, (6) the lack of willingness to cooperate, (7) complication of project application procedures, among others. When the focus are the small and medium-sized enterprises (SMEs), the authors refer the lack of knowledge, willingness to cooperate and the management of human resources and projects. Previously Baldwin and Gellatly (2003), regarding the small and medium-sized enterprises (SMEs), mentioned: (1) lack of financing, (2) use of outmoded technology and (3) maintaining the favourable personnel.

Nonetheless, it is considered more significant to review the factors that influence innovation activity rather than problems, owing to the fact that problems that may arise are based on the impact factors. Katila and Shane (2005) mention the following environmental factors considered to have an effect on the innovation activity: (i) degree of competition, (ii) availability of financial resources, (iii) manufacturing intensity of the production process, and (iv) size of the market. Other authors (D'Este, Iammarino, Savona, & von Tunzelmann, 2012; Bayarçelik, Taşel, & Apak, 2014) consider, as well, financial obstacles important regarding the innovation activity of the companies. Furthermore, Law, Lee, and Singh (2018) observe the value of the financing issue in supporting innovating. The same authors pointed on that efficient financial allocation facilitates in funding research and development. Also Brown and Ulijn (2004) took into account the factors that influence organizations related to a country's specificity such as: (i) financial system and corporate governance, (ii) legal and regulatory

frameworks, (iii) level of education and skills, (iv) degree of personal mobility, (v) labour relations, and (vi) dominant management practices. Indeed, the role of government policies and support should be considered while considering innovation. According to Baldwin and Gellatly (2003), small and medium-sized companies acknowledge the importance of government programs which include training, industrial support and procurement. For example, a high level of taxes may reduce firms' innovation as it decreases firms' internal cash flows, which assumed to be a major source of innovation financing (Howell, 2016). Moreover, Francis and Bessant (2005) mention that the relationships between innovation and bureaucracy are assumed to be negative. More recently, Lundvall (2016) confirmed the great role of education of labour. To his mind, employees are the most considerable and dynamic resource in the innovation system. Hence, the improvement of education and training is one of the key components which contribute to promoting interaction between users and producers. Mihaela and Ţiţan (2014) also who believe that education greatly contributes to development and innovation. Other authors like Hametner, et al. (2018) admitted that public investment in R&D help to generate knowledge and talent. This may increase educational organizations and innovative companies need. Besides, higher public investment in R&D supports private investment in research and innovation, providing new jobs in business, raising demand for scientists and researchers in the labour market. Baldwin and Gellatly (2003) had before argued that R&D capability, as well as the intensity of investment in R&D, tend to be greater in successful organizations. Surprisingly, a recent study of Schmidt, Balestrin, Engelman, and Bohnenberger (2016) concludes that services and infrastructure are necessary, but not sufficient, in order to facilitate R&D processes. Findings confirmed a great role of the infrastructures as a resource in the efficient performance of the company as well as innovation activity Frenz and Lambert (2012). In addition, consumer preferences, as well as the market orientation, are indicated as important indicators for innovation (Bayarçelik et al., 2014). The study of D'Este et al. (2012) provides evidence that market barriers reflect the degree of difficulty on innovation. Based on the research of Anzola-Román, Bayona-Sáez, and García-Marco (2018) it can be assumed that the size and sector of the market are playing a specific role, relying on the type of technological innovation.

Research Methodology: Fixed and Random Panel Data

Considering the literature framework presented in the previous section, this paper intends to identify the business environment factors that impact on the innovation activity in small and medium enterprises all over the world during the last decade (2011 to 2017). Innovation is not measured directly by the Global Entrepreneurship Monitor (GEM), however, a proxy variable will be used. The percentage of the companies involved in total early-stage entrepreneurial activity (TEA) which consider that their product or service is new to at least some customers and that few/no businesses offer the same product. In addition, it is significant to research in which degree each factor has an impact on innovation. The evaluation of the business environment is made by experts of the Global Entrepreneurship Monitor (GEM) regarding factors that may have a strong impact on the innovation activity in the scope of a business. GEM is a platform which has many benefits due to the public use availability, annual release of the global report on the entrepreneurial activity as well the inclusion of national experts who systematically provide the assessments of national entrepreneurship, political and social features.

The research will include all countries around the world in which public available and comparable data do exist – those 100 countries will define the space dimension of the study. As time dimension the study will operate with the observation data on innovation activity of the companies from the period of time from 2011 to 2017. Moreover, the research work intends to bring some contribution as well as increase value of the GEM-based publications regarding the topic of innovation activity as, according to Bergmann, Mueller, and Schrettle (2014), there is a lack of GEM-based works covering the topic of innovation. As mentioned, the variable that will be explained presents the percentage of the companies involved in total early-stage entrepreneurial activity (TEA) which consider that their product or service is new to at least some customers and that few/no businesses offer the same product (GEM, 2018c). Table 1 presents and describes the dependent variable.

Table 1: Identification and description of the dependent variable

Variable	Description	Measurement unit
Innovation	Percentage of those involved in TEA who indicate that their product or service is new to at least some customers AND that few/no businesses offer the same product	percent, %

Source: Author's own elaboration based on the GEM (2018a)

The variables that will be used to explain the innovation activity in the companies are the ones that, according to experts, define the business environment of economies. These variables are the following: financing for entrepreneurs, governmental support and policies, taxes and bureaucracy, governmental programs, basic school entrepreneurial education and training, post-school entrepreneurial education and training, R&D transfer, commercial and professional infrastructure, internal market dynamics, internal market openness, physical and services infrastructure, cultural and social norms. The environment framework condition are measured in a 5 points Likert scale where 1 represents the lowest classification and 5 the highest classification. Table 2 presents and describes these independent variables

Table 2: Identification and description of the independent variables

Variables	Description	Measurement unit
Financing	Availability of financial resources such as equity and debt for small and medium enterprises (SMEs) including grants and subsidies.	5 points Likert scale, where 1 means the statement is completely false, according to the experts, and 5 means the statement is completely true
Governmental support and policies	The extent to which public policies support entrepreneurship - entrepreneurship as a relevant economic issue.	
Taxes and bureaucracy	The extent to which taxes or regulations are either size-neutral or encourage new and SMEs.	
Governmental programs	The presence and quality of programs directly assisting SMEs at national, regional, and municipal levels of government.	
Basic school entrepreneurial education and training	The extent to which training in creating or managing SMEs is incorporated within the education and training system at primary and secondary levels.	
Post school entrepreneurial education and training	The extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools, etc.	
R&D transfer	The extent to which national research and development will lead to new commercial opportunities and is available to SMEs.	
Commercial and professional infrastructure	The presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote SMEs.	
Internal market openness	Extent to which new firms are free to enter existing markets.	
Internal market dynamics	Level of change in markets from year to year.	
Physical and services infrastructure	Ease of access to physical resources such as communication, utilities, transportation, land or space at a price that does not discriminate against SMEs.	
Cultural and social norms	Extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income.	

Source: Author's own elaboration based on the GEM (2018a; 2018b)

Achieving the objective of this research work implies the use of a panel data econometric methodology to explain why companies innovate over time around the world regarding a set of explanatory factors. According to Longhi and Nandi (2015), panel data allows to take into consideration the individual unobserved heterogeneity. In the particular case of this research work, panel data gives the possibility to examine the differences between the economies in analysis, over time. It is possible to apply such econometric techniques as fixed effects (FE) and random effects (RE) (which choice will rely on the Hausman test. Panel data is multi-dimensional data that consists of measurement over a period of time.

Equation [1] for panel model regression explains the relationship between the dependent variable (Y) at time t and observation dimensions and the independent variable (X) at the same time and individual dimensions. In the equation, α is an intercept, β is a parameter which quantifies how much the independent variable (X) influences (explains) the dependent variable (Y) and e is an error (Pillai, 2016).

$$Y_{it} = \alpha_{it} + \beta_{it} X_{it} + e_{it} \quad [1]$$

Panel data may allow to identify individual (group) effects, time effects (or even both effects). For that, panel data are analysed using the fixed effect panel data and the random effects panel data, respectively. The fixed effects (FE) model observes if intercepts vary across groups (countries) or time period. The random effects (RE) model examines differences in the error variance components across countries or time period (Park, 2011). These differences are indicated as individual-specific heterogeneity or time-specific heterogeneity and they will be represented by the fixed parameters, thus the models are deemed to have fixed effect (Biørn, 2016).

According to Park (2011) the equations for the FE model (equation [2]) and the RE model (equation [3]) are the following:

$$Y_{it} = \alpha_i + \beta X'_{it} + e_{it} \quad [2]$$

$$Y_{it} = \alpha + \beta X'_{it} + (u_i + e_{it}) \quad [3]$$

Note, that u_i is a fixed or random effect specific to individual (country) or time period that is not included in the regression, and is assumed that errors are independent and identically distributed. In order to choose between the FE or the RE models, the Hausman test have to be conducted. Hausman test takes into account the existence of a statistically significant p-value that results from the test to accept (or not accept). Hausman test (which hypothesis are presented in equation [4]) assumes as the null hypothesis the RE estimates are efficient and consistent. The alternative hypothesis claims that RE estimates are inefficient and the results of the FE are the ones to be considered (Pillai, 2016).

$$\begin{cases} H_0: Random\ effects\ (RE)\ estimates\ are\ consistent\ and\ efficient \\ H_A: Random\ effects\ (RE)\ estimates\ are\ inefficient \end{cases}, \quad [4]$$

Table 3 identifies the research study hypothesis. The set of the hypothesis presented is based on the literature framework reviewed and presented in the previous section. In the table is possible to verify the hypothesis postulated about each of the individual variables as well as the expected relationship with innovation.

Table3: Research study hypothesis and expected relationship among variables

Environmental factor	Hypothesis	Expected relationship
Financing for entrepreneurs	H1: Availability of financial resources increases innovation activity	+
Governmental support and policies	H2: The extent of government support and policies has a positive relationship with innovation activity in the company	+/-
Taxes and bureaucracy	H3: Taxes or regulations either size-neutral or that encourage new and SMEs increases innovation activity.	+
Governmental programs	H4: The presence and quality of governmental programs directly assisting companies, promote innovation activity.	+
Basic school entrepreneurial education and training	H5: The extent in basic school entrepreneurial education and training may facilitate the improvement the level of innovation activity.	+
Post school entrepreneurial education and training	H6: The extent in post school entrepreneurial education and training may facilitate the level of innovation activity.	+
R&D transfer	H7: The extent of R&D transfer contributes to the success of innovation activity.	+
Commercial and professional infrastructure	H8: The presence of commercial and professional infrastructure has a positive influence on innovation activity.	+
Internal market openness	H9: The extent of internal market openness supports innovation.	+
Internal market dynamics	H10: The level of internal market dynamic has a strong influence on innovation.	+
Physical and services infrastructure	H11: Ease of access to physical and services infrastructure positively influences innovation activity.	+/-
Cultural and social norms	H12: The extent of cultural and social norms has a positive impact on innovation activity.	+

Source: Author's own elaboration

Results and Discussion

The data can be described considering the 100 analyzed countries over the 7 years period of study like follows. Overall, in average, 25.7% companies involved in early-stage entrepreneurial activities (TEA) indicate that their product or service is new to at least some customers and few or no businesses (at all) offer the same product. The standard deviation of innovation activity within a period of time is bigger than across countries. However, the standard deviation between observation reaches a relative value of around 40% of the average value (10.38% out of 25.7%), which indicates that a big variability can be observed for the total number of observations. Moreover, the variability of innovation among countries is bigger than the variability verified for each economy over time - the standard deviation (9.27%) between the groups of economies is bigger than the standard deviation (5.16%) within each economy over time. This fact is confirmed by the observation that the range between minimum and maximum values among groups of countries is much bigger than the range between these values within the economies over time. When describing the business environment factors, results provide evidence that the indicators related to physical and services infrastructure and the internal market dynamics present the highest overall assessment average values. The indicators that present the lowest overall assessment average values are the indicators related with the basic school entrepreneurial education and training (2.02%), the R&D transfer (2.35%) and the taxes and bureaucracy (2.40%). It is also important to notice that the average overall expert's assessment is for most indicators below 3 point values – only the 2 indicators abovementioned indicators with a higher assessment present an average overall assessment higher than 3 point values. However, the average hides the existence of big differences in the expert's assessment. Overall there are economies, in specific years, with a very low assessment. For instance, the indicator that measures the basic school entrepreneurial education and training reaches the

minimum of 1.15 points and never reaches a value higher than 3.43 points. At the same time, the indicator that measures the cultural and social norms presents, according with the experts, an overall minimum of 1.64 points and a maximum assessment of 4.40 points. The indicators that measures the taxes and bureaucracy presents a behavior similar to the cultural and social norms.

Table 4 summarizes the estimated results obtained using the random and fixed effects panel data econometric models for the total twelve hypotheses. In the table is possible to observe which factors are identified as having a statistical significant impact on innovation and the relationship that was found between each one of the factors of business environment the innovation activity in TEA companies.

Table 4 allows to observe the following:

• Hypothesis H1, that analyzes the relationship between the availability of financial resources such as equity and debt for small and medium enterprises (SMEs) including grants and subsidies, statistically confirms the literature support;

• Hypothesis H2, that according with the literature review may support or limit innovation if different authors are followed, has, in the present study, confirmed that the relationship between the public policies that support entrepreneurship and innovation is positive;

• Hypothesis H3, which analysis the extent to which taxes or regulations are either size-neutral or encourage new and SMEs, is confirmed empirically and the results are statistically robust;

• Hypothesis H4 could not be accepted. So was not possible to conclude that the presence and quality of programs directly assisting SMEs at national, regional, and municipal levels of government has a literature support, is positively related with innovation activities;

• Hypothesis H5 which takes into account the extent to which training in creating or managing SMEs is incorporated within the education and training system at primary and secondary levels is accepted confirming the what had been expected after the literature review;

• Hypothesis H6 which considered the impact of the extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools, could not be confirmed;

• Hypothesis H7 considering the extent to which national research and development will lead to new commercial opportunities and is available to SMEs could not, also, be confirmed;

• Hypothesis H8 was not also confirmed, so was not possible to conclude the presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote SMEs, enhance innovation;

• Hypothesis H9, which takes into account the extent to which new firms are free to enter existing markets has been confirmed with statistically robust results;

• Hypothesis H10 regarding the level of change in markets from year to year is accepted by the theoretical framework, was expected a positive effect on innovation, however, the results from this study analysis reached an opposite conclusion. Innovation seems to be limited by yearly changes in markets;

• For hypothesis H11 two possible results were expected since no agreement was found in the literature review on the impact of the ease of access to physical resources such as communication, utilities, transportation, land or space at a price that does not discriminate against SMEs. The present research found a negative statistical significant impact of this business environment factor on innovation;

• Hypothesis H12 which examines the extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income is accepted by the literature support, and based on the analysis is confirmed

Table 4: Research study hypothesis, expected and estimated results

Environmental factor	Hypothesis	Expected relationship	Estimated relationship
Financing for entrepreneurs	H1: Availability of financial resources increases innovation activity	+	+
Governmental support and policies	H2: The extent of government support and policies has a positive relationship with innovation activity in the company	+/-	+
Taxes and bureaucracy	H3: Taxes or regulations either size-neutral or that encourage new and SMEs increases innovation activity.	+	+
Governmental programs	H4: The presence and quality of governmental programs directly assisting companies, promote innovation activity.	+	not possible to conclude
Basic school entrepreneurial education and training	H5: The extent in basic school entrepreneurial education and training may facilitate the improvement the level of innovation activity.	+	+
Post school entrepreneurial education and training	H6: The extent in post school entrepreneurial education and training may facilitate the level of innovation activity.	+	not possible to conclude
R&D transfer	H7: The extent of R&D transfer contributes to the success of innovation activity.	+	not possible to conclude
Commercial and professional infrastructure	H8: The presence of commercial and professional infrastructure has a positive influence on innovation activity.	+	not possible to conclude
Internal market openness	H9: The extent of internal market openness supports innovation.	+	+
Internal market dynamics	H10: The level of internal market dynamic has a strong influence on innovation.	+	-
Physical and services infrastructure	H11: Ease of access to physical and services infrastructure positively influences innovation activity.	+/-	-
Cultural and social norms	H12: The extent of cultural and social norms has a positive impact on innovation activity.	+	+

Source: Author's own elaboration

Conclusion

With this paper is possible to conclude that a specific attention should be paid to drivers and barriers of innovation activity. The research work here presented enables to identify the key factors that impact (positively or negatively) on innovation activity in small and medium-sized companies and due to the scarcity of the scientific work dedicated to the research of factors that influence innovation, especially the ones that are based upon using GEM secondary database (Bergmann, Mueller, & Schrettle, 2014), the current papers offer an important scientific value-added.

In general should be mentioned that, on average, about 26% of companies worldwide, involved in early-stage entrepreneurial activities (TEA) indicate that their product or service is new to at least some customers and few or no businesses (at all) offer the same product. Results also showed the noticeable variance of values indicating innovation activity – with a minimum value of about 1% and a maximum one of almost 59%. Regarding factors that determine business environment in general, findings present that the indicators related to physical and services infrastructure and the internal market dynamics showed the highest degree of influence, and the indicators related with the basic school entrepreneurial education and training, the R&D transfer and taxes and bureaucracy evidence the lowest degree of impact.

A set of limitations of the present research to highlight possible future research lines. The first limitation is connected with the huge amount of number of missing observations, in other words, the secondary panel data which was used is unbalanced. In the future, with the help of balanced panel data, it is achievable to receive a more profound and more statistically robust analysis. Secondly, there is a lack of scientific works with a same background, in order to make a comparison with. Finally, in the future

with the enlargement of the GEM database and statistical information, would be possible to make an analysis country by country, regarding the innovation activity.

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