

Comparative Analysis of European and Global Innovation Performance Barometers

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Abstract – Business competitiveness and innovation play an important role in producing new and innovative products, services, and processes which enable productivity, job creation, and finally sustainable development.

The growth strategy for Europe sets a great emphasis on the investments in research and innovation in all sectors to address issues of businesses innovation performance and to create circumstances for prosperity: smart, sustainable, and inclusive growth.

This paper tackled the importance of innovation and performance and performed a comparative analysis of two well-known instruments envisaged by strategic decision makers to monitor innovation performance and innovation uptake, as key means to identify developments needed for improvement changes: the Innobarometer 2016 – EU business innovation trends and the GE Global Innovation Barometer (GIB) 2018.

The results capture and designate main differences and similarities between the two monitoring tools which assess innovation performance. Finally, the author stressed the benefits brought by both monitoring tools for those responsible for making decisions on innovation, products development and research.

Keywords – innovation and competitiveness, business performance, process improvements.

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1. Introduction

The Europe strategy 2020 tackled the challenges of smart, sustainable and inclusive growth by stressing the need for initiatives to catalyze progress under seven investments priorities as: 1) improved conditions for research and innovation for new products and services which may create growth and jobs; 2) improved education segments needed for facilitating the entry of young people to the labor market; 3) digital agenda for Europe; 4) responsible use of Europe resources; 5) improved business system based on industrial policies for the globalization era; 6) modernized agenda for new skills and jobs; 7) fight against poverty to ensure social and territorial cohesion [1].

As interrelated investments priorities, these are responsible for innovation across all economics sectors strengthening knowledge for future growth and ensuring the transformation of innovative ideas into new products and services.

In the race to improve conditions for innovation and research, the decision making actors are required to reinforce the competitive advantages of businesses through making the best use of knowledge transfer throughout the European Union, using ICTs and exploiting the EU-scale networks.

Following this Europe 2020 strategy, the concern for growth and competitiveness of EU decision makers is seen in the key priorities for industrial policy, with particular attention on stimulating investments in innovation and technologies. This priority, considering the global market competition, restated the need to achieve the Europe 2020 target of spending 3% of GDP (Gross Domestic Product) on research and development (R&D). By coupling the increased investment level in R&D with redefining traditional production and business models, the companies may survive on long-term, accessing the world market by offering high value-added goods and services. In particular, the potential of new and innovative products and services are laid down on integration of new technologies as cloud computing, big data and internet of things, smart cities and factories, artificial intelligence and robotics, 3D printing and design [2].

Many sectors are driven by technological developments requiring relevant skills for enabling competitiveness and innovation such as digital skills, and transversal competences – innovation, entrepreneurship and citizenship. Skills acquisition and development are essential for a rapid adaptation to the digital transformation of our world which is moving toward a collaborative economy opening up new routes into work (i.e. e-services, e-health, etc.) [3].

The concern for innovation and competitiveness is captured and carefully embraced by ten EU policy priority areas related to jobs, growth, and investments, digital single market, resilient energy union, deeper and fairer internal market with a strengthened industrial base, deeper and fairer economic and monetary union, etc. [4].

Therefore, the innovation is perceived as a key means for mainstreaming industrial competitiveness needed for attaining the Europe 2020 targets and the prosperity of the wider society. In this regard, responsible bodies designed and implemented monitoring frameworks and tools to assess innovation performance across countries and economic sectors to identify the improvement needs.

In the attempt to decipher current trends in innovation, the paper analyzed two well-known monitoring tools for innovation performance assessment and drew up useful drivers and barriers needed to be taken into account for future innovation endeavors.

2. Research background

The scientific literature embraced notable studies and researches in the area of innovation, business competitiveness and excellence, entrepreneurship and sustainable growth.

The scholars studied the role of innovation in relation with organizational excellence and outlined the key role of innovation in the assessment of business subjects' performance. By analyzing different excellence models (e.g. ISO 9000 family of standards, Malcom Baldrige model from USA, and EFQM model from Europe) the findings argued the significant role of innovation in the success of the company, 80% of businesses deeming it even to be the key factor of success, despite that 4% of respondents neglected this area [5].

By looking at the implications of ITCs on product innovation and enterprise performance, empirical researches captured the emerging field of strategic entrepreneurship as key factor responsible for firm wealth and value creation. The results designated the direct impact of IT capability on product innovation performance as well as strategic entrepreneurship.

The companies seeking to achieve the right balance between exploring new opportunities and exploiting existing ones are advised to develop both capabilities to unlock the combined potential of ITCs and strategic entrepreneurship [6].

An interesting subject considered for analysis was referred to the social capital with its relational and cognitive dimensions and organizational innovation performance. The study pinpointed the mediating role of social capital in creating knowledge, providing empirical support for considering this one within the innovative capabilities of organizations. Through knowledge exchange and a proper level of social exchange arrangement, the employees are encouraged to share their expertise, to build trust and to enhance organizational innovation performance toward achieving sustained competitive advantages [7].

The innovative activities are also considered from the market and consumer viewpoints, which are concerned about the company's reputation related to technological innovation. In this matter, the scholars analyzed the way in which consumers evaluate innovative performance and argued the tendency to value the costly and uncertain research and development efforts undertaken by companies. Moreover, the practitioners are advised to implement the innovation function in the company when it is envisaged to deliver steady novel solution to customers, considering also the relationship between marketing function and the reputation for technological innovation [8].

Added to the current stream of research on innovation and company's performance, the scholars performed empirical verification of the relationship between innovation capabilities, innovation efforts and related performance. By considering the innovation capability in relation to the identification of future customer needs and expectations, the findings emphasized the drivers for innovation performance as being the product and marketing innovation activities coupled with an organizational culture focused on innovation and performance improvements [9].

Other studies were focused on testing the links between innovation and competitiveness by considering evaluation models of innovation and competitiveness for different countries, such as the Innovation Union Scoreboard and the IMD World Competitiveness Yearbook. In this way, it was emphasized the cause-effect relationship between investments in innovation at different countries at EU level and the enhancement of economies competitiveness, as effect of innovation performance growth [10].

As innovation is the engine for economic growth and societal development, the European Commission

introduced the innovation principle as a key means to assess the impact of new EU policy and legislative initiatives on innovation. The innovation principle is assumed to be a comprehensive set of guidelines for optimizing the legal framework for innovation across member states with the aim to improve the overall societal well-being, based on the enhancement of effectiveness, coherence and comprehensibility of regulations [11].

Looking at the innovation concept, pinpointed was the nature of innovation in terms of new idea in relation to the current stage, which may be linked not only to technical or scientific novelties, but also to organizational change processes in different sectors. Moreover, introduced is a significant dimension of innovation in terms of bringing economic and societal benefits and thereby, innovation being understood as a process by which the novelty needs to win social acceptance and recognition over time [12].

In the attempt to thoroughly capture all dimensions accountable for innovation, the European Innovation Scoreboard introduced a useful framework to assess the innovation level in a systemic manner. The measurement framework is built on four dimensions, each category containing key priority areas and related indicators, as follows [13]:

- Framework conditions with key areas: human resources, attractive research system, and innovation-friendly environment.
- Investments with key areas: finance and supports, and firm investment.
- Innovation activities with key areas: innovators firms, linkages, and intellectual assets.
- Impacts with key areas: employment impact and sales impact.

Each key area has specific measurement indicators which may assist the performance assessment process of innovation trends across different countries. Table 1. presents a synthetic view of indicators and key areas responsible for innovation performance at EU level [13].

The indicators envisaged by the innovation framework cover all facets of innovation life cycle starting with designing the frame for innovation, investing in catalyst factors, facilitating enterprises innovation activities, and finishing with evaluation of the economic impact of these activities.

Moreover, based on a composite indicator which incorporates the values of all indicators, the European Innovation Scoreboard 2017 classifies the EU countries in four performance groups in comparison with the EU innovation performance average (i.e. modest innovators, moderate innovators, strong innovators, and innovation leaders). For

example, Romania and Bulgaria were included in the modest innovator group as their innovation performance level is measured below 50% of the EU average. At the opposite side of the spectrum, countries such as Denmark and Sweden were considered in innovation leaders group, having their innovation performance more than 20% above the EU average [14].

At the EU level, one of the most relevant monitoring initiatives for innovation assessment is pertaining to the Innobarometer 2016 - EU business innovation trends. This survey tool is drawn upon several key areas and related indicators envisaged by the European Innovation Scoreboard and surveyed current EU business activities and attitudes related to innovation. The main research areas covered by the monitoring tool are related to organizational innovation, previous and future challenges for organizational innovation.

Table 1. European Innovation Scoreboard 2017.

Key areas	Indicators	Aim
Human resources	Doctorate graduates	To create the conditions for facilitating innovation potential
	Population aged 25-34 with tertiary attainment	
	Lifelong learning	
Research systems	International scientific co-publications	
	Top 10% most cited publications	
	Foreign doctorate students	
Innovation-friendly environment	Broadband penetration	To support the execution of innovation activities
	Opportunity-driven entrepreneurship	
Finance and support	R&D expenditure in public sector	To perform innovation activities
	Venture capital expenditure	
Firm investments	R&D expenditure in business sector	
	Non-R&D innovation expenditure	
	Enterprises developing ICT skills of employees	
Innovators	SMEs with product or process innovations	To develop networks
	SMEs with marketing or organisational innovations	
	SMEs innovating in-house	
Linkages	Innovative SMEs collaborating with other	To develop networks
	Public-private co-publications	
	Private co-funding of	

	public R&D expenditure	
Intellectual assets	Patent applications	To link the science to market
	Trademark applications	
	Design application	
Employment impacts	Employment in knowledge-intensive activities	To improve the workforce skills
	Employment enterprises of innovative sectors	
Sales impacts	High tech product exports	To uptake innovation outcomes
	Knowledge-intensive services exports	
	Sales of new-to-market and new-to-firm product innovations	

In this regard, Table 2., 3. and 4. show a synoptic view of main indicators and factors used to capture the behavior and trends in innovation-related activities within EU businesses [15].

Table 2. Organizational innovation indicators – EU approach

Innovation indicators	Key factors
Organizational typologies	Types of companies according to size and turnover
	Types of companies related to NACE sector group
Vectors of innovation	Human capital
	R&D infrastructure and degree of investment in R&D&I
	Public-private partnership
	In-house innovation
Organizational innovation	New/significantly improved goods and/or services
	New/significantly improved organizational methods
	New/significantly improved organizational processes
	New/significantly improved marketing strategy
Investment in innovation activities	Machine, equipment, software and licences
	Branding, reputation and web design
	Organization/business process improvements
	Employees training
	Design of products and services
	Research & Development

Table 3. Organizational innovation barriers and solutions – EU approach

Innovation indicators	Key factors
Barriers to commercialize innovative goods and services	Competition, marketing expertise, and demand
	Regulations' costs and complexity
	Human resources availability
	Administrative/legal burdens
	The usage of new technologies
Solutions to overcome obstacles to commercialize innovative goods and services	Intellectual property rights
	Staff training
	Online selling and specialized channels
	Meeting standards and/or regulations
	International market presence
	Intellectual property rights
	Testing new products and/or services before launch

Table 4. Organizational innovation future challenges – EU approach

Innovation indicators	Key factors
Future innovation actions	New/improved processes: production, HR, distribution, financial, R&D
	New/improved services
	New/improved organizational models
	New/improved marketing strategies
Future innovation drivers	Market potential
	Customer requests
	Market competition
	Administrative and/or legal requirements
	New business solutions
Future innovation obstacles	Lack of financial resources
	Lack of customer/market demand
	Unprofitable results
	Complexity of legal/administrative requirements
	Lack of skilled workforce
Innovation strategy	The role in organization
	The effects on organization

The variables used in the Innobarometer 2016 enable researchers to analyze across different EU countries the innovation performance level in relation to different companies' characteristics such as small and medium enterprise (SME) and large companies, and to their areas of operations: manufacturing, retail, services, and industry (i.e. classified according to the glossary of statistical classification of economic activities in the European Community - NACE).

The organizational innovation performance is also quantified according to the proportion of companies introducing innovation in terms of new/improved good and/or services, organizational methods, organizational processes, and marketing strategy. Likewise, each country is quantified according to the proportion of revenue invested in a number of different activities (e.g. 68% of EU companies invested in the acquisition of machines, equipment, software, 59% in employees training, 56% in branding and reputation, and 51% in business process improvements) [15].

Interestingly, the monitoring tool enables to analyze the problems facing companies attempting to commercialize their innovative goods and services and establishes different types of interventions that would have the most positive effect on organizations. For example, the key factors hampering the commercialization of novel goods and services were competitors (65% of respondents), meeting regulations (57%) and the lack of skilled workforce (49%). The recovering solutions seen by the EU innovative companies were training staff in how to promote and market innovative goods and services (29%), followed by reinforcement of on-line selling (26%), and fulfillment of regulations and/or standards (19%) [15].

Finally, the EU Innovation Barometer enables the analysis of future investments in different innovation activities, drawing up the main reasons for investing in innovation, e.g. capitalizing on the market potential (40%) and increased customer request (39%). Also, the companies noted the main reasons not to invest in innovation as lack of financial resources (28%) and unprofitability (30%) [15].

Another trustworthy monitoring tool for innovation performance is pertaining to the GE Global Innovation Barometer (GIB) 2018 undertaken by the General Electric, USA. By surveying the world’s business executives involved in innovation, product development and research within the companies, the framework of global innovation evaluation explored three pillars for innovative growth such as key players in innovation, innovative technologies, and challenges for innovation [16].

In this regard, Table 5., 6., and 7. highlight the relationship between innovation area investigated and the main factors responsible for innovation within organization.

Table 5. Key players in innovation – GE approach

Innovation indicators	Key factors
Actors driving innovation	Types of companies (size, private versus state, country of origin)
Innovation status	Degree of innovative conducive environment
	Ability to foster innovation
Government and innovation policies	Degree of economic development (GDP)
	Impact of government policies on innovation
	Attitudes related to innovation responsibilities

The variables used in the GE Global Innovation Barometer (GIB) 2018 enable researchers to analyze, across worldwide countries, the innovation performance based on different characteristics such as company types i.e. small businesses, SMEs, and multinationals, universities, public authorities at national and local level, and state owned enterprises. The figures showed that multinationals have a growing reputation as drivers of innovation across the majority of countries, especially in emerging economies as Turkey and South Africa [16].

Table 6. Innovative technologies – GE approach

Innovation indicators	Key factors
Potential of innovative technologies	Impact of innovative technologies on businesses
	Benefits of innovative technologies
Investment and return on innovation	Factors responsible for return on innovation
Potential of hype technologies	The potential across different countries
	The transformative effect in societies

Table 7. Challenges for innovation – GE approach

Innovation indicators	Key factors
Drivers for future innovation	Skilled workforce
	Data security and digital capability
	Taking risks
Barriers for future innovation	Investments and financial support
	Risk intolerance
	Organizational inertia

The innovation status across the globe is quantified according to the ability of countries to foster innovation, only five countries being perceived as having a very strong innovative conducive environment such as USA, Japan, Germany, China, and UK, which also have the largest GDP (Gross Domestic Product) [16].

Usefully, the innovation performance is assessed considering the role of governments' policies on supporting the innovative environment. The results noted the attitude of business leaders across the globe who believe a political protectionist stance on innovation would be beneficial to business at a national level.

Having a broader perspective, the GE Innovation Barometer quantifies the business executives' perceptions related to the impact of new technologies on businesses such as: artificial and machine intelligence; internet of things; financial technologies and currency; 3D printing; augmented reality/virtual reality; big data and analytics; smart energy grids; nanotechnology; driverless transport; smart cities; electrification of the transport system; virtual healthcare diagnosis. The findings revealed the artificial intelligence, internet of things, financial technologies and 3D printing as having the most positive impact globally. In addition, 63% of business leaders believed 3D printing having positive impact on their countries such as increased creativity (91%), improved speed to market (89%), and lower productions costs (83%), and improved CO2 footprint (80%) [16].

Among the factors responsible for return on innovation were mentioned the digitalization of work, long-term innovation strategy, innovation measurement system, and also the cautionary approach to innovation.

Finally, the monitoring tool stresses out the elements most crucial to innovation success for business: skilled workforce, data and digital capability, return on innovation, and innovation strategy. Also, the factors hindering efficiently innovation were mentioned as follows: investment and financial support, risk intolerance, calling up organizational innovation, organizational inertia, and effective business models.

As reasoned earlier, the Innobarometer 2016 - EU business innovation trends and the GE Global Innovation Barometer (GIB) 2018 were selected for the comparative analysis, having an international coverage and a large applicability in different sectors and industries.

3. Research results

As a result of comparative analysis applied on the two well-known instruments for monitoring innovation performance at country level, the main similarities and differences are highlighted in Table 8. and 9.

Table 8. The comparative analysis – main similarities

No.	Main similarities	EU Inno barometer 2016	GE – GIB 2018
1	Research aim	identify, analyze, and assess the development of innovation	
2	Data sources	mixt between secondary sources and primary sources of information – questionnaire based	
3	Data collection	survey based on questionnaires addressed to decisions makers of companies	
4	Research variables	perceptions, opinions and attitudes related to different sides of innovation	
5	Investigated areas	investments and innovation activities and results; barriers for innovation: drivers and solutions for effective innovation	

Both innovation performance barometers were performed having the same research methodology in terms of aim, data sources used for analysis, data collection, research variables, and investigated areas. In this regard, the barometers used as secondary sources' statistical data are based with historical information such as Eurostat database and the World Bank data for economic indicators. The primary data were collected through a survey on business decision makers involved in innovation activities. Also, both monitoring instruments surveyed perceptions, attitudes, and opinions related to different facets of innovation inside the companies such as types of innovation introduced, problems encountered, drivers and solutions for effective innovation.

As far as the main differences, the EU Innobarometer 2016 envisaged a more detailed analysis of internal innovation by ascertaining specific processes accountable for innovation such as: human resources, research and development infrastructure, degree of firm's investment in R&D, public-private partnerships, and in-house innovation.

Table 9. The comparative analysis – main differences

No.	Main differences	EU Inno barometer 2016	GE – GIB 2018
1	Research focus	Internal/organizational detailed view	Bird's-eye worldwide view
2	Research boundary	Narrower coverage	Worldwide coverage
3	Sample size	14117 companies	2090 business executives
4	Survey's structure	Organizational innovations Previous innovation challenges Future innovation challenges	Key players Innovative technologies Future innovation challenges
5	Field work period	Data collected during 2016	Data collected during 2017

The GE – Global Innovation Barometer 2018 took a more synoptic view of innovation and analyzed the innovation status across the globe based on linking the economic development of countries and the government policies with the degree of innovative conducive environment.

The research boundary represents another key difference between the two instruments since the EU InnoBarometer 2016 has an European coverage performed in 28 EU countries, but also considering Switzerland and USA, whilst the GE – Global Innovation Barometer 2018 has a worldwide approach based on highlighting main differences across continents: Europe, Middle East and Asia, USA, Canada and Japan.

The sample size was significantly different since the EU barometer interviewed a larger number of companies from all NACE sectors; whilst the GE barometer approached a smaller number of business executives without considered the company's area of activity but rather company type and country of origin.

Another interesting aspect is referring to the content of instruments by which the EU Innovation Barometer emphasized on the organizational innovation, previous and future challenges to organizational innovation as opposite to the GE Innovation Barometer which paid attention to players

in innovation, innovative technologies, and future challenges for innovation.

Although data collection were performed in different periods of time, both innovation performance barometers account for company's responsibility in building a innovation-friendly environment and pinpoint the future investments in innovation and related reasons.

4. Conclusion

Innovation is a precondition for job-creating and sustainable growth leading to social and environmental benefits. The concern for innovation life cycle (i.e. research and development, commercialization, diffusion, innovation uptake, and beyond) gains major importance for businesses which strive to increase their competitiveness and growth.

In this regard, the present study analyzed two well-known innovation performance assessment instruments which provide frameworks for understanding the relative strengths and weaknesses of different innovation systems.

Through a strong focus on main behaviors and trends in innovation-related activities within EU businesses, the EU InnoBarometer 2016 revealed major barriers and drivers, and introduced a useful structure for interested parties in assessing areas in which efforts are needed to boost innovation performance.

Notable, with particular emphasis on the indicators measuring the innovative potential of societies, companies and individuals, the GE – Global Innovation Barometer 2018 introduced a valuable approach in quantifying how different worldwide economies become more conducive to innovative outcomes.

Both frameworks are of major interests for those decision makers accountable for evidence base analysis and represent helpful innovation performance instruments which give beneficial explanations about contextual differences between countries and the prevalence of innovation-opportunities and related factors hindering innovation.

The outcome of this paper resides in analyzing the modern concepts of innovation, inducing a more explicit approach on the subject of innovative performance assessment in the attempt to enhance the effectiveness and coherence of evaluation of performance levels.

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