INNOVATION IN COLOMBIA: ANALYSIS OF PERFORMANCE AGAINST THE GLOBAL INNOVATION INDEX 2020

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ABSTRACT

The following document describes the results obtained in the Global Innovation Index for 2020, where the countries that acquire the best positions within the classification and the factors that were evaluated in the measurement are mentioned. From another perspective, the panorama of innovation in Colombia is analyzed, mentioning some of the current strategies employed and recommendations for improvement in future measurements.

KEYWORDS: *Innovation, Global Innovation Index, Research and Development, Technology*

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INTRODUCTION

The impact of globalization has accelerated the development of technology in the world, promoting advances in various areas that establish new markets through the emergence of innovative products and services which seek to meet unmet needs, for this, one of the most important resources that allow organizations to adapt to the external environment that is constantly changing and evolving is innovation.

Innovation is a process of change that transforms scientific and technological knowledge into products, processes or services with added value or significant improvements suitable for the interior or exterior of the organization, which are accepted in the market and recognized by the society that consumes them (Valdés, Triana, & Boza, 2019) (Kahn, 2018) (Berigüete, Rodríguez, & Mayorga, 2019).

According to the fourth edition of the Oslo Manual there are two types of innovation: product innovation and innovation in business processes. Product innovation refers to the introduction of a good or service to the market which has relevant improvements and is different from other products launched by the company. On the other hand, process innovation refers to the improvement of these products to perform more business functions (Organization for Economic Co-operation and Development (OECD), 2018).

Likewise, the innovation process must be measured to find strategies to improve its performance within the organizations. Measurement is important since figures demonstrate the value of innovation and are used to justify investment projects in this field (Zizlavsky, 2014), in turn, through innovation it is possible to evaluate employees, objectives, projects and programs to properly allocate resources (Gama, Mira, & Ataide, 2007).

In contrast, although innovation is undoubtedly a strategy that organizations employ to stay in the market and be competitive, it is occasionally difficult to initiate a process of innovation because not all markets are open to transformation and customers require a balanced development of new technology in order to obtain durable products.

Additionally, at times the innovative process slows down within companies due to a lack of technological opportunities and negative returns on investment in research, development and innovation (Leitner, 2017).

In accordance with the above, the World Intellectual Property Organization (WIPO), Cornell University and INSEAD Business School, annually prepare the measurement of the Global Innovation Index which is an indicator that measures the performance of the economies of some countries in Africa, America, Asia, Europe and Oceania to know the capabilities and results related to innovation (Presidencia de la República de Colombia, 2017)(Cornell University, INSEAD, & World Intellectual Property Organization - WIPO, 2020).

This document presents an analysis of the results of the report corresponding to the 2020 Global Innovation Index, observing the current panorama of innovation in the world and especially in Colombia, in order to elaborate recommendations according to the strategies acquired in the countries with the best weighting in the ranking.

METHODOLOGY

Firstly, an analysis of the Global Innovation Report (Cornell University, INSEAD, & World Intellectual Property Organization - WIPO, 2020) is elaborated with the objective of finding the factors evaluated in the ranking of countries around the world, the nations that are in the first places of the list are observed and the characteristics in common that they present to obtain the best scores.

Similarly, the strategies implemented by some of the countries in recent years in terms of innovation are mentioned and the current panorama of innovation in Colombia is elaborated with the purpose of presenting recommendations in the area of study for the indicators that present a lower score within the index.

DEVELOPMENT AND DISCUSSION

Analysis

The 2020 Global Innovation Index report presents the innovation trends and results in 131 economies around the world representing 93.5% of the population and 97.4% of the world's GDP.

In addition, the report is composed of three indicators: the general indicator, the input or input sub-indicator and the output or output sub-indicator; therefore, to calculate the general indicator, the average of the input and output sub-indicators must be done, which are composed of the pillars shown in Table 1.

Table 1: Evaluation pillars in the indicators

Indicator	Function	Pillars
Input or input sub-indicator	This sub-index is composed of five pillars that compile the factors that infer in the innovation process.	<ol style="list-style-type: none"> 1. Institutions. 2. Human capital and research. 3. Infrastructure. 4. Sophistication in the market. 5. Business sophistication.

Output Indicator Products	Sub- or	This sub-index is composed of two pillars that provide the results of the innovation activities.	6. Knowledge and technology products. 7. Creative products.
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Source: Own Elaboration

According to the results presented in the report, the Table 2 describes the three global leaders in innovation for the year 2020 by region, this classification by region is based on the United Nations Classification:

Table 2: Global leaders in innovation by region

Region	Country
North America	1. United States of America
	2. Canada
Latin America and the Caribbean	1. Chile
	2. Mexico
	3. Costa Rica
Europe	1. Switzerland
	2. Sweden
	3. United Kingdom
South and Central Asia	1. India
	Islamic Republic of Iran
	3. Kazakhstan
South East Asia, East Asia and Oceania	1. Singapore
	Republic of Korea
	3. Hong Kong, China
Northern Africa and Western Asia	Israel
	2. Cyprus
	3. United Arab Emirates
Sub-Saharan Africa	1. South Africa / Mauritius
	2. Kenya
	3. United Republic of Tanzania

Source: Own Elaboration

On the other hand, the positions acquired by the economies studied in the report are directly related to the level of income of each country, so they were classified in four groups established in the classification prepared by the World Bank: high income which is composed of 49 countries, upper-middle income which is made up of 37 countries, lower-middle income in which 29 countries are found and low income made up of 16 countries, where the top ten innovative economies for each income group are subsequently presented together with their position in the classification within the report, see Table 3.

Table 3: Main innovative economies by income group

No.	High Income	Medium-High Income	Lower-Middle Income	Low Income
1	Switzerland (1)	China (14)	Vietnam (42)	United Republic of Tanzania (88)

2	Sweden (2)	Malaysia (33)	Ukraine (45)	Rwanda (91)
3	United States of America (3)	Bulgaria (37)	India (48)	Nepal (95)
4	United Kingdom (4)	Thailand (44)	Philippines (50)	Tajikistan (109)
5	Netherlands (5)	Romania (46)	Mongolia (58)	Malawi (111)
6	Denmark (6)	Russian Federation (47)	Republic of Moldova (59)	Uganda (114)
7	Finland (7)	Montenegro (49)	Tunisia (65)	Madagascar (115)
8	Singapore (8)	Turkey (51)	Morocco (75)	Burkina Faso (118)
9	Germany (9)	Mauritius (52)	Indonesia (85)	Mali (123)
10	Republic of Korea (10)	Serbia (53)	Kenya (86)	Mozambique (124)

Source: Own Elaboration

However, the classification of the economies is not only made according to the income of the countries, but it also takes into account the level of development of innovation generated by each of these, for this case is divided into economies above the expectations of level of development, in accordance with the level of development and other economies. The Global Innovation Index ranking for each country shows the score obtained, which is in a range of zero to one hundred, the position reached in the innovation ranking, the level of income, the position of the country according to the level of income, the region to which it belongs and the position in the region.

Given the above, the Table 4 describes Colombia's position in comparison to the top 10 countries considered as innovators according to their ranking in the index.

Table 4: Location of Colombia in the ranking

Innovation Ranking	Country	Score	Income Level	Income Level Ranking	Region	Ranking by Region
1	Switzerland	66.08	High	1	Europe	1
2	Sweden	62.47	High	2	Europe	2
3	United States of America	60.56	High	3	North America	1
4	United Kingdom	59.78	High	4	Europe	3
5	Netherlands	58.76	High	5	Europe	4
6	Denmark	57.53	High	6	Europe	5
7	Finland	57.02	High	7	Europe	6
8	Singapore	56.61	High	8	South East Asia, East Asia and Oceania	1
9	Germany	56.55	High	9	Europe	7
10	Republic of Korea	56.11	High	10	South East Asia, East Asia and Oceania	2
68	Colombia	30.84	Medium-High	20	Latin America and the Caribbean	5

Source: Own Elaboration

The results obtained are based on the qualification of the pillars that conform the input and output sub-indicators, these have been divided in four quartiles like this: the fourth quartile represents the best performance corresponding to the position range between 1 and 32, the third quartile composes the ranges from 33 to 65, the second quartile is conformed by the ranges from 66 to 98 and the first quartile is composed by the ranges from 99 to 131. Next, the comparison is made

between the results for the first 10 innovative economies and for Colombia.

Table 5: Classification of the pillars

Country	Pillars						
	Institutions	Human capital and research	Infrastructure	Sophistication in the market	Business sophistication	Knowledge and technology products	Creative Products
Switzerland	13	6	3	6	2	1	2
Sweden	11	3	2	12	1	2	7
United States of America	9	12	24	2	5	3	11
United Kingdom	16	10	6	5	19	9	5
Netherlands	7	14	18	23	4	8	6
Denmark	12	2	4	8	11	12	10
Finland	2	4	9	33	8	6	16
Singapore	1	8	13	4	6	14	18
Germany	18	5	12	24	12	10	9
Republic of Korea	29	1	14	11	7	11	14
Colombia	57	82	50	45	52	72	80

Source: Own Elaboration

As shown in the Table 5, Colombia has high positions in the pillars of human capital and research, creative products and knowledge and technology products, which places these pillars in the second quartile; on the other hand, the pillars of institutions, business sophistication, infrastructure and market sophistication are classified in the third quartile, the country does not have any pillar within the fourth or first quartile (Cornell University, INSEAD, & World Intellectual Property Organization - WIPO, 2020).

In contrast, innovative countries such as Sweden and Denmark are identified as producers of innovative technology, so their economies are in high growth and development, in turn, the labor market is regulated fairly under the same standards and labor laws and base innovation strategies according to the behavior of the economy in the world. Likewise, one of the main technological processes they have implemented is the generation of clean energy, which promotes the supply of jobs for all types of personnel and contributes as a strategy against climate change (Aragónes & Salgado, 2019).

Switzerland is one of the economies that make large investments in research and development contributing about 3% of GDP, where basic research is carried out by universities and research in applied science and economic needs is developed by companies and technical schools, in addition much of the investment is for the pharmaceutical sector, metallurgical, scientific laboratories and new technologies (Confederación Suiza, 2017).

Panorama in Colombia and Recommendations

In Colombia the business base grows annually by about 3.5%, in 2019 the country registered 1,643,849 productive units of which 92% are micro businesses, 6% small businesses and 2% represent medium and large enterprises (Red de Cámaras de Comercio - Confecámaras, 2020), given the above, it is necessary to promote mechanisms designed for MSMEs that contribute to innovation to increase competitiveness and economic development of the country.

Currently there are initiatives such as INNPULSA Colombia developed by the Ministry of Commerce, Industry and Tourism which seeks to promote the acceleration of high potential entrepreneurship, innovation processes and financing through the development and articulation of a financial culture in entrepreneurs and specialized attention to minimize knowledge gaps in order to build more favorable environments (Innpulsa Colombia, 2019) (Ministerio de Comercio, 2018).

Another strategy is that developed by the Chamber of Commerce of Bogotá (CCB), which developed an innovation program aimed at promoting these processes within organizations, for which INNOVALAB is an Innovation and Design Center that provides specialized consulting services for identifying innovation opportunities, structuring projects and accompanying the development of (Cámara de Comercio de Bogotá, 2020).

Likewise, the Innovation and Technology Gap Closure project supported by Innpulsa Colombia, the PTP Productive Transformation Program, the ANDI and VT SAS aims to identify innovation and technology gaps in sectors such as post-consumer, steel and metal-mechanical, household appliances, and automotive, textile and clothing, cosmetics and toiletries, medical devices, and business process outsourcing (BPO), which seeks to generate capacities that will allow the maintenance of the dynamism in the change of the environment by increasing the competitiveness of the country (Gobierno de Colombia, Asociación Nacional de Empresarios de Colombia ANDI, Innpulsa Colombia, VT SAS, & Programa de Transformación Productiva PTP, 2018).

From another perspective, internally the Departmental Innovation Index for Colombia is elaborated which employs a methodology similar to the measurement of the Global Innovation Index where seven pillars are used for the classification, the results obtained in this report for 2019 are found in the Table 6:

Table 6: Level of Innovation Performance

Performance Level	Department and Score
High	Bogotá and Cundinamarca (69.92), Antioquia (64.42).
Medium - High	Santander (52.11), Atlántico (50.65), Risaralda (49.32), Valle del Cauca (45.72), Caldas (43.23) and Quindío (37.55).
Medium	Bolívar (36.16), San Andrés and Providencia (34.46), Boyacá (34.02), Cauca (32.05), Norte de Santander (30.98), Meta (30.58) and Tolima (29.18).
Medium - Low	Huila (27.91), Casanare (24.12), Magdalena (23.37), Nariño (22.38), Cesar (22.02), Córdoba (21.92), Sucre (21.50) and Caquetá (19.46).
Under	Amazonas (17.17), Putumayo (17.03), Arauca (16.24), Guainía (15.46), La Guajira (15.02), Chocó (15.02), Guaviare (12.42) and Vichada (11.66).
Unclassified	Vaupés

Source: Own elaboration

The report determines that at medium to low performance levels the factors that have the greatest difficulty are human capital and research, infrastructure, business sophistication, creative production and production of knowledge and technology, while high performance levels present shortcomings in the aspects of knowledge and technology production and creative production.

Although efforts have been made to implement innovation in organizational processes, components such as investment in research and development, ICT infrastructure, greater investment capacity, creation, impact and dissemination of knowledge, cooperation between companies and educational institutions, and ecological sustainability still need to be strengthened (Departamento Nacional de Planeación DNP, 2019).

Additionally, other weaknesses that have been evidenced in the application of Science, Technology and Innovation

policies are: the lack of highly trained human capital for the development of competitive and quality innovation activities, low international projection, fragile support mechanisms to finance innovation, lack of public and private investment, among other aspects that impact on the strengthening of innovation strategies (Perez & Pertuz, 2018).

According to the study conducted by the National Association of Entrepreneurs of Colombia (ANDI) in 2020 found that companies point to the innovation of technology platforms, new products and business models, likewise, it states that the main obstacles facing organizations are the difficulty to consolidate a culture of innovation, lack of technology providers in the country and difficulty in accessing laboratories and specialized equipment.

On the other hand, the financing mainly comes from a greater proportion of own resources and a smaller percentage of national public resources and national private banks. In spite of the above, the investment by companies for the implementation of innovation generates the creation of new jobs, which allows the integration of highly qualified human capital from all levels and areas of training within the innovation processes (Asociación Nacional de Empresarios de Colombia -ANDI, 2020).

At the same time, there is a need to increase investment in Research and Development in Colombia, since in 2016, according to the Colombian Science and Technology Observatory, only 0.27% of the GDP was available (Clara Pardo & Colombian Science and Technology Observatory, 2017), a reduced value compared to countries such as the Republic of Korea, which invested 4.24% of the GDP in the same year (Comercio, 2018).

Similarly, cooperation strategies should be implemented between higher education institutions and public and private sector companies for the construction of innovation programs and the development of high-quality research with the purpose of disseminating knowledge that generates great impact at the international level.

CONCLUSIONS

Innovation is a constant process which must optimize the use of available resources for its development. Part of the success of this process is the acceptance within organizations where one of the necessary strategies is the construction of a culture of change focused on research for the creation of new technologies, products, and knowledge.

Colombia has programs that largely support entrepreneurship and some innovation processes, however, there is still a low level of investment in Research and Development where the potential of doctors trained in various areas of knowledge is used to increase the dissemination of results internationally.

The use of technological resources contributes to the advancement of the country's competitiveness, since through the creation of new products focused on optimizing daily activities that represent some level of difficulty, the quality of life of citizens can be increased.

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