

GLOBAL INNOVATION INDEX: ASSESSMENT OF THE STATE OF TURKEY AMONG BRICS-T COUNTRIES AND THE IMPACT OF FINANCING

Ayşegül GÜRSOY¹ Gülüzar KURT GÜMÜŞ²

Gönderim tarihi: 01.09.2023

Kabul tarihi: 17.12.2023

Abstract

Innovation plays a key role in achieving sustainable development. While focusing on sustainable development, countries also focus on increasing productivity, producing value-added products and providing competitive advantage. The objective of this study is to reveal the place of Turkey compared to BRICS countries by using Global Innovation Index 2022. Additionally, the study focuses on the current financing opportunities position of Turkey among other countries in two tiers: credit and investment. Finally, the study collates the financing opportunities and search the existence of differences for 2013 and 2022 time span. Findings reveal that Russian Federation and Brazil are the countries that Turkey has not statistically different scores in most of the indices and financing related sub-pillars. Regarding Turkey's Innovation Output Sub-index, market sophistication, loans from micro finance institutions and market capitalization scores are significantly different from all other countries.

Keywords: Global Innovation Index, BRICS-T

JEL Classification: O32, O38

KÜRESEL İNOVASYON ENDEKSİ: TÜRKİYE'NİN BRICS-T ÜLKELERİ İÇERİSİNDEKİ YERİNİN DEĞERLENDİRİLMESİ VE FİNANSMAN ETKİSİ

Özet

İnovasyon, sürdürülebilir kalkınmayı sağlanmasında kilit bir rol oynamaktadır. Ülkeler bir yandan sürdürülebilir kalkınmaya odaklanırken bir yandan da verimliliği artırma, katma değerli ürünler üretme ve rekabet avantajı sağlamaya yönelmektedir. Bu çalışmanın amacı, Küresel İnovasyon Endeksi 2022 verilerini kullanarak Türkiye'yi BRICS ülkeleri ile karşılaştırılarak mevcut yerini saptamaktır. Ayrıca çalışma, Türkiye ile diğer ülkeler arasındaki mevcut finansman fırsatlarına kredi ve yatırım olmak üzere iki aşamalı olarak odaklanmaktadır. Son olarak çalışmada finansman fırsatları incelenmiş ve 2013 ve 2022 zaman dilimleri için farklılıkların varlığı araştırılmıştır. Bulgular, Rusya Federasyonu ve Brezilya'nın, Türkiye'nin birçok endekste ve finansmana ilişkin alt endekslerde istatistiksel olarak farklı puanlara sahip olmadığı ülkeler olduğunu ortaya koymaktadır. Türkiye'nin İnovasyon Çıktısı Alt Endeksi, piyasa gelişmişliği, mikro finans kuruluşlarından alınan krediler ve piyasa kapitalizasyon puanları ile ilgili olarak diğer tüm ülkelerden önemli ölçüde farklıdır.

Anahtar Kelimeler: Küresel İnovasyon Endeksi, BRICS-T,

Jel Kodları: O32, O38

¹ Doç. Dr., Dokuz Eylül Üniversitesi, İİBF, İşletme Bölümü, Buca/İzmir; ORCID: 0000-0002-5523-1397

² Prof. Dr., Dokuz Eylül Üniversitesi İşletme Fakültesi Uluslararası Ticaret ve İşletmecilik Bölümü Tınaztepe Kampüsü Buca- İzmir; ORCID:0000-0002-9016-285X

1. Introduction

Nowadays, in the fast-paced environment, innovation is the key factor to stay competitive in the market. Both the developed and developing countries invest in the innovation to gain comparative advantage and foster economic growth. In addition to being the main driver of economic growth, it helps to improve productivity and results in the rise in per capita income and GDP of countries.

There are various definitions of innovation but the most widely accepted one is prepared by OECD and Eurostat. In the Oslo Manuel, innovation is defined as the *implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations* (OECD- Eurostat, 2005).

United Nations (UN) has 17 sustainable development goals. Goal 9 is '*Build resilient infrastructure, promote sustainable industrialization and foster innovation*'. So as to achieve sustainable development goal, the impact of innovation is emphasized (United Nations, 2023).

There are main techniques used by researchers such as the European Innovation Scoreboard, which assesses the innovation performance of EU countries; the Global Competitiveness Index developed by the World Economic Forum (WEF) and the Global Innovation Index (GII).

Global Innovation Index (GII) is co-published by Cornell University, INSEAD (European Institute of Business Management) and WIPO (World Intellectual Property Organization) annually until 2020. Since 2021, academic and corporate network partners also contribute in the publication process (Global Innovation Index, 2022).

Jim O'Neill, economist at Goldman Sachs in 2001, first coined the acronym "BRIC" to refer to Brazil, Russia, India, and China. He emphasized that these emerging countries would drive global markets in the near future. South Africa joined the group in 2011 and since then BRIC group was renamed as BRICS.

BRICS is a group of emerging markets that trigger the global economic growth over the years. Based on the World Bank (2019) data, BRICS comprise 41% of the world population, have 24% of the world GDP and have over 16% share in the world trade.

Turkey is one of the emerging markets as well. Since BRICS and Turkey are in the middle income group and have similar economic and financial indicators, the place of Turkey compared to BRICS countries are analyzed by using Global Innovation Index 2022.

The objective of this study is to reveal the place of Turkey compared to BRICS countries by using Global Innovation Index 2022. Additionally, the study focuses on the current financing opportunities position of Turkey among other countries in two tiers: credit and investment. Finally, the study collates the financing opportunities and search the existence of differences for 2013 and 2022 time span.

The rest of this paper is structured as follows. Section 2 defines the Global Innovation Index and Sub-indices. Section 3 analyses financing opportunities and Global Innovation Index whereas Section 4 focuses on the literature and in Section 5, the empirical analysis is conducted and finally Section 6 concludes.

2. Global Innovation Index

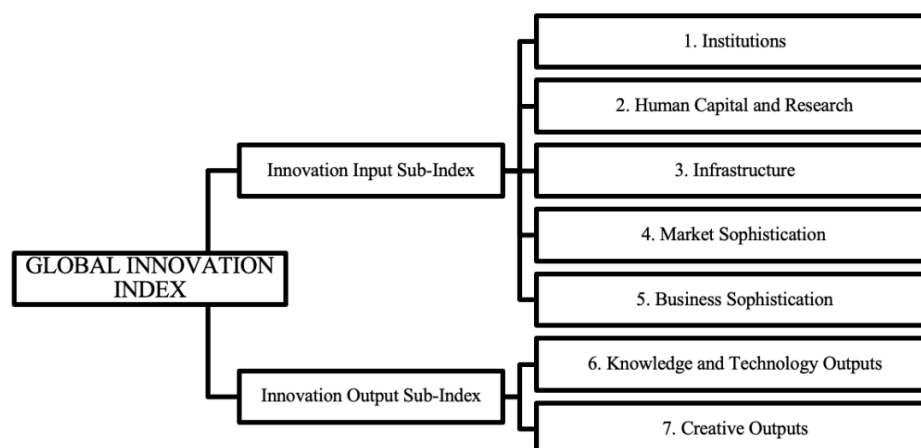
Table 1 indicates the Global Innovation Index and its sub-indices: Innovation Input Sub-Index and Innovation Output Sub-Index³. The overall GII score is the average of the Input and Output Sub-Indices.

According to Global Innovation Index Conceptual Framework (2020), Innovation Input Sub-Index has five pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication. The pillars define aspects of the environment initiative to innovation within an economy and also capture elements of the national economy that enable innovative activities.

Innovation Output Sub-Index has two pillars: Knowledge and technology outputs and Creative outputs. Innovation outputs are the result of innovative activities within the economy. Although the Output Sub-Index has two pillars, Output Sub-Index and Input Sub-Index are equally weighted for overall GII score calculation.

³ Global Innovation Index Conceptual Framework (2020)

Table 1: Global Innovation Index



The definitions of 7 pillars that make up the Global Innovation Index are given in Table 2.

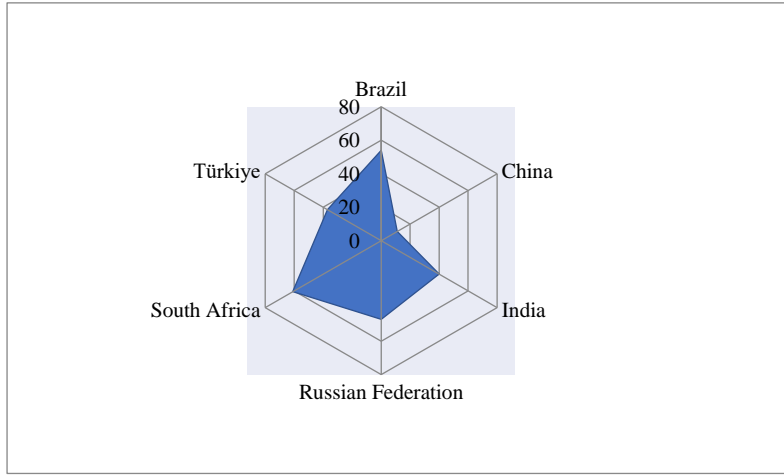
Table 2: Pillars

INNOVATION INPUT	INNOVATION OUTPUT
<p>Institutions: measures the institutional framework of the economy in terms of political, regulatory and business environment.</p>	<p>Knowledge and technology outputs: measures traditional thought results of innovations and/or inventions.</p>
<p>Human capital and research: measures human capital of economies with achievements at elementary and secondary education levels, tertiary education and research and development.</p>	<p>Creative Outputs: measures intangible assets, creative goods and services, and online creativity with top-level domains, mobile app creation.</p>
<p>Infrastructure: measures information and communication Technologies, general infrastructure, and ecological sustainability.</p>	
<p>Market sophistication: measures the availability of credit, investment ecosystem, access to international markets, competition, and market scale.</p>	
<p>Business sophistication: measure the level of business sophistication in terms of firms' conduciveness to innovation activities.</p>	

GII reports position of the countries in two ways: ranks and scores. The analysis starts with general evaluation of BRICS-T countries' ranks with the latest report of 2022 (Figure 1).

Global Innovation Index ranking indicates Turkey has the highest second rank after China among BRICS-T countries. South Africa and Brazil record comparatively low performance. Turkey has come a long way in nine years and has managed to increase its ranking from 68 to 37 (up 31 places in 9 years). China's continuously improving performance also takes attention: its 2013 rank was 35 and 11 in 2022 (up 24 places in 9 years).

Figure 1: Global Innovation Index-Rank



Innovation output sub-index performance of Turkey outperforms Innovation output sub-index performance. While Turkey ranks 2nd among BRICS-T countries in terms of innovation output, it ranks 4th in terms of innovation input (Figure 2). China is in the leader position both for input and output. Turkey's innovation input ranking, which was 81 in 2013, has increased 32 places. Turkey's innovation input ranking, which was 53 in 2013, has increased 20 places as well.

Figure 2: Input-Output Sub Indices-Rank

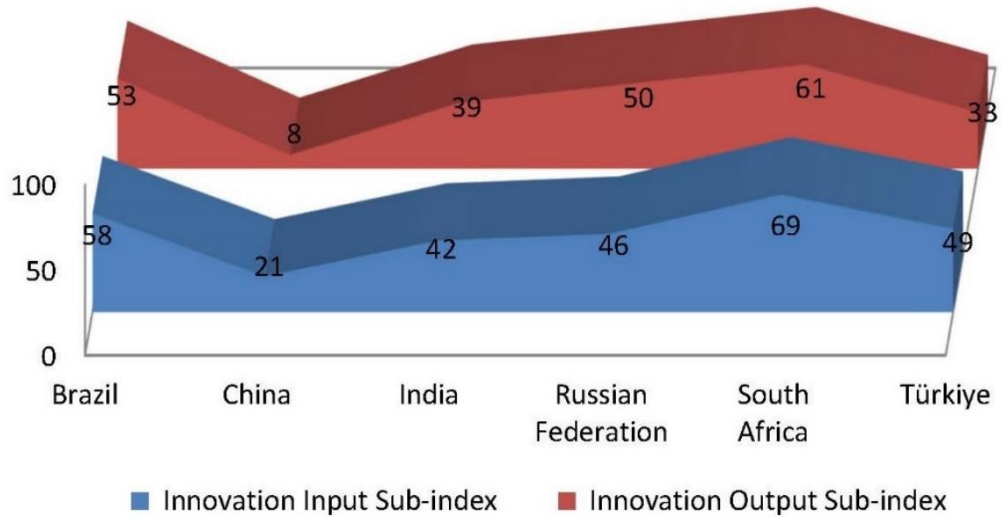
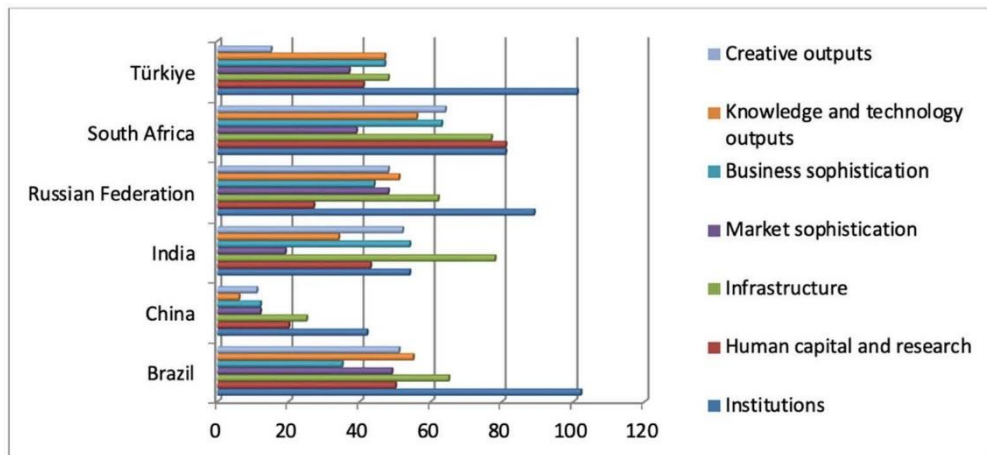


Figure 3 focuses on all of five pillars of Innovation Input Sub-index and two pillars of Innovation Output Sub-index. Turkey has distinguishing performance specifically in creative outputs, market sophistication and human capital and research; moderate performance in knowledge and technology outputs, business sophistication, and infrastructure. The performance in institutions is open improvement in most of BRICS-T countries other than China and India.

Figure 3: Main Pillars-Rank

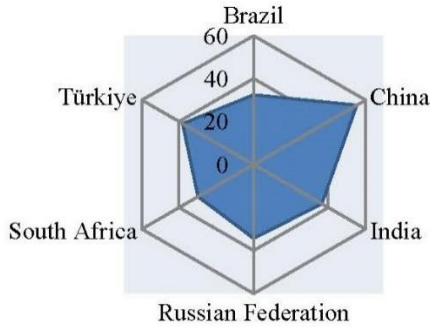


- **With Score**

In this part of the study, an evaluation was made by considering the scores.

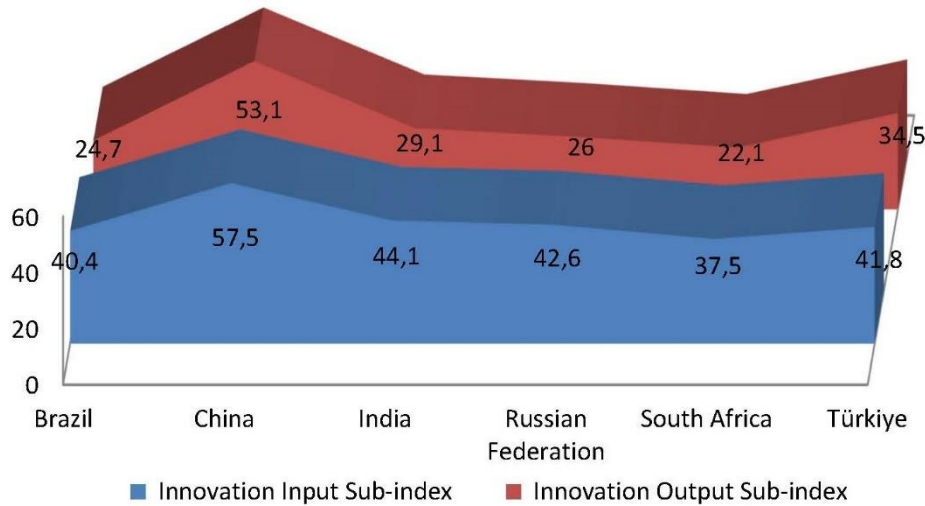
Turkey has the second outperforming score after China. Turkey's score is stable since 2013.

Figure 4: Global Innovation Index-Score



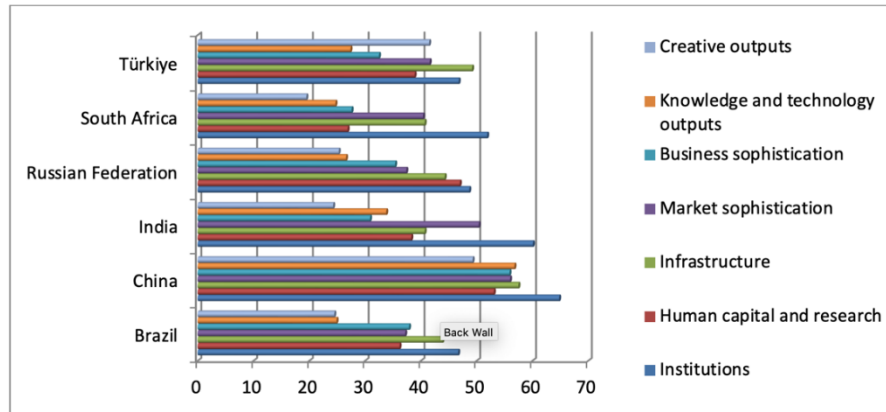
Since innovation output sub-index score is lower compared to innovation input sub-index, output's ranking success is comparatively higher. Another striking point is that although Turkey has a lower input score than most other countries, it has a higher output score. It refers that inputs are used more efficiently in creating output.

Figure 5: Input-Output Sub Indices-Score



Scores of main pillars resemble ranks. Figure 6 indicates that Turkey gets higher scores in most of the pillars. For the other countries creative outputs get the lowest score among their other pillar scores. Among all pillars of Turkey, the knowledge and technology outputs -the traditionally expected results of innovation- has the lowest score.

Figure 6: Main Pillars-Score



3. Financing Opportunities and Global Innovation Index

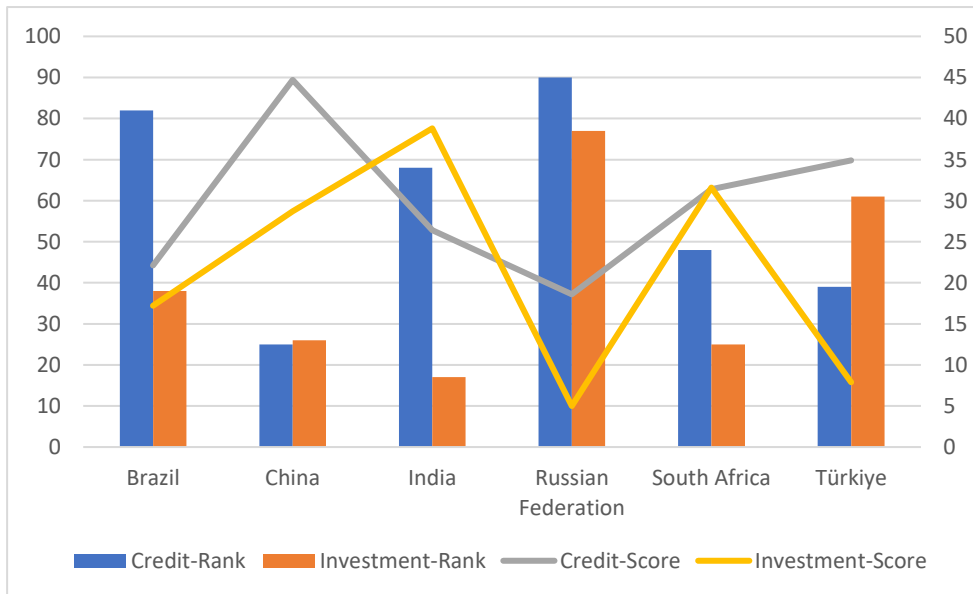
GII Part 4: Market Sophistication has two subsections: credit and investment. These indicators have their own ranks and scores. On the other hand, they concentrate on different sub pillars and each of those have their own ranks and scores as well (Table 3).

Table 3: Sub-pillars: Credit-Investment

CREDIT	INVESTMENT
<p>Finance for startups and scaleups: the average perception scores of experts on finance for starting and growing firms. Experts in different fields assess conditions for entrepreneurship in their country via statements.</p>	<p>Market capitalization, % GDP: the share price times the number of shares for listed domestic companies.</p>
<p>Domestic credit to private sector, % GDP: the financial resources provided to the private sector by financial corporations.</p>	<p>Venture capital investors, deals/bn PPP\$ GDP: the number of venture capital deals invested in and are reported per billion PPP\$ GDP.</p>
<p>Loans from microfinance institutions, % GDP: outstanding loans from all microfinance institutions in a country as a percentage of its GDP.</p>	<p>Venture capital recipients, deals/bn PPP\$ GDP: number of venture capital deals received and are reported per billion PPP\$ GDP.</p>

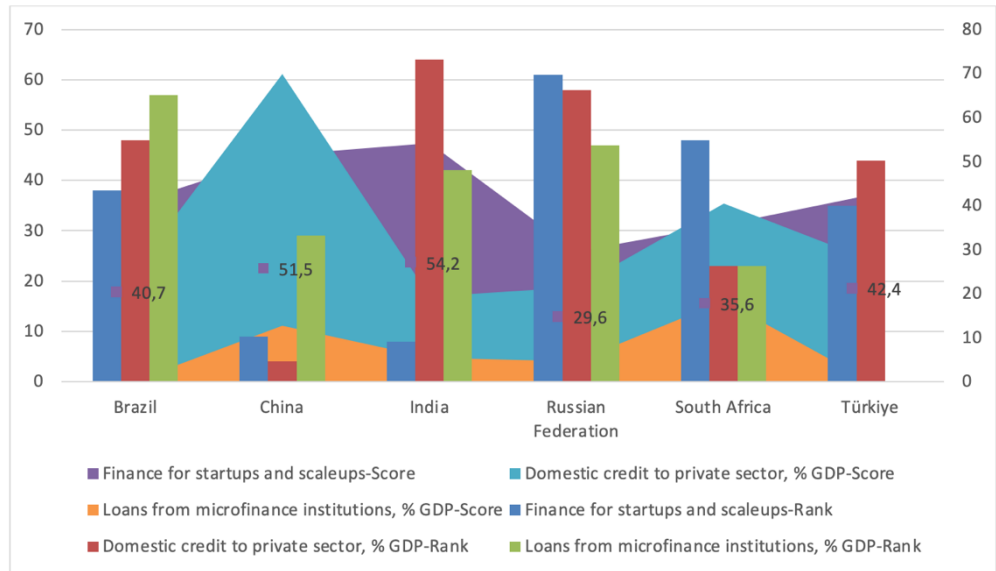
Although credits scores are higher than investment scores for Turkey and China, they are distinguished with positive difference between credit and investment in terms of rank among others. Turkey is the second-best performing country after China in credit sub-pillar. Investment performance needs improvement (Figure 7).

Figure 7: Credit-Investment

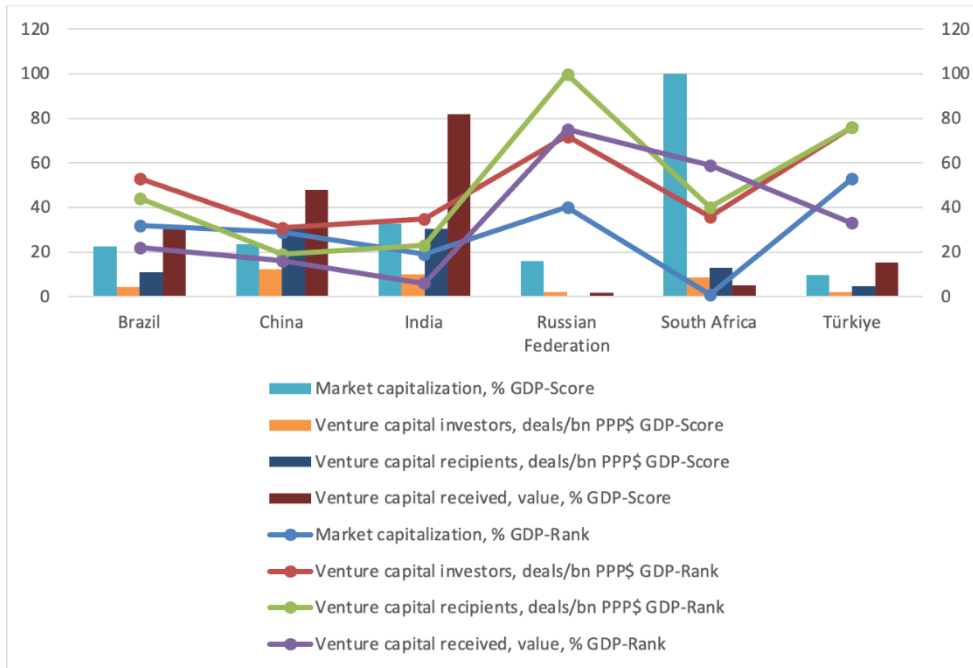


Turkey shows higher performance in finance for startups and scaleups. Domestic credit to private sector and loans from microfinance institutions performances are comparatively low, so they need special attention (Figure 8).

Figure 8: Breakdown: Credit



Turkey's investment pillar's performance is behind credit pillar's performance. Specifically venture capital related indicators must be developed (Figure 9).

Figure 9: Breakdown: Investment

4. Literature Review

There are 3 main contributions of the Global Innovation Index to the countries. First of all, it allows to analyze innovation performance from different perspectives on an annual basis with comprehensive indicators. Second, it allows to explore potential areas of intervention by seeing the strengths and weaknesses of the innovation ecosystem. And finally, it paves the way for the development of evidence-based structural reforms for these intervention areas. (TİM, 2022).

Global Innovation Index (GII), which is a guideline for countries, helps them understand their current innovation performance and gives an insight about innovation trend for the foreseeable future (Bras, 2023).

The Global Innovation Index is prepared annually on an increasing number of countries and provides a basis for comparison among countries. Besides, in addition to innovation performance of countries, factors that affect the innovation is also defined (Baykul, 2022).

The Global Innovation Index (2022) ranks the innovation performance of 132 countries and highlights innovation strengths as well as the weaknesses.

In the literature, empirical studies are conducted on different country groups by using various innovation measurement methods. For instance, Bielińska-Dusza and Hamerska (2021) identified the factors affecting Summary Innovation Index and the rankings of countries on the European Innovation Scoreboard (EIS).

Various studies focus on market sophistication pillar of the Global Innovation Index. Financing as well as investment opportunities are investigated. Lumpkin and Dess (1996) pointed out that the difference between market innovation and technological innovation could lead an effective measure to shape innovation. From this perspective, market innovation is assumed as a significant input to reach the output as a result of innovation mechanism.

Balasubramanyam, Salisu, and Sapsford (1996) emphasized the significant impact of foreign direct investment as a proxy for market sophistication on the growth of productivity and knowledge diffusion. Besides, Abdolmohammadi (2005) exhibited the impact of intellectual capital disclosure on market capitalization.

Hall, Jaffe, and Trajtenberg (2005) indicated that market value is related with patent citation factors. Horbach (2008) pointed out that innovation is fostered by market structure as well as the applications for patents.

Oturakci (2023) conducted a comprehensive analysis of the Global Innovation Index on all countries from 2013 to 2022. Findings of canonical correlation analysis reveal that Human and Capital Research and Business Sophistication pillars define the Innovation Input Sub-Index with 69 % and 68 % respectively. Besides, the Creative Outputs factor demonstrates the Innovation Output Sub-Index at 98%.

Stojanovic et al. (2022) investigated the innovative competitiveness of Western Balkan countries. The indicators of Global Innovation Index for 2019-2021 period is analyzed by multi-criteria decision making. Findings indicate that Montenegro had the best innovation indicators, followed by Serbia whereas Albania had the lowest indicators.

Coutinho and Oliveira (2023) studied the factors influencing innovation performance of Portugal. The innovation performance of Portugal is compared with Ireland, Belgium, and the Czech Republic. Similar study is conducted by Al-Sudairi and Bakry (2014). In the study

the state of Saudi Arabia is compared with Brazil, Russia, Malaysia and South Korea by using the knowledge issues of the Global Innovation Index.

5. Empirical Analysis

Time series are generated for Part 4: Market Sophistication and its sub-headlines. Table 3 indicates Turkey's t-test results with other countries for 2013-2022 period. Russian Federation and Brazil are the countries that Turkey has not statistically different scores in most of the indices and financing related sub-pillars.

Turkey's Global Innovation Index score is statistically different than other countries except Russian Federation. Innovation Input Sub-index performance of Turkey is also statistically different than other countries except India and Brazil.

Turkey's Innovation Output Sub-index, market sophistication, loans from micro finance institutions and market capitalization scores are significantly different from all other countries.

On the other hand, credit score, finance for startups and scaleups score, domestic credit to private sector score, investment score, and venture capital investors-deals score are not significantly different from Russian Federation and India; South Africa, Russian Federation, and China; Brazil; Russian Federation, China, and Brazil; and Russian Federation, India, and Brazil respectively.

As a result, Turkey's finance for startup and scaleups and some investment scores are not different than China which has a leading position in almost all indices and sub-pillars among BRICS-T countries.

Turkey should give more attention specifically in credit sub-pillar's domestic credit to private sector part and additionally venture capital related parts of investment sub-pillar.

Table 3. T-Test Results

	GLOBAL INNOVATION INDEX	INNOVATION INPUT SUB-INDEX	INNOVATION OUTPUT SUB-INDEX	Market sophistication	Credit	Finance for startups and scaleups	Domestic credit to private sector, % GDP	Loans from microfinance institutions, % GDP	Investment	Market capitalization, % GDP	Venture capital investors, deals/on PPPs GDP
South Africa	<i>0,0054</i>	<i>0,0436</i>	<i>0,0002</i>	<i>0,0006</i>	<i>0,0004</i>	<i>0,2004</i>	<i>0,0000</i>	<i>0,0412</i>	<i>0,0000</i>	<i>0,0000</i>	<i>0,0909</i>
Russian Federation	0,4640	<i>0,0014</i>	<i>0,0123</i>	<i>0,0279</i>	0,3987	0,2321	<i>0,0182</i>	<i>0,0728</i>	0,1288	<i>0,0493</i>	0,3204
India	<i>0,0008</i>	0,1583	<i>0,0125</i>	<i>0,0170</i>	0,1120	<i>0,0044</i>	<i>0,0003</i>	<i>0,0000</i>	<i>0,0055</i>	<i>0,0000</i>	0,3171
China	<i>0,0000</i>	<i>0,0000</i>	<i>0,0000</i>	<i>0,0078</i>	<i>0,0000</i>	0,4679	<i>0,0000</i>	<i>0,0888</i>	0,1072	<i>0,0000</i>	<i>0,0195</i>
Brazil	<i>0,0000</i>	0,4218	<i>0,0001</i>	<i>0,0003</i>	<i>0,0204</i>	<i>0,0080</i>	0,2370	<i>0,0001</i>	0,3665	<i>0,0063</i>	0,4100

Note: Statistically significant results at 10 % are written in bold and italic format

6. Conclusion

The aim of this study is to reveal Turkey's Global Innovation Index performance in comparison with BRICS countries. For this purpose, the latest 2022 report was used. In addition, the main score performance of the Index and the two sub-components of the index were compared over the years (2013-2022), and it was tried to determine whether any difference was caused by a difference in financing.

This paper contributes to the literature about Turkish innovation system and its position amongst the BRICS country group. In order to overcome the challenges of the future, Turkey should understand its current position in terms of innovation input and output as well as the rankings. Regarding the market sophistication, Turkey should invest in digitalization and focus on financing alternatives in addition to investment opportunities.

Turkey's financing related sub-pillars are noteworthy. Credit climate in the country is outperforming. Investment climate must be improved and there is still way in investment indicators especially those related to venture capital related.

Country-based analysis results indicate that Turkey's performances in financing related sub-pillars are not significantly different from Russian Federation and Brazil generally. On the other hand, most of those are significantly different from China, the leader in almost all indices and pillars among BRICS-T countries.

In order to increase Turkey's score and increase its ranking China and India should be examined more closely in terms of GII pillars and their applications that make a difference should be taken as an example.

References

- ABDOLMOHAMMADI, M. J. (2005). "Intellectual capital disclosure and market capitalization". *Journal of Intellectual Capital* 6 (3): 397–416.
- AL-SUDAIRI, M., & HAJ BAKRY, S. (2014). "Knowledge issues in the global innovation index: Assessment of the state of Saudi Arabia versus countries with distinct development". *Innovation*, 16(2), 176-183.
- BALASUBRAMANYAM, V. N., SALISU, M., & SAPSFORD, D. (1996). "Foreign direct investment and growth in EP and IS countries". *The Economic Journal*, 106(434), 92-105.
- BAYKUL, A. (2022). "İnovasyonun Belirleyicileri: Küresel İnovasyon Endeksi Üzerinde Bir Araştırma". *Finans Ekonomi ve Sosyal Araştırmalar Dergisi*, 7(1), 52-66.
- BIELINSKA-DUSZA, E., & HAMERSKA, M. (2021). "Methodology for calculating the European innovation scoreboard—proposition for modification". *Sustainability*, 13(4), 2199.
- BRAS, G. R. (2023). "Pillars of the Global Innovation Index by income level of economies: longitudinal data (2011-2022) for researchers' use". *Data in Brief*, 46, 108818.
- COUTINHO, E. M. O., & AU-YONG-OLIVEIRA, M. (2023). "Factors influencing innovation performance in Portugal: A cross-country comparative analysis based on the Global Innovation Index and on the European Innovation Scoreboard". *Sustainability*, 15(13), 10446.
- GLOBAL INNOVATION INDEX (GII). (2022). What is the future of innovation driven growth? <https://www.globalinnovationindex.org/userfiles/file/reportpdf/gii-full-report-2022.pdf>
- HALL, B. H., JAFFE, A. and TRAJTENBERG M. (2005). "Market value and patent citations." *RAND Journal of Economics* 36 (1): 16–38.
- HORBACH, J. (2008). "Determinants of environmental innovation—New evidence from German panel data sources". *Research Policy* 37 (1): 163–173.
- LUMPKIN, G. T., & DESS, G. G. (1996). "Clarifying the entrepreneurial orientation construct and linking it to performance". *Academy of management Review*, 21(1), 135-172.
- OECD-Eurostat (2005), *Oslo Manual, Guidelines for Collecting and Interpreting Innovation Data*, Paris: OECD.

STOJANOVIC, I., PUSKA, A., & SELAKOVIC, M. (2022). "A multi-criteria approach to the comparative analysis of the global innovation index on the example of the Western Balkan countries". *Economics-innovative and economics research journal*, 10(2).

The Global Innovation Index Conceptual Framework (2020), (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020-appendix1.pdf)

OTURAKCI, M. (2023). "Comprehensive analysis of the global innovation index: statistical and strategic approach". *Technology Analysis & Strategic Management*, 35(6), 676-688.

TİM- Türkiye İhracatçılar Meclisi (2022). *Küresel İnovasyon Endeksi Türkiye Eylem Planı ve Stratejisi 2021-2023*, <https://tim.org.tr/files/downloads/Raporlar/KüreselİnovasyonEndeksiTürkiyeEylemPlanıveStratejisi2021-2023.pdf>, Erişim Tarihi: 08/08/2023

UNITED NATIONS (2023), <https://www.un.org/sustainabledevelopment/infrastructure-industrialization>, Erişim Tarihi: 08/08/2023