

ECONOMIC DEVELOPMENT THROUGH INNOVATION IN SIX ASIAN COUNTRIES

Iskren Konstantinov, PhD student
University of National and World Economy

Abstract. From the second half of the 20th century and into the 21st century, Asian countries have managed to achieve remarkable economic development with a focus on innovations. The intellectual property system, particularly the patenting system, has provided a means of protecting the innovative and useful technical solutions to problems generated on the continent and has been a prerequisite for establishing competitive market advantages. This paper focuses on the development of six Asian economies leading in different income groups from 2014 to 2023 – Singapore, South Korea, China, Malaysia, India, and Vietnam. The countries will be compared considering gross domestic product, patent applications, export of high technologies, number of researchers, and research and development expenditure. The paper looks to determine whether the observed various leading Asian economies rely on research and development and the help of the intellectual property rights system to create innovation and be more competitive.

Keywords: intellectual property; innovation; Asia

Introduction

From the second half of the 20th century continuing through the present day, some Asian countries have seen significant economic development fueled by the manufacturing of goods that are exported throughout the world. One of the main examples is Japan, which arose from the destruction created by the Second World War and created world-known industrial policies, company structures, and products that challenged the competitive advantage of established Western companies. Another example is South Korea, devastated by the Korean War, which had as its main manufactured exports in the 1960s clothing, plywood, and wigs, which accounted for 1 million dollars in 1960 and grew to 300 million dollars in 1969 (Hyong Chun Kim 1971). Today, the country is known as a leading technological innovator, exporter, and producer of smartphones, domestic appliances, and chips, among other technologies. Other now classic examples are Singapore and China. There are also examples of countries seen as developing and having future potential, such as Vietnam, which struggled with the consequences of the Vietnam War, India, which is in the 1st place as the most populated country in the world, etc.

For years, Asian countries have held leading positions in intellectual property protection, which is an important indicator of their innovative capabilities. In 2023, the Asian continent accounted for 68.7% of global patent application filings, compared to 58.4% in 2013 (WIPO Facts and Figures, 2024).

Economic development with a focus on innovations is crucial for companies and countries. Patentable innovations, which inherently are novel and useful, are a prerequisite for establishing a competitive market advantage, for technological growth, for generating higher income, and for the increase of highly competent workers. Creating impactful innovations at the current global technological level and surpassing that level require large multidisciplinary research teams capable of adapting and oriented towards generating new and creative solutions to existing problems. Gone are the days of the lone researcher who invents the next big thing working alone in a lab.

The paper will compare the development of six Asian economies leading in different income groups as presented in the World Intellectual Property Organization's annual Global Innovation Index. The high-income economies are Singapore and the Republic of Korea, the upper-middle-income – China and Malaysia – and the lower middle-income – India and Vietnam (WIPO Global Innovation Index, 2024). The countries will be compared considering gross domestic product, patent applications, export of high technologies, number of researchers, and research and development expenditures.

The present paper examines the innovation-focused economic development of six Asian countries over a ten-year period.

The aim is to determine whether the various leading Asian economies rely on research and development and the help of the intellectual property rights system to create innovation and be more competitive.

The author's thesis is that countries' economies can achieve noticeable growth with sufficient investments in research and development and the help of an intellectual property rights system.

Research limitations of the paper: The paper focuses on six Asian countries and therefore its conclusions cannot be considered valid for the whole continent. The intellectual property aspect of the paper is limited to inventions which form part of the industrial property subsystem of intellectual property. The other major subsystem – the literary and artistic property (the copyright and related rights system) is important from an economic, financial, and cultural standpoint. Its main object – the various types of works (literary, musical, architectural, audiovisual, etc.) can form complex systems of relations, can involve long and expensive processes, many IP rights holders, different types of funding, for example such as in the making of a film product (Ivanova 2024), but they are not as relevant to product innovations as the invention and are also not the goal of research and development. It is important to underline that although patenting activity provides valuable information, there is no way to confirm that an innovation protected by the intellectual property system has been implement-

ed or marketed by a company. The time scope of the paper is ten years (between 2014 and 2023) which allows observation of the economic development of the countries both before and after the pandemic which began in 2020 and had significant impact on the normal functioning of private and public organizations.

Intellectual Property and Innovation

In the International Standards section “Statistics of science, technology, and innovation,” innovation is described as the result of innovation activity, that is, a new or improved product introduced to the market, a new or improved technological process used in practical activity, or a new approach to social services (Damyanov 2004, p. 12).

Intellectual property (IP), established over the centuries through numerous national laws and international treaties, has specific characteristics that make it an indispensable factor in promoting global progress and boosting technological progress. A country’s government must have and maintain the necessary legislation and ensure that people do not violate it (Aleksandrov 2024).

The protection of intellectual property objects grants the owner of the object the exclusive right to use it, dispose of it, and prohibit third parties from using it without the owner’s permission (Patents and Registration and Utility Models Act 1993). Intellectual property rights are a state-granted monopoly for trading in the object and its copies.

Intellectual property is intangible. Due to this specificity, it can be used repeatedly by many people without that use causing depreciation of the object.

To obtain a patent for an invention, it must undergo an examination procedure carried out by experts at a patent office. There are three main criteria adopted across the world for determining the patentability of inventions – novelty (is it new), inventive step (does it build on what already exists in the world), and industrial applicability (can it be mass produced so people can benefit from its use). IP protection is limited in time (for inventions, in most countries around the world, this term is 20 years from the date of application) and has a territorial effect (protection is valid only in the territory where the patent for the invention was issued).

The granted monopoly over the invention is key, as it provides an opportunity for a return on the investments made by the creator of the invention and for generating profit. Creating innovations and the general search for solutions to existing problems can allow us to reduce production costs and increase profits.

Successful market implementation of innovations generates income for the company, which in turn, together with the acquired knowledge and experience, can be invested in improving the existing technologies of the enterprise and creating new ones. Therefore, consistent investment in R&D to develop new inventions is a prerequisite for sustainability in innovative development. It should also be noted that technologies today have shorter innovation cycles, creating the need for systematic and consistent R&D (Markova 2020). With that consistency, there

is a more significant possibility to produce novel and useful technical solutions to problems that can seek IP protections, and “intellectual property continues to be the main tool for achieving technical progress” (Petrova 2021)

Research shows a clear link between intellectual property rights, increased bilateral trade, and positive economic outcomes. Pfizer spent 10.679 billion dollars on research and development in 2023. Significant investments are characteristic of the pharmaceutical industry and most high technologies. Without the protection provided by the IP system, once the company released its medical products on the market its competitors would immediately adopt Pfizer’s research results in their production, and Pfizer itself would not be able to recoup the huge investments it made. Without the IP system and the financial incentive that it provides for companies to create innovations, research results would decline, which would undoubtedly affect the economic development of countries.

Singapore

Singapore is an island country covering 719.1 thousand sq. km. Its population is 6.02 million people. However, the country has an impressive GDP that has significantly increased in the observed period—from 314.86 billion dollars in 2014 to 501.43 billion dollars in 2023 (World Bank data).

The country’s gross research and development expenditure has consistently been around 2 % during the time period, with a low of 1.8% in 2018 and a high of 2.2 % in 2020 (Fig. 1). For the same period (2014 – 2020), according to the UNESCO Institute of Statistics, the average R&D expenditure as a % of GDP for the world was 2.09% in 2014, increasing to 2.49% in 2020. From that, we can conclude that the country’s investment in research has followed the global trends, slightly lagging in recent years.

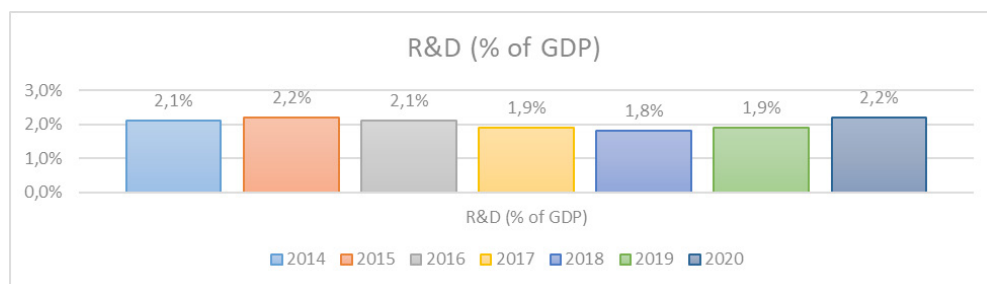


Figure 1. R&D (% of GDP)

Source: World Bank

An important metric in determining a country’s capability to generate innovations is the research personnel engaged in the activity. Per 1 million population,

Singapore had an increase from 6632 researchers in 2014 to 7225 in 2020 (Fig. 2). According to the UNESCO Institute of Statistics, the world average was 1521 in 2018, which means that Singapore is over four times the world average.

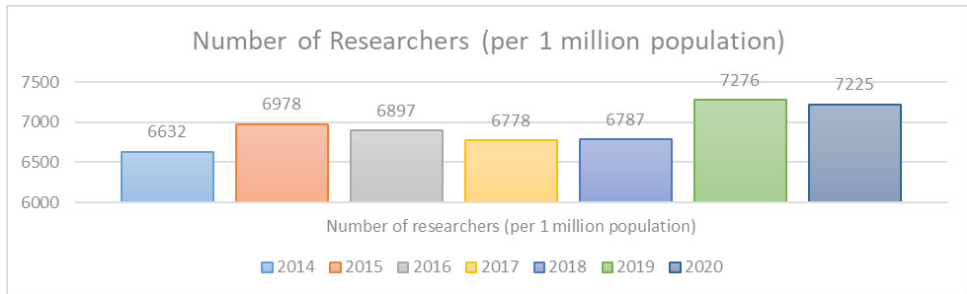


Figure 2. Number of Researchers (per 1 million population)

Source: World Bank

With expenditure in R&D as a % of GDP, which follows the average world expenditure and significantly more researchers than the world average, as well as the growth in the absolute their absolute number, Singapore has increased its patent application activity between 2014 (5937 applications) and 2023 (9450 applications) which shows that the country's financial and human capital investments lead to the generation of new technical solutions (Fig. 3).

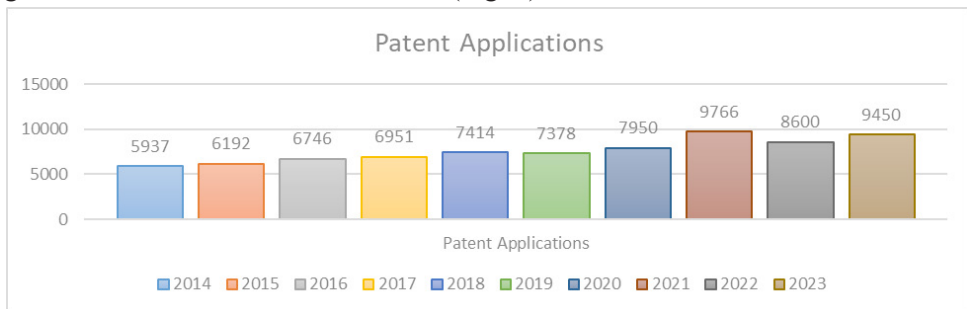


Figure 3. Patent Applications

Source: WIPO

The World Bank's data clearly shows that Singapore's high-technology exports as a percentage of all manufactured exports have increased from 50.64% in 2014 to 56.14% in 2023 (Fig. 4). That is also more than double the world average high-technology exports as a percentage of manufactured exports, which, according to the United Nations Comtrade, is 23% in 2023.

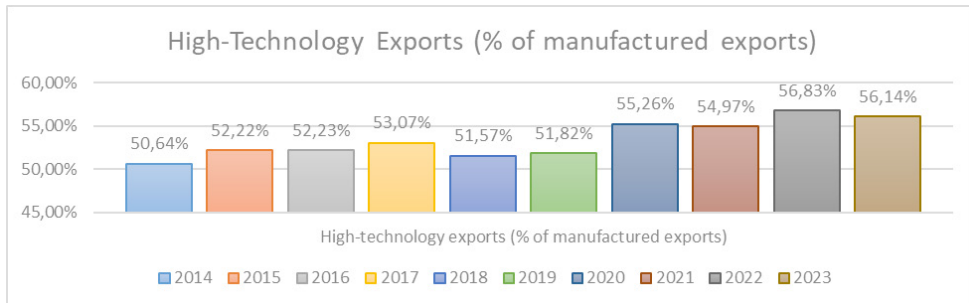


Figure 4. High-Technology Exports (% of manufactured exports)

Source: World Bank

Although Singapore's R&D expenditure as a percentage of GDP has slightly changed over the observed years, the country's GDP has risen substantially, which means an increase in total expenditure. We also see an increase in research personnel. Investment in innovation leads to positive results, shown in the big increase in patent applications and an increase in the country's high-technology exports.

South Korea

The Republic of Korea takes roughly half of the Korean Peninsula. It covers 99 thousand sq. km. and has a relatively big population with consideration of its territory - 52.08 million people. In the decades following the Korean War, the country focused on acquiring the necessary competence to develop its technological capacities. Its GDP has increased from 1.48 trillion dollars in 2014 to 1.71 trillion dollars in 2023. In 2021, a year after the pandemic's beginning, we see an increase to 1.82 trillion, which can be attributed to the technological specialization of the country and the global demand for technology such as chips, various appliances, transportation, etc. (World Bank data).

Korea spends significantly more than the global average for R&D 2.49% (2020) – from 4.1% in 2014 to 4.9% in 2023, steadily increasing over the years (Fig. 5). This indicates the importance of innovation for local organizations and the government.

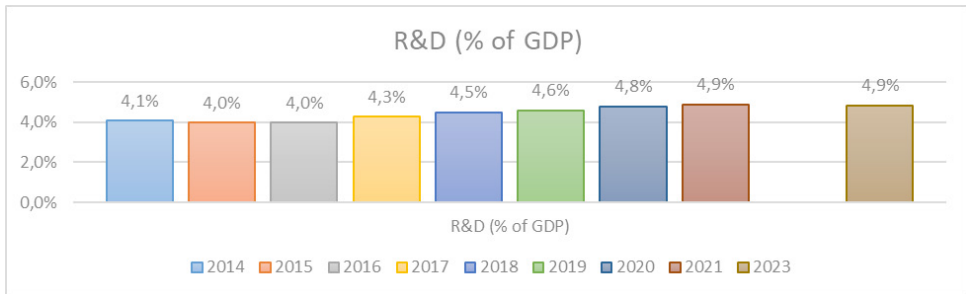


Figure 5. R&D (% of GDP)

Source: World Bank

We also saw a big increase in the number of people engaged in R&D between 2014 and 2021, from 6864 to 9082 (Fig.).

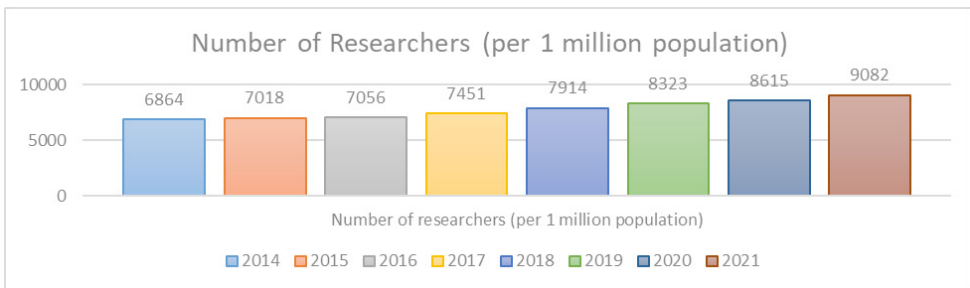


Figure 6. Number of Researchers (per 1 million population)

Source: World Bank

For a long time, the country has been among the leading Asian economies in patent application filing. We can see a substantial growth from between 226 and 238 thousand patent applications in 2014-2017 followed by a steady increase to 288,414 applications in 2023 (Fig. 7).

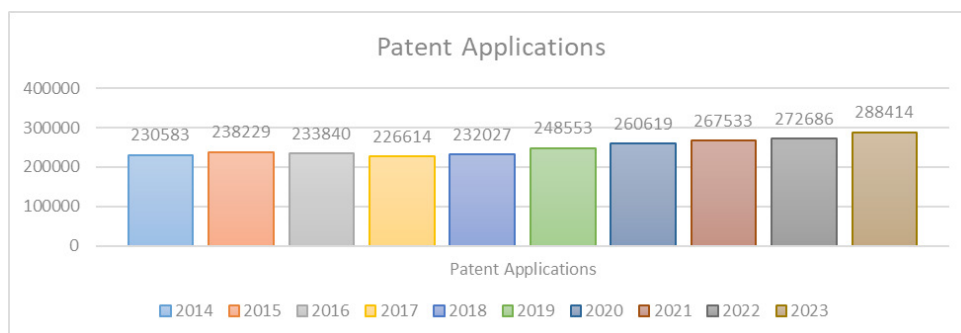


Figure 7. Patent Applications

Source: WIPO

36.12% of Korea's manufactured exports are high-technology exports. There is an increase in comparison with 2014, and the number is more than the global average (Fig. 8).

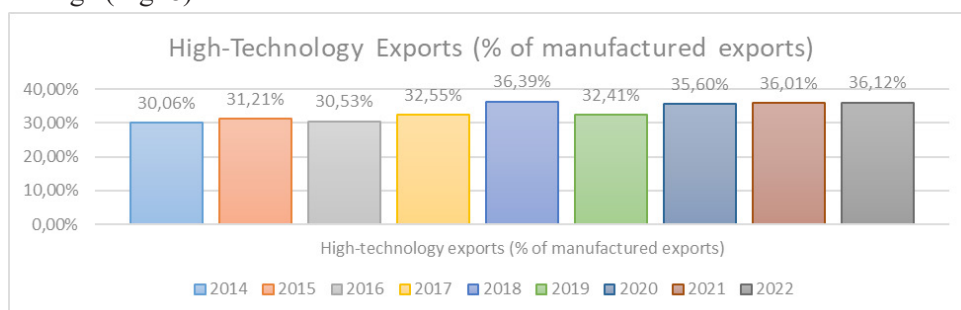


Figure 8. High-Technology Exports (% of manufactured exports)

Source: World Bank

In Korea, the comparatively large expenditure on R&D over the years has created a need for more research personnel, which has led to an increase in the use of the intellectual property system to protect the newly created research results.

China

The People's Republic of China covers a large land area of 9.59 million sq. km. The country is second in population behind India, with 1.4 billion people. China is world known for its rapid economic growth. We can clearly see that in the immense increase in GDP from 10.48 trillion dollars in 2014 to 17.79 trillion dollars in 2023 (World Bank data).

The country's gross R&D expenditure has grown from 2.0% in 2014 to 2.6% in 2023, which is above the world average and, considering its GDP, is a substantial investment in research (Fig. 9).

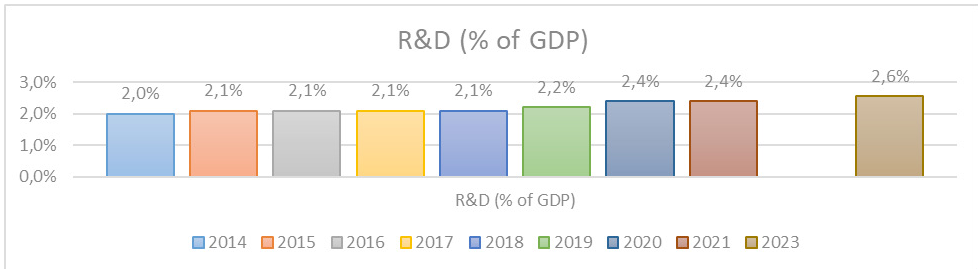


Figure 9. R&D (% of GDP)

Source: World Bank

The number of researchers per 1 million population was 1104 in 2014, and it has continuously increased to 1687 people per 1 million in 2021 (Fig. 10).

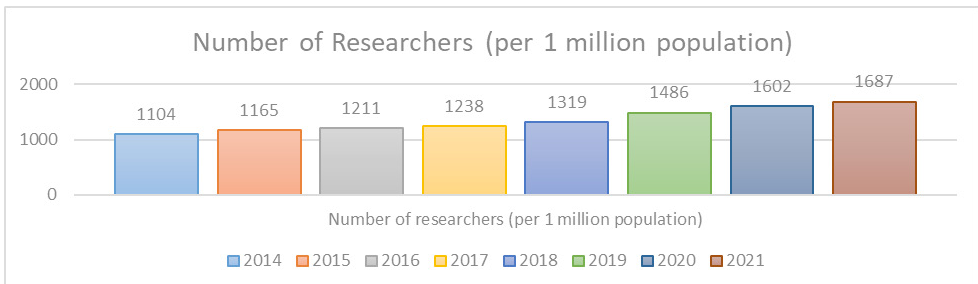


Figure 10. Number of Researchers (per 1 million population)

Source: World Bank

China is the global leader in patenting activity, with 1,664,331 patent applications in 2023, doubling from 837,857 in 2014 (Fig. 11). This shows a remarkable increase in the creation of new intellectual property.

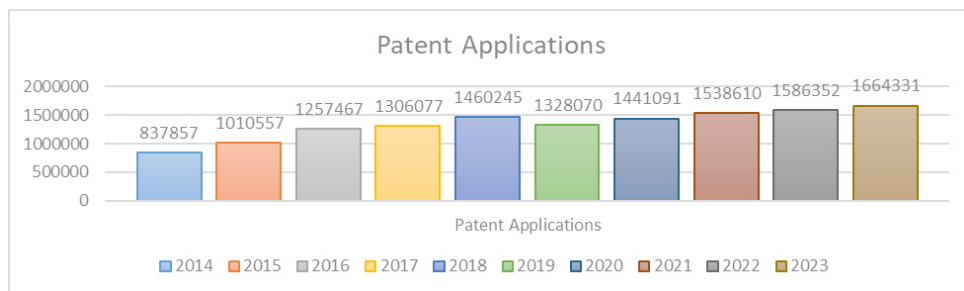


Figure 11. Patent Applications

Source: WIPO

The data from the World Bank show a relatively steady level of high-technology exports as a percentage of manufactured exports between 2014 and 2020 (a low of 29.7% in 2014 and a high of 31.55% in 2018), which significantly decreases in 2021 and 2022, and reaches 26.57% in 2023 (Fig. 12). That can be attributed to tariffs, export restrictions, bans on the use of certain Chinese technologies, and investments in certain Chinese technologies imposed on the country by the US Administration.



Figure 12. High-Technology Exports (% of manufactured exports)

Source: World Bank

The People's Republic of China is an example of an unprecedented increase in innovation, as seen by the doubling of its patent filings, increase in research, and steady expenditure in R&D that is above the global average. Geopolitical issues mainly affect and can further affect its technological development and presence in global markets.

Malaysia

The Malaysian monarchy covers 329.8 thousand sq. km. and has a population of 34.56 million people. According to the World Bank statistics, its GDP has increased

from 338 billion dollars in 2014 to 399.7 billion dollars in 2023, with a high of 407 billion dollars in 2022 (World Bank data).

The country, which is among the leading high middle-income economies, spent 1.3% of GDP on research and development in 2014, growing to 1.4% in 2016 and decreasing to 1.0% in 2020. That is significantly below the global average (Fig.13).

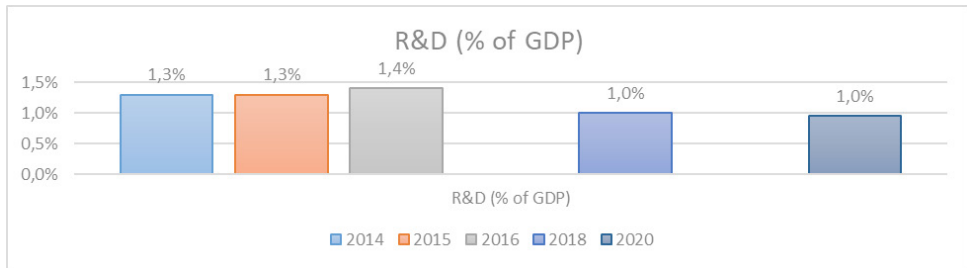


Figure 13. R&D (% of GDP)

Source: World Bank

The low investment in R&D is accompanied by a relatively low number of researchers per 1 million population—from 2020 people in 2014 to 726 people in 2020 (Fig. 14).

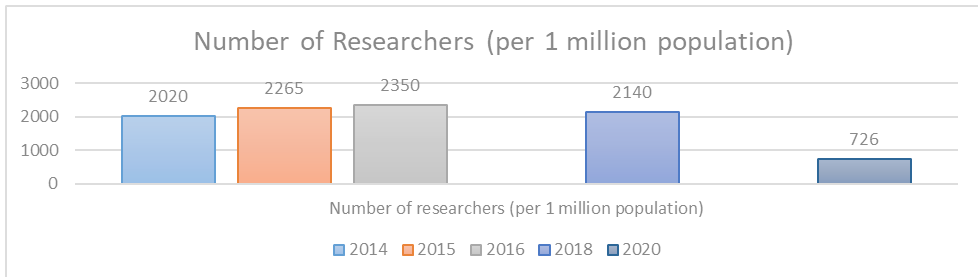


Figure 14. Number of Researchers (per 1 million population)

Source: World Bank

As it comes to Malaysia's patent application activity, we can see a decrease in filing from 2661 applications in 2014 to 1684 applications in 2023. There is an evident decline in the generation of new technical ideas that seek the protection of the IP system (Fig. 15).

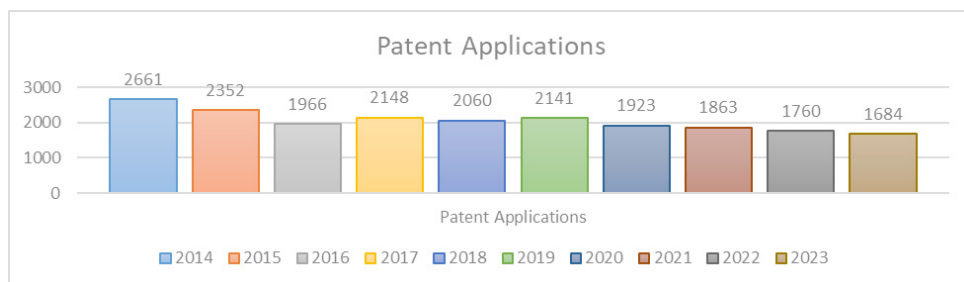


Figure 15. Patent Applications

Source: WIPO

When it comes to its manufactured exports, Malaysia's high-technology exports account for a large share – from 49.22% in 2014 to 59.42% in 2023, which is well above the world average of 23% in 2018 (Fig. 16).

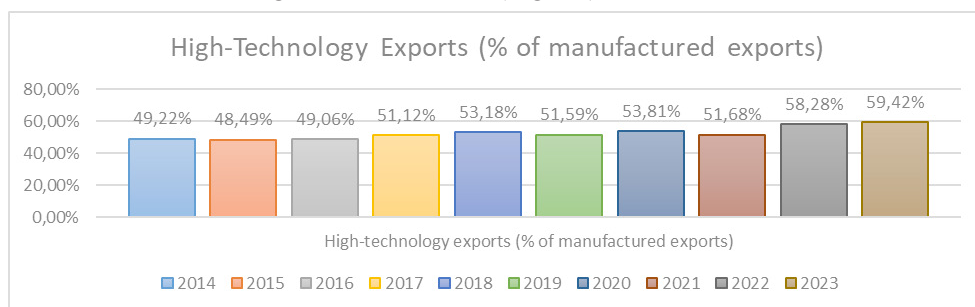


Figure 16. High-Technology Exports (% of manufactured exports)

Source: World Bank

The country's GDP has not shown a clear increase over the years. In fact, there have been various highs and lows. R&D expenditures and the number of people engaged in research are low, understandably leading to a significant decrease in patent filings.

India

The Republic of India covers an area of 3.28 million sq. km. and is the most populous country in the world, with 1.4 billion people. Because of its impressive population, India is considered a lower middle-income economy and an Asian state with a large potential for future economic development. The country's gross domestic product has steadily expanded from 2.04 trillion dollars in 2014 to 3.57 trillion dollars in 2023 (World Bank data).

Gross R&D expenditures were considerably below the world average of 2.49% in 2020 and have decreased from 0.70% in 2014 to 0.64% of GDP in 2020 (Fig. 17).

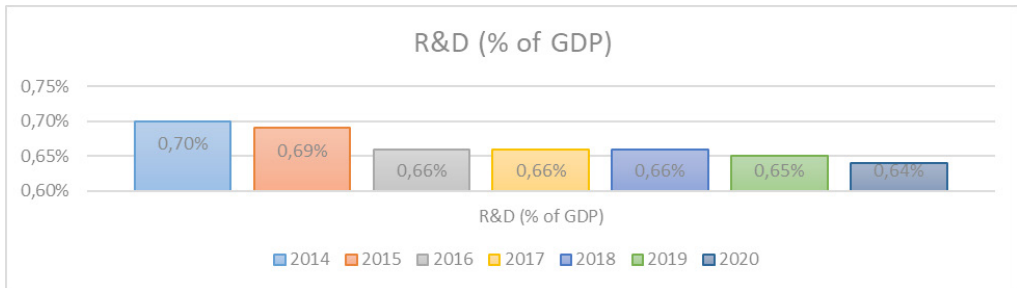


Figure 17. R&D (% of GDP)

Source: Tradingeconomics.com

The number of researchers per 1 million population is notably less than the global average of 1521 researchers in 2018. In India, there were 215 researchers per 1 million population in 2015, which grew to just 260 in 2020 (Fig. 18).

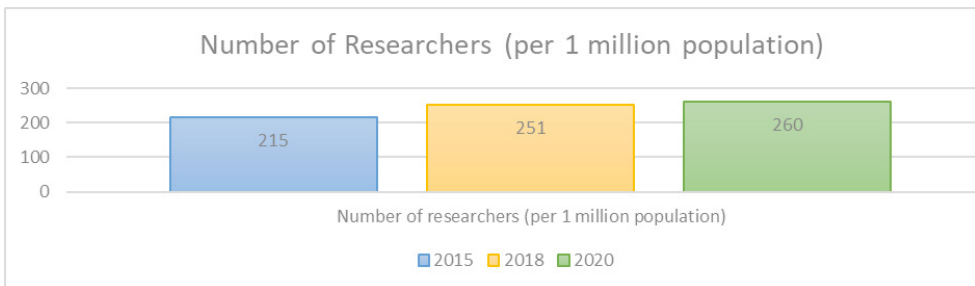


Figure 18. Number of Researchers (per 1 million population)

Source: World Bank

India's patenting activity increased almost threefold between 2014 and 2023, from 22,476 applications to 65,204 applications (Fig. 19). This is a significant increase in the generation of new technical solutions to problems for which IP protection is sought.

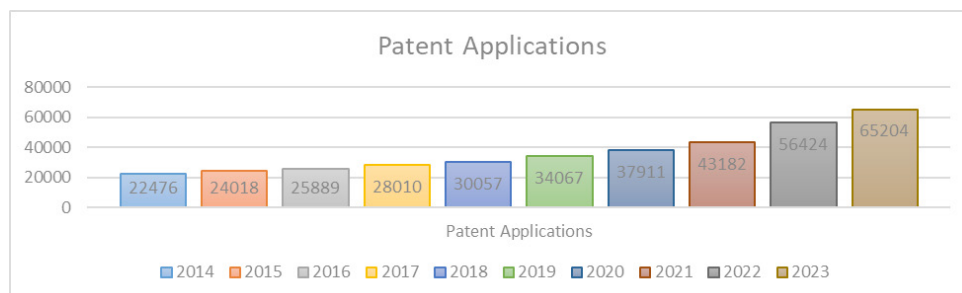


Figure 19. Patent Applications

Source: WIPO

The country's high-technology exports grew from 9.22% of all manufactured exports in 2014 to 14.93% in 2023 (Fig. 20), which is below the world average.



Figure 20. High-Technology Exports (% of manufactured exports)

Source: World Bank

The Republic of India has seen an increase in its GDP as well as in its patent applications. It has a very low number of researchers per 1 million people and invests significantly less in R&D than the rest of the world. We can see that those aspects also affect its high-technology exports, which are also below the world average. Considering its GDP and population, the country has more potential for innovation if it increases its expenditure on R&D.

Vietnam

The Socialist Republic of Vietnam covers an area of 331.21 thousand sq. km. and has a population of 105.7 million people. The country's GDP has steadily increased from 233.45 billion dollars in 2014 to 429.72 billion dollars in 2023 (World Bank data).

Vietnam has a gross R&D expenditure that is significantly below the world average. In 2015, it was estimated that 0.35% of GDP, and it will slightly increase to 0.42% in 2021 (Fig.21). That is indicative of a lack of focus on the development of an innovation-based economy.

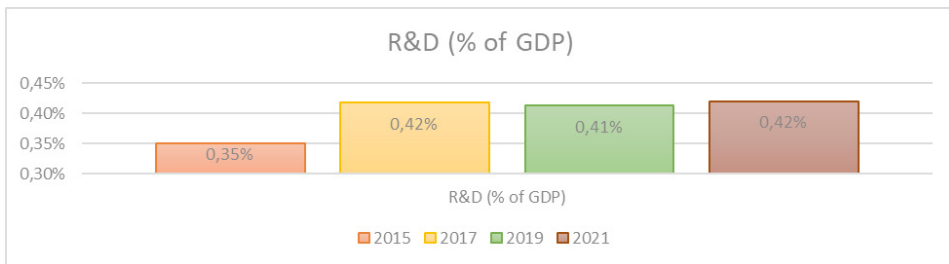


Figure 21. R&D (% of GDP)

Source: Tradingeconomics.com

The number of researchers per 1 million population is roughly half that of the world average, but it increased from 686 researchers in 2015 to 779 researchers in 2021 (Fig. 22).

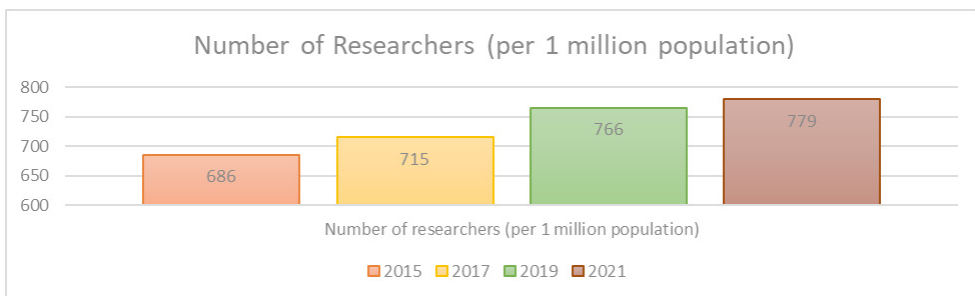


Figure 22. Number of Researchers (per 1 million population)

Source: World Bank

The country doubled its patent application filings from 562 to 1119 between 2014 and 2023 (Fig. 23).

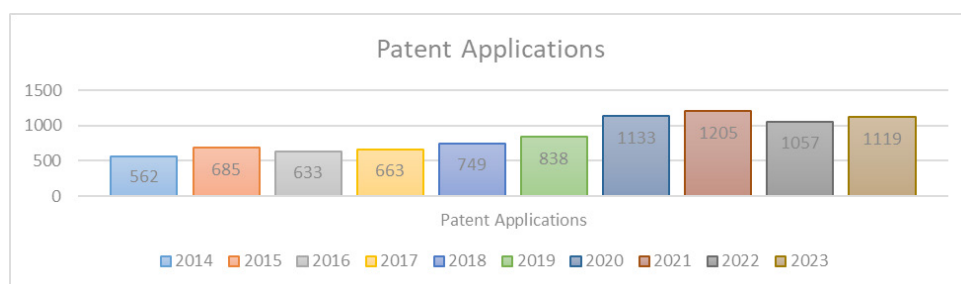


Figure 23. Patent Applications

Source: WIPO

The high-technology exports as a % of all manufactured exports were 32% in 2014, which increased to 42.69% in 2022. That is above the world average (Fig. 24).



Figure 24. High-Technology Exports (% of manufactured exports)

Source: World Bank

Although Vietnam has seen a significant increase in its GDP, and the share of high-technology exports in all manufactured goods is above the average, the country has notably low expenditures on R&D and a below-average number of researchers. That shows the country's potential for further technological development if it moves its investment towards the world average.

Conclusions

Firstly, it should be noted that all researched countries – Singapore, Korea, China, Malaysia, India, and Vietnam, have experienced an increase in their gross domestic product between 2014 and 2023. We see the largest GDP increase in Vietnam (84%), followed by India – 75%, China – 69.7%, Singapore – 59.2%, Malaysia – 18.2%, and Korea – 15.5%.

The country with the largest patent filing activity is China, which filed 1,664,331 patent applications in 2023, followed by South Korea, which filed 288,414 patent

applications in 2023. Although the population of Korea is roughly 27 times less than that of China, its patenting activity is only six times less, and the number of researchers is about 5 times more than that of China per 1 million researchers. Among the researched countries, Korea has a significantly larger R&D expenditure as a % of GDP, which seems to compensate for its relatively small population. Both countries have grown their economies over the observed period.

The other four countries have significantly fewer patent applications. Among them, India has the most applications, with 65,204 in 2023. Considering its position as the most populated country, that is about 25 times less than China's filings, which has a similar population. Singapore follows with 9450 filings in 2023, which is impressive considering that it has the smallest population among the researched countries – 6 million people. Singapore also has the biggest number of researchers per 1 million population – 9450, substantially more than everybody else. China and Korea.

Malaysia and Vietnam have similar patenting activities – 1684 and 1119 in 2023. However, Vietnam has a population about three times larger than Malaysia – 105.7 million to 34.5 million.

China, Singapore, and especially Korea's expenditures on R&D as a percentage of GDP clearly indicate the focus on creating innovation, which also results in patent filings.

With regard to investing in research, India and Vietnam's R&D expenditure is systematically under 1% of GDP, while Malaysia's is slightly above 1%. That is well below the world average of 2.49% in 2020 and signals a lack of focus on innovation for future economic development. However, it also poses an opportunity for potential economic growth if those countries decide to aim towards the global average and increase their expenditure. That will also affect the low number of researchers. India had 260 researchers in 2020 per 1 million population, Malaysia – 726 in 2020, and Vietnam – 779 in 2021. That is significantly lower than the global average.

Considering the significant increase in GDP of countries with low R&D expenditure and researchers such as India and Vietnam, we can attribute that to a large extent to the fact that countries such as Korea and Singapore experienced their intensified economic development in the second half of the 20th century and are considered developed knowledge-based economies whereas India and Viet Nam are still developing economies. It can also be concluded that the economies of India, Vietnam, and Malaysia are not based on new, patentable, homemade innovations, and they rely on generating growth through lower-value industries compared to China, Korea, and Singapore. If those less developed countries want to compete with developed countries, they will have to put an emphasis on R&D, specialized research personnel, and their own IP, which can lead to bigger exports of higher-value technologies in the global market.

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✉ **Iskren Konstantinov, PhD student**

Intellectual Property and Technology Transfer Department
Business Faculty
University of National and World Economy
19, December 8th St.
1700 Sofia, Bulgaria
E-mail: iskrenk@unwe.bg