

Challenges of employing scientific research to support economic growth in Arab Countries

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Abstract

Arab countries face many challenges in investing their scientific and research capabilities in order to achieve economic growth and reach the desired development goals. These challenges include the absence of clear policies that link scientific research with development plans, as well as weak funding allocated to scientific research, in addition to weak coordination between universities and research centers on the one hand and economic sectors on the other hand. Brain drain abroad has also led to a lack of competencies and expertise needed to develop and grow local economies, not to mention weak infrastructure and the absence of an environment that supports creativity and innovation, which requires the development of comprehensive strategies that enhance scientific research skills and provide the necessary incentives for scientists and researchers while strengthening the link between academic circles and economic sectors.

1. Introduction

Employing scientific research to support economic growth is a fundamental and necessary topic to ensure a sustainable future in Arab countries, especially with the rapid developments witnessed by the global economy, as innovation and investment have become a basic condition for achieving well-being and prosperity. Despite the scientific and human capabilities and components that Arab countries possess, there are gaps between the outputs of scientific research and the needs of the economy, which is still ongoing, which limits its use or efficient employment in achieving sustainable growth (Al-Mahmoudi, 2019).

Scientific research currently represents the cornerstone of building advanced economies capable of facing the challenges of the era by supporting and encouraging innovation, knowledge, enhancing competitiveness, all of which requires monitoring, and diagnosing the obstacles and difficulties that stand in the way of the growing role of the knowledge economy and adapting it to serve scientific research.

Most Arab countries face great difficulties in employing the outputs of scientific research to support the needs of the economic and productive sectors, which creates a gap between them that weakens the path of economic growth and stands as an obstacle to the development of these economies and their development capabilities. Therefore, the research problem revolves around the following question: What are the most important challenges facing the investment of scientific research and its employment in order to achieve the targeted economic growth?

To highlight the most important challenges facing the employment of scientific research in the development of Arab economies, especially with regard to financing issues and linking the outputs of scientific research to the productivity of economic sectors. The research also focuses on the need to transform scientific research into a driving force and engine for economic growth in a way that serves the future of these countries and enhances their economic growth.

Developing countries in general and Arab countries in particular face many challenges that hinder their economic growth, especially in the field of developing effective and efficient policies that work to link scientific research with the development of the local economy and its growth in a way that achieves development goals.

The importance of the research comes from addressing the most important difficulties facing Arab countries in the field of employing scientific research and linking it to the economic and developmental performance of those countries and the most important means and proposals to narrow this gap in order to keep pace with the rapid global economic developments and achieve the goals of growth and development.

1.1. The Concept of Scientific Research, Its Characteristics and Types

There are many definitions and concepts of scientific research. It can be understood as a means of study through which a solution to a specific problem can be reached by conducting a comprehensive investigation of all evidence and observations related to that problem and verifying them. Scientific research is also viewed as an organized investigation that aims to add knowledge that can be verified and scientifically tested, or as an attempt to discover and verify new information or relationships.

This means that scientific research requires the existence of a specific problem that encourages the researcher to study it in an organized and scientific manner. Through this process, the researcher follows the scientific method in order to interpret the problem and reach new results and facts. In this regard, scientific research depends on a specific scientific method or approach. It is also seen as a way to increase the facts and information known by individuals, enabling them to adapt better to their environment and control it.

Scientific research includes all fields of knowledge and addresses various problems, as it is used in all areas of life. One of its most important characteristics is objectivity, which means that the steps of scientific research should be carried out objectively, away from bias and personal opinions, since objectivity prevents the researcher from reaching unscientific results.

Another characteristic of scientific research is testability. The research problem must be measurable and testable, and it should be possible to collect information about it and examine the validity of the hypotheses associated with it. Scientific research should also allow the possibility of repetition and generalization. If the same problem is tested again by following the same methodology, research steps, and conditions, it should be possible to obtain the same results, and these results may be generalized to similar cases in the same country or in another country.

Scientific research is also characterized by abbreviation and simplification. This means using logical processing in presenting the research problem, arranging data and information in a logical sequence, and simplifying them without complexity in the method of analysis. In addition, scientific research must have a clear goal or purpose. The researcher should have a specific objective that he or she seeks to achieve through the research steps, without being distracted by secondary issues that are not related to the main goals of the research.

Flexibility is another important characteristic of scientific research. Research should be suitable for different problems and phenomena and should be able to address them accurately and correctly. Scientific research is also cumulative, meaning that knowledge develops through accumulation. In this context, the importance of previous studies appears at the beginning of the research, as they provide a foundation for the current study.

Finally, scientific research is characterized by organization. This means following the scientific method in presenting and sequencing data, defining the problem, and investigating it in order to reach results. Organization makes the research easier for readers to understand and enables them to interact with it accurately (Al-Mahmoudi, 2019). The importance of scientific research comes from its contribution to the development of individuals and the improvement of their cognitive ideas as well as technological development in addition to investigating the problems and facts that confront people such as epidemics, diseases, economic, educational, social problems, etc. Scientific research

also adds new information and helps in making adjustments to previous results and information in order to continue and develop. Scientific research contributes to the transfer of knowledge and sustainable development for future generations in addition to its interpretation of various phenomena and the search for means to avoid the damages resulting from the problems studied (Bin Al-Niya & Budoukha, 2023).

As for the types of scientific research, they are many and varied. Research can be classified according to its nature or purpose into several types, including basic research, applied research, documentary research, field research, experimental research, academic research, and non-academic research (Dabis, n.d.).

Basic research, which is also called theoretical research, aims to add knowledge and science. The main motive of this type of research is to develop theoretical concepts and reach facts. It is usually derived from initial and intellectual problems and has a theoretical nature. However, its results may later provide foundations and solutions for current or immediate problems. In contrast, applied research aims to apply research results in order to address a specific problem or difficulty related to a particular phenomenon. This type of research seeks to identify the actual causes of the problem studied, discover new information about it, and benefit from the findings in practice.

Documentary research relies on the historical method in tracing a phenomenon from its emergence, through its stages of development, to its causes, in order to explain it. This type of research depends on printed and unprinted sources and documents, such as periodicals, books, and bulletins. Field research, on the other hand, is conducted by collecting data and information directly from field units, such as institutions, establishments, companies, and human communities, either through questionnaires or interviews.

Experimental research is conducted in various types of practical laboratories, whether in the humanities or applied sciences. In this type of research, the researcher collects information through observation, measurement, and the available surrounding conditions without changing them. Academic research refers to research related to universities, institutes, graduate students, and academic institutions. It is usually closer to theoretical research than applied research, although its applications and results may still be useful later.

Non-academic research is specialized research conducted in various departments, companies, and institutions with the aim of developing their work and addressing the problems they face. This type of research is usually closer to applied research because it focuses on practical solutions and the improvement of institutional performance.

1.2. The Conceptual Aspect of Economic Growth

Economic growth refers to the increase in real production per capita and is proportional to the percentage change in real Gross Domestic Product (GDP) per capita within a certain period, usually one year. It can also be understood as the total production of goods and services divided by the population in a year. Some thinkers believe that economic growth is the real and continuous increase in the economic performance index, which means that it represents the increase in the income of a particular country and is usually measured by the percentage growth of GDP over a year.

Technological development, the increase in capital, and the improvement of education levels are among the main factors that determine economic growth (Abbas, 2011). Accordingly, economic growth can be seen as quantitative growth that expresses the increase in production in the long term. In other words, it refers to the long-term increase achieved in a country's production and therefore represents the successive expansion of the economy.

Economic growth may be associated with economic progress if the growth rate of the national product is greater than the population growth rate. However, it may not be accompanied by economic progress if the growth rate of the national product is equal to the population growth rate. Growth may also be accompanied by a state of economic recession if the population growth rate is higher than the growth rate of the national product. Therefore, growth is a necessary but not sufficient condition for raising the material standard of living of individuals. Another important condition is

the way in which the achieved increase is distributed among individuals, which is related to the nature of the economic and political system of the state (Khashab, n.d.).

Economic growth can be divided into two main categories: quantitative growth and qualitative growth. Quantitative growth occurs when production is increased by increasing inputs under a certain technological and industrial level. Qualitative growth, on the other hand, occurs when production is developed and improved through technological progress resulting from innovation and creativity, through the introduction of new products that create new demand, or by strengthening industrial structures.

Qualitative growth in agricultural products and societies is relatively limited because technological development in the agricultural sector tends to be slower compared to industrial societies and sectors. Industrial sectors are more characterized by qualitative growth due to the clear emergence and influence of technological progress within them.

Economic growth has several characteristics. It does not necessarily focus on who benefits from the fruits of growth or how these benefits are distributed among individuals. It also contributes to maintaining national and food security and generates investment opportunities in many areas. In addition, growth has a cumulative nature, meaning that if a certain country grows faster than other countries, the gap between that country and the others will increase.

Economic growth also leads to an increase in living standards in the long term. It may occur automatically without direct state intervention in planning and investment. However, economic growth is considered a less comprehensive concept than development, since development usually requires state intervention and includes broader social, economic, and institutional dimensions (Al-Khatib & Diab, 2013).

Economic growth also has several types. Growth may be automatic as a result of the high flexibility of the economic structure, or it may be transient growth that does not have the characteristic of continuity and occurs as a result of external circumstances. There is also planned growth that arises as a result of prior scientific planning of resources and the requirements of society. There is also expanded growth and intensive growth. These latter types include linking income growth to the population growth rate (Atallah & Abdullah, 2021).

1.3. The Relationship Between Scientific Research and Economic Growth

Scientific research is one of the important means of spreading knowledge through research in various scientific, human, social and natural fields. This research is directly related to economic growth and development requirements. It contributes to increasing production rates, developing its quality and using modern technologies. Many countries have used scientific research tools and technological and cognitive progress as basic means of innovation and creativity, which are necessarily reflected in improving and increasing production and thus raising economic growth rates. The growth of most countries is due to the knowledge stock and maximizing knowledge wealth and benefiting from it, especially in the field of applied scientific research, which has an effective impact on economic and social growth and makes countries excel economically and technically.

Knowledge and scientific research are in continuous development until they have reached digital technologies at the present time. The knowledge economy depends on interactive information based on and collecting data from various sources to be a useful means that can be invested in developing various economic sectors and achieving targeted growth.

Some economists have found that technological differences are among the main reasons for income disparities between countries, while education plays a central role in strengthening the ability to use new technology and narrowing the technological gap among nations. Several indicators support this view, as knowledge is considered one of the most important forms of basic capital, and economic growth depends greatly on the accumulation of knowledge. Modern technologies and innovations produced through scientific research also contribute to higher growth rates. Furthermore, creativity and innovation resulting from scientific research can encourage investment

and support sustainable growth. Intellectual property rights also play an important role because they stimulate investment in research and development, which in turn contributes to economic growth. Therefore, technology and technical progress help increase gross domestic product and improve productivity by relying on scientific research and innovation (Al-Shammari, 2008).

2. Method

The research adopts the descriptive and analytical method to study the reality of scientific research in Arab countries and the factors that hinder its employment to support economic growth by dividing the research into several topics, the first includes: the theoretical framework of scientific research and economic growth, while the second topic is about the reality of scientific research in Arab countries and its trends, while the third topic includes the challenges of employing scientific research to support economic growth and development in addition to addressing the most important opportunities available to enhance the role of scientific research in productivity and welfare.

3. Results and Discussion

3.1. The Reality of Scientific Research and Trends in Economic Growth in Arab Countries

3.1.1. The Reality of Arab Scientific Research

The reality of scientific research in Arab countries remains relatively low compared to developed countries, even though Arab countries possess material capabilities that could place them at the forefront of scientific research. According to Al-Ruwaili (2024), scientific research in these countries is characterized by several challenges, including the scarcity and weakness of scientific research inputs, the low number of researchers in both academic and non-academic institutions, and the limited quality of research outputs as a result of weak inputs. In addition, the level of educational systems in academic institutions remains relatively low, while scientific research and innovation skills among pre-university students are still weak. The number of research centers in Arab countries is also limited, and scientific research has not yet become one of the main priorities of Arab governments. These conditions indicate the need to strengthen the concept of scientific research, improve its characteristics and types, and increase institutional support for research development. Table 1 presents the ranking of Arab countries according to the number of published research outputs relative to the total research production of Arab countries during the period 2008–2018 (Al-Khatib, 2020).

Table 1. Ranking of Arab Countries by Research Publications, 2008–2018

Arrangement	Country	Number of Researches	Percentage
1	Saudi Arabia	112,256	25
2	Egypt	106,891	24
3	Tunisia	48,417	11
4	Algeria	37,137	8
5	Morocco	26,914	6
6	UAE	25,360	6
7	Jordan	16,890	4
8	Qatar	16,328	4
9	Lebanon	15,087	3
10	Iraq	12,119	3
11	Kuwait	9,294	2
12	Oman	7,793	2
13	Sudan	4,379	1
14	Palestine	3,786	1
15	Syria	3,251	1
16	Libya	2,902	1
17	Yemen	2,235	0
18	Bahrain	2,224	0
19	Mauritania	300	0
20	Djibouti	118	0
21	Somalia	74	0
22	Comoros	68	0
Total published Arabic papers		410,549	100

As it is clear above that the percentages are generally low, but Saudi Arabia ranked first in the Arab world, publishing (122,565) and its percentage is 25 percent, which is equivalent to a quarter of Arab research production, followed by Egypt in second place with 24 percent. We find that there are four Arab countries (Saudi Arabia, Egypt, Tunisia and Algeria) that are the most productive in research during the period (2008-2018). When compared to the population, the population percentage in Egypt is equal to (22.5) percent, while the population percentages in Saudi Arabia were 14.3 percent and Tunisia (13) percent and 2.78 percent of the population of the Arab world, meaning that Tunisia comes in first place in terms of the percentage of research per person, while Algeria ranked fourth, contributing approximately 9 percent of the total Arab production (Al-Khatib, 2020). The contribution of scientific research to the gross domestic product in Arab countries ranged between zero and one percent ("The Reality of Scientific Research in the Arab World," n.d.), and despite some developments and successes achieved by some Arab countries in this field recently, as they introduced digital technology and research into their development projects, these Countries are still far from catching up with global cognitive development due to many obstacles that will be mentioned later.

3.1.2. Trends in Economic Growth in Arab Countries

The concept of economic growth is linked to the role of human capital and technology, especially in modern theories, including what is known as internal growth models, which emphasized the link between long-term growth and the state's ability to base its activities and production on intangible resources represented by technology and technical development, which is the result of its human capital and their potential for innovation and creativity, which in turn is based on their research and intellectual outputs, so that the knowledge and technological factor becomes one of the most important components of growth. Accordingly, increasing and raising economic growth rates responds greatly to the extent of interest in scientific research and the extent of improving the quality of education and knowledge. In general, the contribution of economic activities to economic growth varies from one Arab country to another. Some are affected by the manufacturing sector, others are affected by extractive industries, and others may be affected by the services sector, and so on.

Local factors have a major role and drive for economic growth in Arab countries. On the demand side, there is the factor of consumer spending, government spending, and investment, in addition to net trade, which is one of the important determinants of expansion and growth. As far as scientific research is concerned, we find that it is The factors determining economic growth from the supply side, most notably capital formation, as investments in physical assets such as infrastructure, machinery and buildings are among the most important stimuli for growth, which are linked to increased production capacity and improved productivity, leading to building a stronger and more diversified economy. This is also linked to the workforce, their productivity and their education, referred to as human capital, as the quality of the workforce is no less important than its size, which leads to enhanced productivity and innovation. As for techniques and technology, they are among the important factors in influencing economic growth at the present time, as they are a basic driver of growth currently compared to other factors, which necessarily requires encouraging scientific research and adopting scientific and cognitive capabilities to support the growth path efficiently (Arab Monetary Fund, 2024).

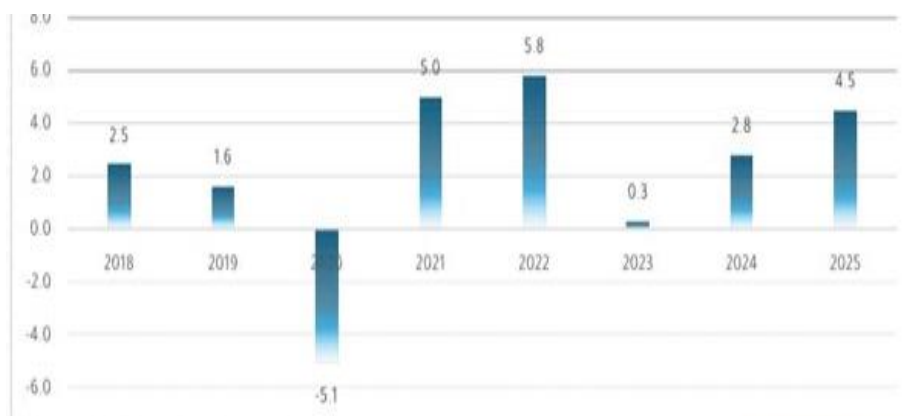


Figure 1. Economic growth rates to the horizon of 2025 (Arab Monetary Fund, 2024)

Economic growth rates generally indicate low rates, but we find that oil countries have higher growth rates than others, such as Saudi Arabia and the Emirates. In addition, these countries have clearly adopted technological development compared to other countries and supported and encouraged research and scientific capabilities, as they focused on investing in human capital, which was positively, reflected in their economic growth paths, as shown in Table 2.

Table 2. Economic growth rates in Arab countries for the period (2019-2024) (Al-Khatib, 2020)

Countries	2019	2020	2021	2022	2023	2024
Saudi Arabia	1.1	3.6-	5.1	7.5	0.8-	4.4
United Arab Emirates	1.1	5.0-	4.4	7.5	3.1	3.9
Qatar	0.8	3.6-	1.5	4.2	1.6	1.8
Kuwait	0.6-	3.4-	1.7	6.1	1.9-	2.7
Oman	1.1-	3.2-	3.0	4.3	1.3	2.3
Bahrain	2.2	4.9-	2.2	5.1	2.6	3.5
Arab oil exporting countries	1.2	4.2-	3.2	7.4	0.6	3.7
Algeria	0.8	4.9-	4.0	3.6	4.2	4.2
Iraq	5.8	15.7-	5.9	7.0	2.6-	3.1
Yemen	2.1	8.5-	2.0-	1.3	0.8-	1.5
Libya	13.2	59.7-	177.3	5.5-	12.1	6.2
Other Arab oil exporting countries	3.8	13.4-	15.6	4.3	2.0	3.7
Egypt	5.6	3.6	3.3	6.7	3.8	3.2
Morocco	2.9	7.2-	8.2	1.5	3.4	3.2
Jordan	2.0	1.6-	2.2	2.4	2.6	2.5
Tunisia	1.5	8.7-	4.5	2.8	0.4	1.9
Mauritania	5.6	1.8-	3.0	6.4	3.4	4.3
Palestine	1.4	11.3-	7.0	4.1	5.3-	4.2-
Lebanon	7.3-	27.7-	15.2-	1.7-	1.2-	0.4-
Sudan	2.5-	3.6-	0.5	1.7-	29.7-	15.7-
Djibouti	6.5	1	4.0	3.1	5.5	5.3
Comoros	2.0	0.2	2.4	2.4	3.0	3.5
Oil Importing Arab Countries	2.7	2.5-	2.6	3.8	1.1-	0.4
Arab Countries	1.6	5.1-	5.0	5.8	0.3	2.8

3.2. Challenges of Employing Scientific Research in Enhancing Economic Growth and Available Opportunities to Increase Productivity and Well-Being

3.2.1. Challenges of Scientific Research in Achieving Economic Growth

The scientific research system in most Arab countries is characterized by weakness because of the decline in the economic, intellectual, and cultural structure in general, in addition to the backwardness of the educational and pedagogical systems associated with scientific research. This weakness is generally linked to many obstacles. One of the most important obstacles is the lack of funding and low spending on scientific research in Arab countries. Spending on scientific research in Arab countries does not exceed 0.5 percent of the gross domestic product, and their share in patents does not exceed 0.2 percent. This means that scientific research has no significant role in economic growth because spending on it is less than 1 percent of the gross domestic product. At the same time, these countries spend huge sums of money on defense sectors and weapons, as they spent approximately \$133 billion on military expenditures in 2016, which is many times greater than what is spent on scientific research. This decline in funding is due to each country's view of the importance of scientific research for its future. Most of these countries usually separate their local and economic problems and their requirements from scientific research as a means of addressing these problems. This is also linked to the absence of the private sector and its weak contribution to financing scientific research, along with reliance on government support in this field (Al-Bahlol, 2021).

Another obstacle is the weak research infrastructure, the lack of laboratories and scientific equipment, and the weak connection between scientific research and productive sectors. Although Arab countries enjoy a high level of wealth, they lack a strong base for science and technology, and their performance in higher education remains below the required level. Arab countries have

approximately 136 researchers per million people, in addition to the weak reliance of productive sectors on purchasing research and knowledge to support their various economic activities (Qader, 2018).

The decrease in the number of researchers in the field of research and development, along with brain drain, also represents a major challenge. The phenomenon of brain drain, or the migration of scientific competencies to developed countries, has expanded for many political, economic, and social reasons. This has led to a decrease in the number of scientists and researchers. Usually, a high percentage of immigrants are doctors, engineers, researchers, and people with scientific expertise. Immigration has included 50 percent of doctors and 25 percent of engineers. Reports also indicate that about 50 percent of Arab competencies migrated to developed countries such as the United States of America, Canada, and European countries during the second half of the twentieth century ("The Migration of Islamic Minds and Competencies," n.d.).

In addition, there is a lack of clear plans and strategies for scientific research. Scientific research in these countries is not carried out according to plans that suit the needs of production and service institutions. Most scientific research is prepared spontaneously without specific plans that meet the needs of society and the requirements of its development.

Finally, the lack of an appropriate climate suitable for preparing scientific research is another important obstacle. The current period is characterized by researchers being preoccupied with securing their basic life requirements, in addition to their practical, administrative, and teaching tasks. There are also weak facilities for participation in scientific conferences and a lack of a sense of academic freedom. All of this has negatively affected the levels of research and scientific performance and has therefore weakened support for economic growth (Al-Bahlol, 2021).

3.2.2. Proposals to Support and Stimulate Scientific Research in Arab Countries

To encourage scientific research and activate its role in achieving the targeted economic growth in Arab countries, a set of measures can be proposed at different academic, industrial, and governmental levels. These measures include enhancing funding and spending on scientific research by increasing the budget allocated to this field, establishing funding funds dedicated to supporting research and innovation projects, and providing financial incentives to researchers and research centers to achieve specific development goals.

Improving the infrastructure for scientific research is also necessary through the provision of advanced laboratories and research centers, as well as the improvement of digital networks required for knowledge exchange. In addition, cooperation between different sectors should be strengthened by encouraging partnerships between universities and industry, linking scientific research to productive and economic activities, and enhancing regional and international cooperation in research projects.

Educational and rehabilitation policies should also be developed and directed toward innovation and creativity in a way that serves the achievement of sustainable development goals. Moreover, legislation and policies that support scientific research should be developed and activated, including intellectual property rights, tax facilities and allowances, and the establishment of companies that adopt the outputs of scientific research.

Another important measure is encouraging the return of Arab immigrant minds to their countries of origin by providing the capabilities available in developed countries and supporting their scientific innovations. Through these procedures, scientific research can be transformed into a basic driver of economic growth in Arab countries, which enhances their competitiveness on the global stage (Zainouni et al., n.d.).

4. Conclusion

Based on the findings, most Arab countries are characterized by low levels of scientific research due to the lack of appropriate conditions, the limited number of researchers, and the migration of scientific competencies as a result of weak incentives and support. Investing in human capital and

enhancing mental and cognitive capacities have become essential drivers of economic growth, no less important than other factors of production. Developed countries that adopted research and development strategies have achieved higher rates of economic growth and competitiveness, while also reducing unemployment by successfully linking research institutions with production and economic institutions. In contrast, Arab countries still suffer from weak spending on research and development, insufficient infrastructure, limited attention to research activities, and weak private sector participation in financing and supporting scientific research, which has reduced its contribution to economic growth and development goals. In oil-producing countries, economic growth remains largely dependent on the oil sector, which weakens the tendency to stimulate scientific research in other productive sectors such as industry and agriculture. Therefore, Arab countries should give greater attention to researchers, experts, and scientists by providing suitable material and moral incentives, preparing the necessary requirements and equipment for research work, and facilitating the transformation of intellectual and cognitive inventions into economically valuable products or services. It is also necessary to establish specialized ministries or bodies for scientific research and cognitive development, issue laws that support innovators and thinkers, stimulate the private sector to finance research and development, and oblige large companies to allocate part of their profits to support scientific research that serves economic activities. In addition, laboratories and research centers in universities should be linked to solving contemporary problems of local economies according to their specializations, with periodic evaluation and follow-up to ensure alignment with international standards. More focus should also be placed on increasing expenditure on research and development and establishing economic incubators that encourage small and medium-sized productive enterprises, create job opportunities, and support innovation.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

All authors in this publication declare no conflict of interest regarding the title, data, location, and results of the research.

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Supplementary Materials

This study does not include any supplementary materials.

Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript. AI were used only to improve readability and language under strict human oversight; no content, ideas, analyses, or conclusions were generated by AI.

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