Migration Letters

Volume: 20, No: S8(2023), pp. 841-863

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)
www.migrationletters.com

The Impact of Spending on Research and Development on the Global Patent Index for a Sample of Developed Countries for the Period 2007-2021

Bushra Abdulbari Ahmed[1], Aymen Ajina[2]

Abstract

The study aims to identify, measure and analyze indicators of spending on research, development and patents for the period (2007-2021) for high-income countries that include (the United States of America, Britain, Japan, Germany, France, Sweden, Canada). The study relied on the standard analysis method.

While the study reached a number of results, the most important of which are: the existence of a direct and significant relationship at the level of (1%) between (X1), which represents spending on research and development, and (Y), which represents patents, and that increasing (X1) by (1%) will lead to an increase in (Y) by (0.138%) in high-income countries, in addition to the existence of a direct and significant relationship at the level of (1%) between (X2), which is represented by researchers working in research and development, and (Y), which is represented by patents, and that an increase in (X2) by (1%) leads to an increase in (Y) by (0.698%) in high-income countries. It also found that there is a direct and significant relationship at the level of (1%) between (X3), which is represented by technicians working in research and development, and (Y), which is represented by patents. An increase in (X3) by (1%) will lead to an increase in (Y), which is represented by patents, by (0.229%) in high-income countries.

While the study recommended working to increase the allocations allocated to scientific research and technological development from the national income, allocating a percentage of foreign grants and aid for research and scientific purposes, encouraging the beneficiary sectors to contribute to financing research and development projects, and creating a balanced and stable financial system for scientific research, and its success depends on the provision of sufficient financial allocations, so it must The government should allocate a separate budget for research, development and patenting, on the basis of which the winning scientific projects will be funded in competitions to choose the best research project.

Keywords: *research and development, patent.*

Introduction

Interest in research and development is considered one of the basic reasons for mobilizing human capabilities and competencies and developing them in their scientific and behavioral aspects, which leads to providing people with resources and skills that increase their ability to work and produce. Human capital development is one of the urgent strategic issues, so that this element plays its role in economic and social issues.

[1] University of Tikrit, Bushra.ae33@tu.edu.iq
[2] FSEG, University of Sousse, ayman.ajina@gmail.com

Investment is increasing in various ways and methods, such as education, training, scientific research, and patenting, which contribute to the accumulation of human capital.

Research and development is also considered one of the most important mechanisms that countries have become betting on to achieve development and development in all fields. Spending on research and development is an effective technological indicator in measuring the progress of countries and is the basic investment pillar that contributes to managing technological transformations, and it is an investment that gives results in the long term.

The patent was presented with different concepts and visions by researchers and writers, relying on their scientific specializations, their orientations, the experience and skill they possess, or on the basis of the field in which their studies were applied. The patent is a general term used in many researches, and when talking about the patent, it must be noted. In any field, it is only the result of individual and organizational preparedness.

Today, it is no longer possible to separate research, development and knowledge from technology in supporting building the foundations of economic development, spreading the culture of creativity and patenting, and containing the requirements of global growth. Research and development and patents have become essential drivers for improving income and living standards. Therefore, the spread of scientific research and the optimal use of innovation are an important indicator of the effectiveness and success of economic transformation plans and the creation of added value at all levels.

Firstly. Study problem:

The problem of the study can be formulated through the following questions:

Is there a quantitative impact of spending on research and development on the global patent index?

Does increasing government spending on research and development lead to an increase in the global patent index?

Does increasing the number of researchers and technicians lead to an increase in the global patent index?

Is there a suitable scientific climate for completing scientific research, encouraging and valuing the efforts of researchers, and providing research facilities by the academic institution and research centers?

Does the difference in levels of spending on research and development between developed and developing countries affect the global patent index?

secondly. the importance of studying:

The importance of the study lies in the following:

It highlights the importance of spending on research and development and patents, as they are considered economic issues in light of global changes.

1. Measuring and analyzing the impact of spending on research and development on the patent index and to what extent the global patent index can be affected by spending on research and development through the use of some modern standard methods.

Third. Objectives of the study:

The study aims to identify:

1. Examining the conceptual aspect of global R&D and patent spending.

2. Analysis of indicators of spending on research and development as well as global patent indicators.

3. Measuring the impact of spending indicators on research, development and patenting for the period 2007-2021 for high-income countries that include (the United States of America, Britain, Japan, Germany, France, Sweden, Canada)

Fourthly. Study methodology:

The study included the use of a descriptive and analytical theoretical approach and the use of statistical and analogical methods to study the relationship of the most important indicators of spending on research and development and global patent indicators, and to explain the relationship between them by applying the steps of standard models of estimation, testing, and adopting (double) panel data to measure and analyze the impact of spending on research and development. In the patent index for the group of study countries using the E-Views12 statistical program.

Fifth. Study hypothesis:

There are a number of hypotheses from which the study begins:

The study assumes that there is a long-term relationship between spending on research and development and the patent index.

There is a quantitative effect of spending on research and development, the number of researchers, and the number of technicians. Increasing spending on research and development and increasing the number of researchers and the number of technicians leads to an increase in the global patent index, and this effect can be measured quantitatively.

There is a difference in the effect of spending on research and development on the patent index between high-income countries and middle-income countries.

Sixthly. Limitations of the study: temporal and spatial:

1. The time limits include the period (2007-2021), due to the development occurring in the global patent during this period.

2. Spatial boundaries of some high-income countries.

Seventh. previous studies:

Afcha & Lucena (2020), The effectiveness of R&D subsidies in fostering firm innovation: The role of knowledge-sourcing activities What problem addressed the effectiveness of R&D subsidies to increase knowledge sources at the level of corporate innovation in terms of patent applications? What is the effectiveness of research and development subsidies to increase sources of knowledge at the level of corporate innovation in terms of launching new products? The study also aimed to reveal the effectiveness of subsidies to support research and development aimed at increasing sources of knowledge at the level of company innovations in terms of applying patents and launching new products. The study's approach was based on the descriptive analytical approach. In the first stage, we relied on previous literature to evaluate the R&D subsidy system. In the second stage, regression analysis was used to determine whether the impact of R&D subsidies on companies' knowledge sources also affects their innovation performance. In addition to employing count-data models, the most important findings of the study are that systems of subsidies and support for research and development in companies lead to increasing and advancing sources of knowledge. Research and development subsidies do not affect the company's innovation directly, but by bringing about changes in the company's knowledge sources and helping it open up to technology markets.

As for the study by Pegkas, Staikouras, & Tsamadias (2019), it addressed: Does research and development expenditure impact innovation? Evidence from the European Union countries The problem of the study was to explain what is the impact of spending on research and development on the level of innovation? The study also aimed to investigate the relationship between spending on research and development on innovation in terms of patents in European Union countries. The study adopted the descriptive analytical approach, through standard statistical methods for financial data. The most important findings of the study are that there is a co-integration relationship between spending on research and development and innovation processes, which is the presence of a strong positive impact of research and development in the business sector and public and higher education on innovation. The European Union should strengthen cooperation between the business sector and research and development in the field of public and higher education. By encouraging partnerships between the private sector and research, development and innovation systems.

The first topic

The theoretical framework of the study

First: The concept of public spending:

Public spending can be defined as the amount spent by the government to achieve a public benefit (Al-Banna, 267, 2009). The expense is considered public by the government or one of its agencies or public bodies, or by any person with public moral capacity, but if the expense is private, it is the responsibility of an individual or private person (Abdullah and Hameed, 1, 2017).

From the previous concept, we can deduce the pillars of public spending as follows:

1. Monetary nature: In order for expenditures to be public, they must be in the form of a cash amount, which ensures ease and flow for the state so that it can perform its duties. This leads to activating the supervisory role over public spending and facilitating the task of financial institutions in carrying out their work within the concept of transparency, and that the government Through its cash spending, it seeks to obtain its requirements for goods and services that will ensure the continuity of the functioning of its public facilities (Al-Janabi, 2011, 17-18).

Despite this, most researchers believe that the expense can take the in-kind form as long as there is a possibility of estimating it in cash. Therefore, we find that some of them tend to use alternative expressions for the monetary amount, such as replacing it with the phrase “amount of money,” when they define the concept of public expense. This definition allows in-kind expenditures to be adopted and counted as public expenditures. Therefore, it is possible, from the point of view of some, for in-kind expenditures to be considered public expenditures. An example of this is land that has been allocated by the government and granted to private entities that are of public benefit and provide public services, such as associations and unions (Al-Jubouri, 2015). ,11).

2. Public nature: The expenditure acquires a public character when it is spent by a public person such as the government or one of its public institutions. It does not fall within the concept of public expenditure for any person to spend for the purpose of achieving a public benefit, such as a person donating to establish a health center or build a school. Then this expenditure is called expenditure. It is private and may not be called public spending because it was carried out by an ordinary person. It is considered part of public spending that the government spends in exchange for providing public services such as security, judiciary, defense, health, education, and building economic projects (Al-Obaidi, 2012, 57).

3. The purpose of public spending: Public spending aims to satisfy the needs and desires of society in order to achieve a public benefit, such as the government spending on health, education, security, justice, and defense. Expenditures that lead to satisfying or achieving a private benefit are not considered public expenses, as the expenditures that they undertake The government bears the burden of the citizen through the taxes collected from them, which are considered one of the sources of public revenues. Therefore, it is

self-evident that this citizen has the right to benefit from these expenses, and in order to achieve social justice, the purpose of public spending must be to achieve public benefit (Al-Taie, 2011, 12).).

Second: Concepts of research and development

1. Research and Development - (R & D (Research and Development) Research and development means: -

A set of mechanisms that are adopted and patented and creative works and projects that are being implemented in an organized and integrated manner with the aim of increasing the knowledge and cultural stock of humans, including knowledge of man and society, and using this knowledge to build new applications, improve human lives, increase economic growth, and achieve security (Al-Husseini, 2008, 170).

It is also defined as: all organized efforts to transform approved knowledge into technical solutions in the form of production methods or methods and products, material, consumer, or investment (Mustafa and Murad, 2013, 28). Thus, research and development activity is associated with creativity, adding to knowledge, and transforming its results into goods and services through which institutions gain competitive advantages. Research and development can also be considered as a systematic and creative activity

Which aims to increase knowledge in various scientific fields, and therefore the issue of spending on this activity is tantamount to an investment according to appropriate plans and accurate scientific methods (Al-Khaikani, 2010, 100).

The Organization for Economic Co-operation and Development (OECD) defines research and development as creative work that is carried out on a systematic basis with the aim of increasing the stock of knowledge, including knowledge of man and society, and using this stock of knowledge to find new applications (Friedrich, 2000, 24-25).

Therefore, it is one of the activities that relies on knowledge and experiences as inputs and its outputs are new knowledge or expansion of existing knowledge, and investigation is considered a methodology for the sake of increasing knowledge (Ghilan, 2009, 210).

Therefore, research and development is the activity associated with generating creative knowledge and transforming it into practical applications in the form of goods and services, with a relentless aspiration to achieve the highest levels of performance (Shehata, 2002, 13).

The concept of research and development (R & D) includes two concepts: scientific research and development.

1. Scientific research: (Scientific Research), which is defined as a process of investigation, exploration, scrutiny and investigation in order to enrich and develop knowledge in addition to, enrich and increase it, through analysis, criticism and conclusion in a way that contributes to achieving a new addition to knowledge (Mustafa and Murad, 2013, 28).

Scientific research is also defined as: - It is an organized intellectual process carried out by a person called a researcher in order to study the facts regarding a specific issue or problem called the subject of the research by following an organized scientific method called the research methodology in order to arrive at solutions or results suitable for generalization to similar problems called the results of the research (Khalaf, 2007, 117). It is defined as a method of organized, systematic, accurate and objective investigation and tracking to uncover new information, facts and relationships, as well as developing and modifying existing information. It is inquiring about the picture of the future by discovering new facts and relationships and verifying their validity, or a means through which various problems can be solved through investigation. A comprehensive and accurate account of the phenomena, variables, and evidence that are related to the research problem (Al-Khalil and Bou Issa 2019, 102).

It is also known as a means of study through which a solution to a specific problem can be reached through a comprehensive and precise investigation of all verifiable evidence and evidence related to the specific problem (Zahid, 2007).

Scientific research is an objective tool and method for scientific truth, and it is an acceptable way to establish and consolidate the truth in human fields where it is presented and criticized objectively, and it is the easy way to expand mental agreement among people and make their rulings more acceptable and accurate to others (Al-Kubaisi and Al-Rawi, 2010, 6).

There are types of scientific research, including the following- :

1.Theoretical basic research:

It aims to acquire new knowledge in order to arrive at facts, principles, and concepts, and does not aim directly at practical application (Khader, 2011, 5.(

Basic (theoretical) research represents abstract or theoretical works directed primarily to acquiring knowledge related to observed phenomena and events without any intention of applying it or using it for a special use (Mustafa and Murad, 2013, 28.(

Its scope is often in the field of theoretical natural sciences, such as mathematics. The most important characteristic of this branch is that most of its results are not perceptible and tangible to the public. The longest period is more than a generation because it deals with the scientific theories that humans have arrived at and the relationships between the various phenomena of the universe, and most of it is found in universities and some research institutions. Scientific. Scientific research into basic knowledge contributes to the accumulation of human knowledge on the one hand, and also establishes the foundation for future applied research on the other hand. It has a human dimension, and is planning that looks to the future and prepares for it on the other hand (Shaker and Abdel Haq, 2011, 7).

2. Applied research:

Directed to achieve a specific purpose in a specific industry or service. It is what is done to solve a problem, and this problem is often in the industrial or humanitarian field. This research is usually carried out in the research and development department of educational institutions or large companies in particular. It is based on theories in the field of various applied natural sciences, such as engineering, medicine, and agriculture. The most important feature of this branch is that it is research directed at solving an existing problem. The results of applied scientific research appear quickly and noticeably. It is carried out by research and development institutions in the public and private sectors and can be directed to Universities are some aspects of applied research (www.Competitiveness.Gov.jo.(/

3. Patent or development search:

It is a series of experiments, works and designs that are carried out on acquired knowledge resulting from basic or applied research, or from a scientific experiment, and aim directly to innovate and produce new goods, materials and devices, or to build and develop processes or to innovate systems. Or services, or improve their components. Developmental research includes a wide range of scientific and technological activities related to the production, development and application of acquired scientific and technical knowledge. This research aims to transfer contemporary technology, adapt it for the benefit of the country, and develop appropriate local technologies. Industrialized countries show great interest in research and development activities, given the role of research in human and economic development processes and in developing industrial structures to improve conditions of competition in production and marketing within local and foreign markets (Kandilji, 2008, 33). Thus, it becomes clear that scientific research aims to increase human knowledge, raise his ability to adapt and control his environment, and discover solutions to the problems facing societies and individuals, and that it is necessary to build a modern, prosperous state. Therefore, the research carried out must be linked to the development plan set by the government (Al-Safadi and Awad, 2006, 205). Scientific research also aims to find solutions to society's present and future problems in various aspects of life and to innovate methods and tools that facilitate the work of individuals through scientific and technical progress (Khader, 2011, 5).

Therefore, the government's ability in the fields of scientific research, and the application of its outputs, can be considered a measure of its economic progress and the well-being of its society, so that interest in scientific research and means of knowledge has become a characteristic of developed countries, as technical progress constitutes one of the most important factors responsible for economic growth and a rise in the standard of living, and technical progress contributes about half Per capita income rate in advanced industrial countries (Al-Rifai, 2009, 21). The rapid progress in science and knowledge has led to more patents and inventions, which have become an integral part of any production process. On the other hand, the backwardness of developing countries in using science, scientific research and its applications makes them dependent on developed countries to equip them with industrial goods, especially high-tech ones. This is what enables developed countries to control global markets as well as their political and military dominance, which imposes more economic, social and financial burdens. Therefore, developing countries cannot achieve real economic development without achieving real progress at the scientific and technological levels.

The importance of scientific research to society comes through (Awad, 1998, 42)

a. Using scientific research to serve development issues.

b. Attracting external funding for research by marketing research capabilities.

c. Attracting elite researchers by raising the high reputation of higher education institutions.

Th. Qualifying local research cadres.

Building bridges of cooperation with local and national institutions in the form of contracts, research consultations, and technical services.

Investing in scientific research is one of the most successful types of investment, and one of the most profitable. A number of recent economic studies have proven that the returns of scientific research are very large and that investing in research is no less important than investing in any other field. Science and its innovations have become an integral part of supporting the national economy, as the percentage of technological development resulting from applied scientific research in the growth of the national product and improving the standard of living is between (60-80%), which is a large percentage whose returns are estimated to be many times the returns on other investments (www.Mohyssin.com/forum/showthread.pdf).

4. Development: (Development) is an organized activity that benefits from applied basic research and patents with the aim of introducing new products, inventing new methods, or making fundamental improvements to existing ones (Al-Khaikani, 2010, 100).

Development means that a person is active in inventing new things that meet his needs and raise the quality of his life, taking advantage of the natural and cognitive resources available to him (Ockel, 1992, 113).

It is also defined as transforming the results of research or other knowledge into a plan or design for a new product, service, or new technical method, or the fundamental improvement of a known product, service, or technical method, whether for the purpose of sale or use (Saudi Ministry of Higher Education, 2012, 13-14). That is, development is the application of knowledge for the purpose of producing or developing useful products, systems or means, which includes designing the basic templates for the products and making the required improvements. An example of this is reverse engineering, which is one of the tributaries of industrial development through analyzing the components of technologically advanced products and imitating them. That is, it is an activity that depends on existing scientific knowledge that has been achieved through research and scientific experience with the aim of producing new materials or improving existing ones. Development is usually the result of research work as a result of continuous improvements in products and production methods. Research investment works to implement new and existing innovations (www.Compertitiveness.Gov.jo). Development includes theoretical formulation, design and testing of alternatives, preparation of prototypes, and operation of experimental industrial units. Development does not involve significant, frequent changes to existing products, product lines, manufacturing processes, or other processes.

As for spending on scientific research: - It means calculating what is allocated to scientific research and related development and what is spent on it from the governmental and non-governmental sectors. Spending on scientific research is also defined as: Providing the necessary funds from governmental and non-governmental resources to finance studies and research with specific objectives, in various scientific fields such as medicine, science, engineering, agriculture, social and human sciences, and other sciences (Al-Latif, Workshop without year of publication, 84). Spending on research and development is defined according to the Franscati methodology as what is spent on a research unit in a specific unit of time, usually a financial year, whether from funds originally allocated to it or from sources external to it, such as grants and others, and its methodological name is Expenditure. The Franscati methodology stated that there are two methods for calculating the amount of spending: Performer Based: Calculating what was actually spent or what was committed to spending in a designated budget placed at the disposal of the research unit.

Source Based: Listing any amounts allocated for spending, while the budget submission may not be committed. UNESCO adopts the Frascati methodology for calculating spending on scientific research, which was developed by the Organization for Economic Co-operation and Development (OECD) and its latest version was issued in 2002.

Second: -Essentials for the success of research and development activities:

Research and development activities are based on a set of basic requirements and requirements that have priority in the advancement of scientific research centers, which are as follows:

1. Attracting and developing research cadres. Qualified and efficient research resources are among the inputs and components of work in research activities and centers. Therefore, one of the components of the success of research centers is qualified and specialized cadres for scientific research and its development, including researchers and inventors with advanced degrees, as well as providing auxiliary cadres for the work of researchers, including technicians and administrators. Universities and technical institutes are the source of the workforce. In research centers, they are the ones who provide human resources with qualifications and research skills, so that the preparation and training of researchers depends mainly on the level of progress of higher education. The low level of graduates leads to the mediocre performance of the research centers that will employ them (United Nations Development Programme, 2003, 71).

Qualifications alone are not sufficient to guarantee a high return on scientific research. The extent of research achievement also depends on providing a suitable and encouraging environment for scientific research by meeting the human and social needs of researchers. These elements are necessary to prepare the researcher for giving and creativity, and providing the material needs means devoting the researcher's time to work without Being busy in order to provide those needs (Saeed, 2006, 373).

2. Supporting investment in the field of research and development

The issue of establishing institutions that support investment in the field of research and development is an important matter for financing the development process through strengthening the link between various research institutions with the aim of establishing Arab research networks in this field and joint cooperation between scientific research centers and Arab universities, especially in the field of establishing or establishing (technology incubators). Arab-supported in order to activate economic and technological initiatives, contribute to supporting development, and then achieve international competition in the field of economics (Al-Tanir, 2001, 4-5).

3. Competent administrative qualifications

Scientific research centers need competent administrative qualifications to supervise and manage their affairs. As long as the management is good, there is quality in scientific research that leads to achieving the desired goals, while incompetent management negatively affects the quality of the research centers' outputs (Al-Aghbry, 2002, 5). Administrative qualifications are considered one of the most important components of scientific research and technological development, as they are supportive administrative services through the introduction of continuous and radical changes in the administrative system, to enable this activity to perform its role in a manner of continuous changes, as the presence of effective management of research centers and institutions helps in planning, research and development directions and Then contribute to the development of the economy (Al-Khikani, 2010, 101).

Therefore, the management of these centers should have the following:

A. It should enjoy credibility, transparency, and a positive relationship with the higher education system and economic sectors (United Nations Development Programme, 2009, 168).

B. Staying away from lengthy administrative and financial procedures and complications in spending, equipment, salaries and incentives (Abu Arafa and Ali, 2000, 239).

C. Staying away from routine in various lengthy and inflexible legal, administrative and financial procedures, such as those followed in implementing scientific research or those followed in obtaining a grant or sending a mission abroad.

4. Financial spending on research and development

Spending on research and development is a productive investment that achieves the highest returns (UNDP, 2003, 99). Based on published data that confirms that developed countries pay great attention to scientific research, the technological progress occurring in them has come as a result of large financial spending in the areas of research and development. This is compared to developing countries, which are in great need of financial resources to finance research and development. The share of scientific research in the total GDP in developing countries does not exceed 1% for the average period (2000-2005), while the Organization for Economic Co-operation and Development (OECD) achieved (2.4%) As an average for the same period, the percentage was (2.7%) in the United States of America and (3.1%) in Japan (United Nations Development Programme, 2008, 261-264).

Among the most important reasons that lead to a decrease in the volume of spending on research and development in developing countries are (Al-Qahtani, 2005, 13):

A. Weak private sector participation in supporting scientific research due to its dependence on abroad, whether for technical imports or to address the problems it faces.

B. Weak cooperation and coordination between research centers and productive sectors, as the weakness of what is allocated by the government to the budgets of universities and research centers and their weak relationship with the public and private sectors may push them away from conducting applied research to focus their reliance on basic research.

C. Weak financial allocations and failure to allocate ambitious and independent budgets for scientific research. Therefore, and for other reasons, most universities in developing countries, especially Arab ones, focus more on the teaching process than on scientific research. Statistical studies show that there is a strong correlation between the percentage of spending on scientific research and the level of scientific progress in that country, and there is also an inverse correlation between the percentage of private sector funding for research and development and scientific and technical progress (Al-Qalq, 2003, 24).

In general, it can be said that the more advanced the country is scientifically and technically, the lower the percentage of government spending compared to the increase in the percentage of private sector spending on research and development. The private sector constitutes the largest financier of research and development activities in developed countries, especially applied and technical sciences, while the public sector supports funding basic research and training engineers. And technicians, so private sector spending was double the public sector, in France, Britain, Germany, and the United States, while the government agreement on research and development did not exceed (30%) in the United States and (20%) in Japan, and on the contrary in developing countries, where the contribution did not exceed The private sector in Arab countries (5%) of total spending on research and development in 2002 (United Nations Development Programme, 2003, 174). Therefore, governments may finance the bulk of scientific research and development expenditures in these countries by funding universities and government research institutions. This funding is divided into random allocations, with research budgets being unstable and fluctuating from time to time, which requires rationalizing spending according to the priorities of research projects and adopting precise systems for allocating funds and integrating and coordinating between research institutions (Al-Sharrah, 2000, 353-357).

5. Availability of modern scientific information and sources

Scientific information and data services must be available to researchers in research centers, and this requires the presence of national centers that provide the necessary information and data in an efficient and effective manner to researchers (Saeed, 2006, 373). It also requires providing modern references and periodicals to researchers in research centers, and facilitating their task of obtaining the necessary field information and data from relevant private and governmental institutions, as well as following global developments and benefiting from electronic communication with global research networks with coordination between universities in the field of research. and scientific exchange (http://iraqilaws.dorar-aliraq.net).

6. Interaction and coordination between scientific research centers and sectors of society.

The social and cultural environment is one of the necessary requirements to motivate researchers to innovate, patent, and continue research. In the absence of this, human competencies will diminish and migration will occur outside their countries of origin, as the culture of research and development helps to allow individuals to keep pace with economic development, and thus the societal view of the scientific researcher will be A basis for the progress of research and development (Al-Khikani, 2010, 107). Whereas successful research centers are those that interact with society in resolving its issues and finding appropriate solutions for them, while it is observed in developing countries in general, and Arab countries in particular, that there are no close links between scientific research centers and various sectors of society, as government and private agencies prefer to deal with foreign research institutions. And adopting the expertise and experiences of other countries. This weak relationship reflects negatively on the returns of scientific research through the lack of incentives necessary to stimulate scientific research (Yaghi, 2006, 591). It leads to the interest of most researchers in expanding the circle of community benefit from their work, and it does not only mean that scientific research does not perform its basic function, in addressing the problems faced by sectors of society, but it also means depriving it of the support that could be provided to it by these sectors. Therefore, the ability to promote the research results of research centers is one of the indicators of success in their interaction with sectors of society, as the process of promoting scientific research helps scientific research centers achieve their goals (Arab Human Development Report, 2003, 100).

7. The presence of a clear research strategy.

A clear strategy for scientific research should be adopted at the economic level, which includes defining the objectives and priorities of scientific research and providing the necessary material requirements for the work of research centers (Qanoo, 2005, 86). This is done through plans and programs for scientific research that draw general future directions and determine appropriate legislative and executive procedures. The national strategy for scientific research should include the following contents:
The requirements and objectives of scientific research must be clearly defined, in a manner consistent with national development plans and the requirements of economic sectors and activities (Saeed, 2006, 373) and in a manner consistent with available human capabilities, in order to increase the possibility of applying scientific research and discoveries.

A. The existence of a national policy for scientific research that would direct researchers towards the economic, social and technical problems that society suffers from in order to find appropriate solutions to them. The absence of such a national policy leads researchers to move towards individual and selective research and avoid participating in drawing up public policies and using the results of their studies for the decision maker (Al-Rifai, 2009, 34).

B. The strategy must aim to achieve the greatest degree of partnership between research and development centers on the one hand and the private and public sectors that benefit from its results on the other hand (Arab Knowledge Report, 2009, 167). This includes granting incentives to the private sector to play an important role in investing in research and technical activities.

8. Technical and scientific qualifications.

Technical and scientific requirements are among the main basic components for providing a technology development structure, as the issue of their availability facilitates the process of technological development, monopolization, and information exchange, as well as cognitive integration, thus supporting research and development activity. The availability of the necessary tools, such as scientific laboratories equipped with devices, equipment, and technicians, is necessary to advance the scientific research process. (Al-Khaikani, 2010, 101).

9. Knowledge accumulation

It can be said that there is a mutual dependence between the accumulation of knowledge, scientific research, technological development, and the results and applications that are reached. Hence, cognitive development is based on scientific research, which leads to the possession of technology, which is considered the direct and basic indicator in achieving optimal investment of economic resources in order to reach development. Economic. This relationship (knowledge accumulation - applied scientific research) has borne fruit. The experiences of a group of countries in the developing world, such as Taiwan, South Korea, Malaysia, Singapore, Hong Kong, and some other countries, especially in Southeast Asia, as knowledge-sinking countries, have shown the reality of this relationship, as these countries have benefited from gaining... Knowledge and then apply it to reach the stage of competition with developed countries such as the United States of America (Naifah, 2001, symposium).

The aforementioned countries have demonstrated significant success, as new industrialized countries, in regaining the attraction of many of their migratory skills. They have developed promising programs to maximize the use of these skills and have focused on establishing communication networks between these skills at the global and local levels that enable them to obtain new knowledge capital that was not previously available. A day in which he is able to invest (Al-Nasser, 2003, 34). That is, the outcome of investment experience in financing projects is of great importance.

The second topic

Estimating and testing the results of the standard model of the impact of spending on research and development on the global patent index for a sample of selected countries

First: The group of study countries: In our study, we relied on a sample of (7) countries, according to income level, where the group (high-income countries) was represented by (the United States of America, Britain, Japan, Germany, France, Sweden, Canada). This selection of the sample came in order to measure the impact of spending on research and development on the patent index in high-income countries, as well as to provide an opportunity for the purpose of generalizing the results of the standard aspect.

Temporal limits for the standard aspect: The duration of the study included the years (2007-2021) given that those years witnessed major turning points in the levels of the global patent index in most of the countries used in the study.

Second: Study variables: The variables of the standard model in high-income countries are as follows:

1. Dependent variable – Patents Y:

Patents are worldwide patent applications filed through the Patent Cooperation Treaty or with a national patent office to register private ownership of an innovation, whether it is a product or a process that includes a new way of making something or provides a new technical solution to a problem. A patent provides protection for the invention in favor of the patent owner for a limited period, generally up to 20 years.

Independent variables - spending on research and development - X: It includes the following variables:

A. Spending on research and development (GDP%) X1:

Expenditures related to research and development are current and capital expenditures (in the public and private sectors) on creative works undertaken in a systematic manner for the purpose of advancing knowledge, including human, cultural and societal knowledge, and using knowledge in new applications. R&D covers basic and applied research and experimental development processes

B. Researchers working in R&D (per million people)

R&D researchers are professionals engaged in creating or inventing new knowledge, products, tools, processes, methods, or systems - and managing the projects involved. The data includes doctoral graduate students involved in the research and development process.

C. Technicians working in the field of research and development: X3

R&D technical specialists or equivalent personnel are people whose work requires technical knowledge and expertise in the engineering, physical and life sciences (technical specialists), or social and human sciences (equivalent personnel). They participate in research and development by performing scientific and technical tasks that involve the application of operational concepts and methods, usually under the supervision of researchers.

Third: Analysis of the estimation results for the group of high-income countries:

1. Statistical indicators matrix: The most important statistical indicators of the study data in high-income countries are presented, where the highest value of the series (Y) was recorded in the United States of America (640865) in the year 2021, while the lowest value was recorded in Sweden (2280) in the year 2018 and reached Its average is (147278.11), and the highest value was recorded for the series (Y2) in the year 2021 and reached (249.5) in Germany, while its lowest value was recorded in Sweden and reached (17.4) in the years 2017 and 2018, and its average reached (104.60), and as for the series (Y3 recorded the highest value in the United States of America in 2021 and reached (519388), while the lowest value was recorded in Sweden and reached (9210) in the year 2018 and its average reached (117833.17), and the highest value was recorded for the series (X1) in the year 2021 and reached (701) in the United States of America, while its lowest value was recorded in the year 2009 in Sweden (15) and its average reached (134.18). The highest value was recorded for the series (X2) in Sweden and reached (8026) in the year 2021, while its lowest value was recorded. In Britain, it reached (3579) in the year 2007 and its average was (4831.6). The highest value for the series (X3) was recorded in the year 2021 in the United States of America and it reached (4150). Its lowest value was recorded in the year 2021 (2.25) in Britain and its average was (1727.77), see Table (1).

Table (1) Statistical indicators in high-income countries

Statistics						
	Y	Y_2	Y_3	X_1	X_2	X_3
Max	640865	249.5	519388	701	8026	4150
Mean	147278.11	104.60	117833.17	134.18	4831.68	1727.77
Min	2280	17.4	9210	15	3579	2.25
Std. Deviation	200416	66.13	117913.81	163.26	929.79	849.54

Source: Prepared by the researcher based on the statistical program (SPSS 25)

2. Correlation matrix: The correlation matrix is displayed for study variables in high-income countries according to the Pearson Correlation test, and the results are as follows:

Table (2) Correlation matrix for study variables in high-income countries

Pearson Correlation						
	Y	Y2	Y3	X1	X2	X3
Y	1	0.495	0.913	0.938	-0.126	0.405
Y2	0.495	1	0.540	0.584	-0.461	0.114
Y3	0.913	0.540	1	0.972	-0.214	0.589

Source: Prepared by the researcher based on the statistical program (SPSS 25)

a. Patents (Y): The sign is positive, which means that the relationship is positive with spending on research and development (X1) and amounts to (0.938), and an inverse relationship with workers in research and development (X2) and amounts to (0.126), and a direct relationship with technicians working in research and development. (X3) and amounted to (0.405.(

B. Exports of advanced technology (Y2): The sign is positive, which means that the relationship is positive with spending on research and development (X1) and amounts to (0.584), and an inverse relationship with workers in research and development (X2) and amounts to (0.461), and a direct relationship with technicians working in research. And development (X3) amounted to (0.114.(

T. Trademarks (Y3): The sign is positive, which means that there is a positive relationship with spending on research and development (X1) and amounted to (0.972), an inverse relationship with workers in research and development (X2) and amounted to (-0.214), and a direct relationship with technicians working in research and development. (X3) and amounted to (0.589), see Table (2.(

.1Drawing the study variables:

a. Drawing the study variables at the level of total countries: The graph includes panel data at the level of total countries. It is noted that the time series is unstable and has different trends. It increases or decreases and is not stable over time. See Figure (1).

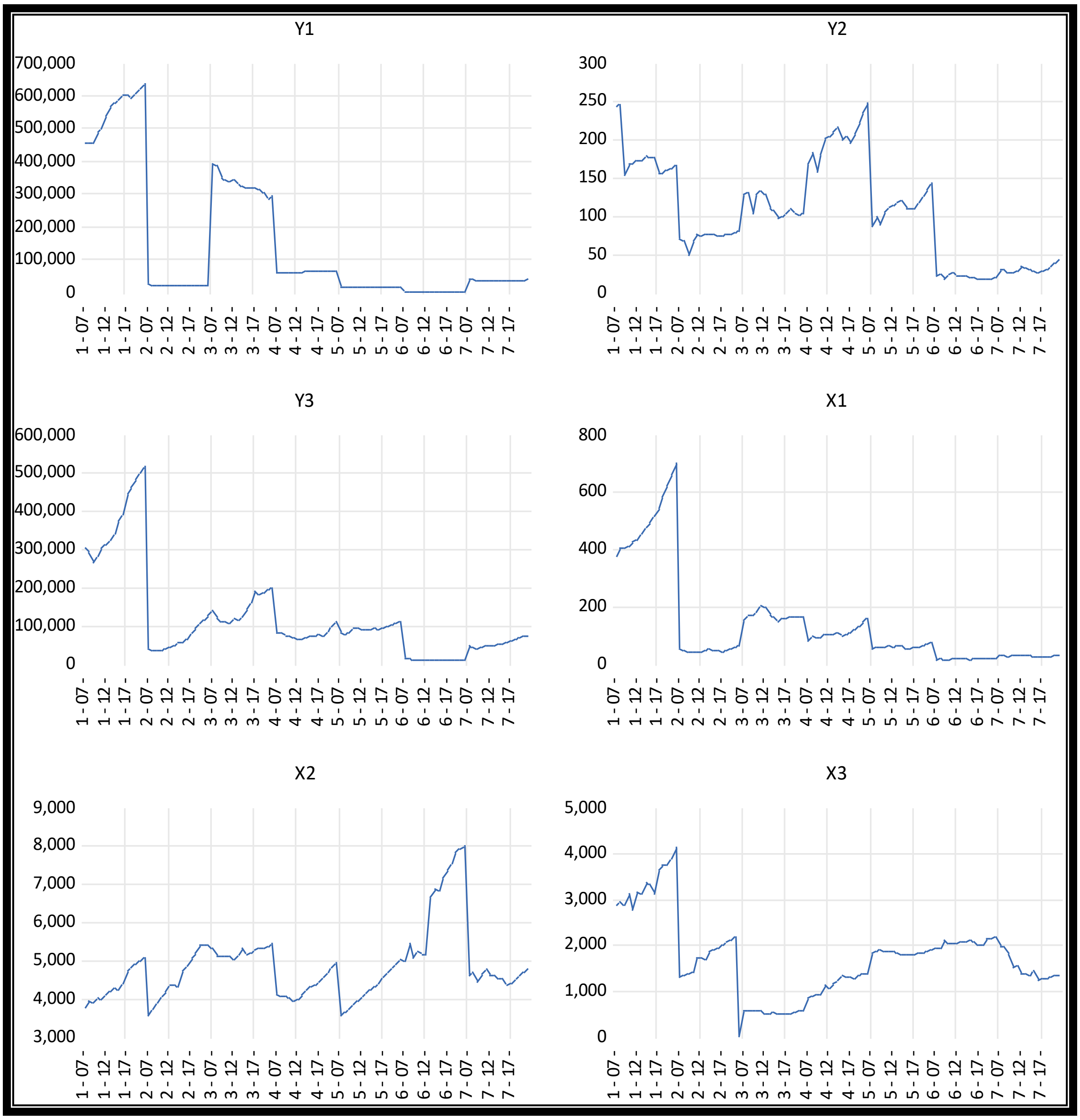

Figure (1): Plot of study variables in high-income countries

.Source: Prepared by the researcher based on the outputs of the E-Views 12 program

a. Drawing the study variables at the single-country level: It is also clear that the variables are unstable at the single-country level and have different trends. They increase or decrease and are not stable over time. See Figure (2).

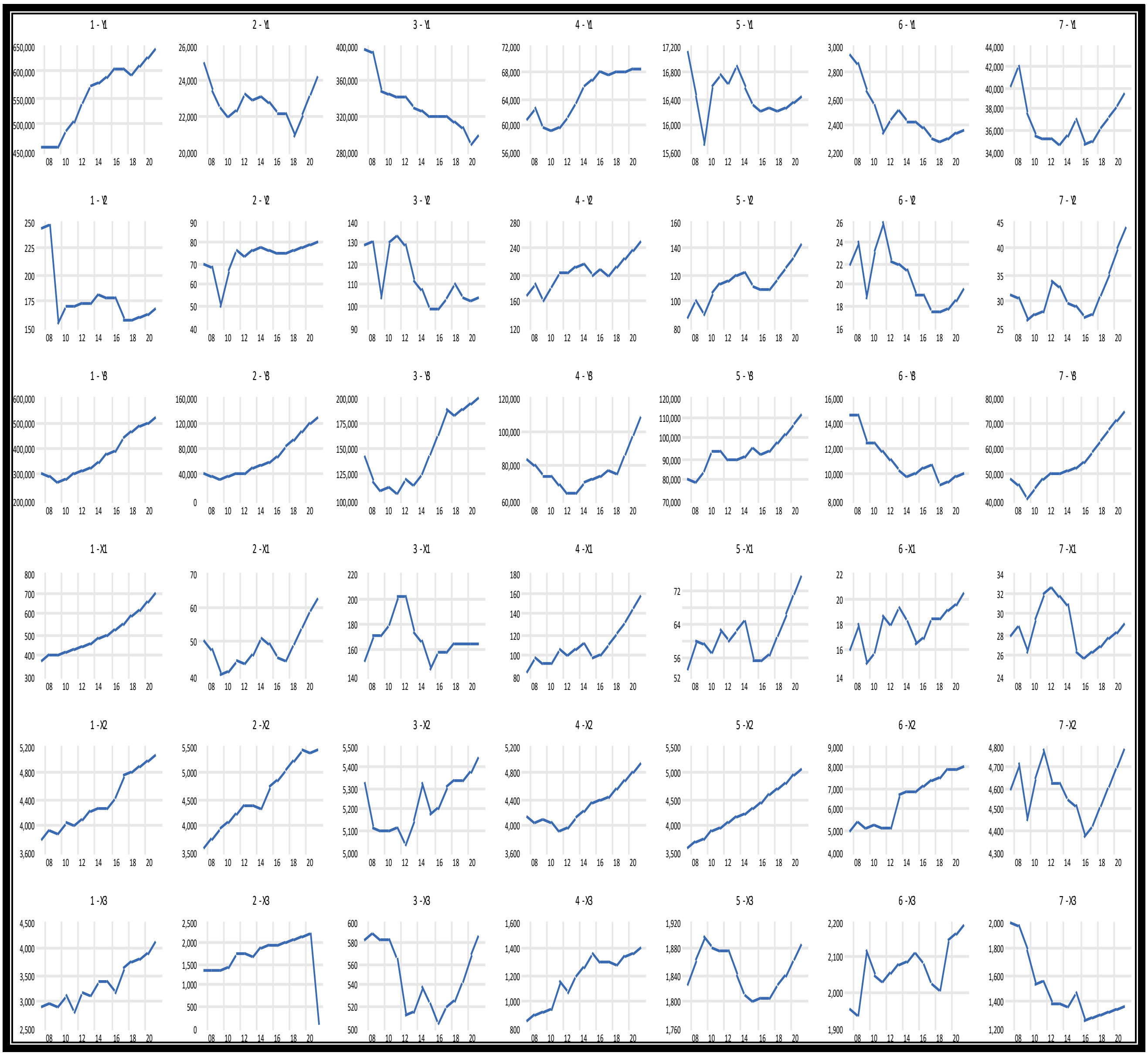

Figure (2): Plot of study variables at the single-country level

Source: Prepared by the researcher based on the outputs of the E-Views 12 program.

First: Testing the stationarity of the study variables in high-income countries: The unit root test is used in order to verify the stationarity of the time series and ensure that it is free from the problem of spurious regression of the estimated equations in order to reach correct and accurate results that can be adopted in measuring and predicting the future, using the following tests. :

Table 3: Panel unit root tests for high-income countries

panel unit root test		Levin, Lin & Chu t				Im, Pesaran and Shin W-stat			
		Individual Intercept		Individual intercept and trends		Individual Intercept		Individual intercept and trends	
		t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.

Y	At Level	-3.363	0.000	-5.210	0.000	-2.624	0.004	-2.565	0.005
	At First Difference	-5.052	0.000	-3.409	0.000	-3.909	0.000	-2.577	0.005
X_1	At Level	6.754	1.000	1.038	0.850	4.130	1.000	1.827	0.966
	At First Difference	-2.684	0.003	-4.352	0.000	-1.822	0.034	-1.621	0.052
X_2	At Level	2.254	0.987	-1.454	0.072	3.532	0.999	0.542	0.706
	At First Difference	-4.401	0.000	-4.982	0.000	-2.922	0.001	-1.924	0.027
X_3	At Level	-2.299	0.010	0.424	0.664	-0.747	0.227	1.987	0.976
	At First Difference	-1.755	0.039	-3.171	0.000	-2.042	0.020	-2.208	0.013

Source: Prepared by the researcher based on the outputs of the E-Views 12 program.

a. Levin, Lin & Chu t test: According to this test, at the original level of the variables (At Level), it appears that the variables (Y, , X3) are stationary at their level and do not have a unit root at the individual intercept, but when Individual intercept and trends: It becomes clear that (Y) was static, while the independent variables were non-static, that is, they have a unit root. However, after taking the first difference (At First Difference), it becomes clear that all the dependent and independent variables were static, i.e. It is stable at the first difference, whether in the individual intercept, or in the individual intercept and trends.

B. Im, Pesaran and Shin W-stat test: According to this test, it is clear that the variables (Y) were static and did not have a unit root, while the rest of the dependent and independent variables were non-static, and this means that they had a unit root at the individual intercept. At the individual intercept and direction, at the level (At Level), it becomes clear that only the variables (Y) were stationary, but after taking the first difference (At First Difference), it appeared that all variables are stationary, that is, stable at the first difference. See the table. (3.(

In light of the above results, some of the variables were non-stationary except for the variables (Y,, Which can be applied to the PMG/ARDL model for variables in the standard model for high-income countries.

Second: Patents (Y:(

.1Pedroni Residual Cointegration Test: It is a test of the cointegration relationship between patents (Y) and the independent variables represented by spending on research and development (X1), workers in research and development (X2), and technicians working in research and development (X3), as it showed The results through the Badroni test show that five out of seven tests confirm the existence of a long-term cointegration relationship between the variables at a significant level (5% and 10%) at the individual intercept and trends, see Table (4)

Table (4) Pedroni Test (Y)

Pedroni Residual Cointegration Test				
Test	Statistic	Prob	Weighted Statistic	Prob
Panel v-Statistic	5.325	0.000	0.996	0.159
Panel rho-Statistic	1.866	0.969	1.102	0.864
Panel PP-Statistic	-1.616	0.053	-3.892	0.000
Panel ADF-Statistic	-2.911	0.001	-4.315	0.000
Alternative hypothesis: individual AR coefs. (Between-dimension				
Test	Statistic	Prob		
Group rho-Statistic	2.167	0.984		
Group PP-Statistic	-3.751	0.000		
Group ADF-Statistic	-4.303	0.000		

Source: Prepared by the researcher based on the outputs of the E-Views 12 program.

Estimating long-term and short-term relationships (PGM): Based on the Acquaike criterion (ACI), the optimal degree of slowness is equal to (2 = Lag). To estimate relationships using the optimal degree of slowness, which showed that the program chose the optimal model from among seven models that it estimated with an optimal slowness of (1, 1,1,1) To get rid of the problem of residue correlation:

Long-term relationship results and my relationship:

There is a direct and significant relationship at the level of (1%) between (X1) represented by spending on research and development and (Y) represented by patents, and increasing (X1) by (1%) will lead to an increase of (Y) by (0.138%.(

There is a direct and significant relationship at the level of (1%) between (X2), which is represented by researchers working in research and development, and (Y), which is represented by patents. An increase in (X2) by (1%) leads to an increase in (Y) by (0.698%. .(

There is a direct and significant relationship at the level of (1%) between (X3), which is represented by technicians working in research and development, and (Y), which is represented by patents, and increasing (X3) by (1%) will lead to an increase in (Y), which is represented by patents by (%0.229).

Short-term relationship: The estimated relationships showed that the unconstrained error correction coefficient (ECM) reached a negative value of (-0.513), and a significance level of (5%). This indicates the existence of an equilibrium relationship in the short term between the variables of the study towards a long-term equilibrium relationship. The value of the error correction factor means that (51%) of the imbalances that occur in the short run in (Y) in the previous period (t-1) can be corrected in the long run by economic policy makers. In other words, the imbalances are corrected in the long run. The long one is approximately one year and eleven months because 1/0.513≅1.94. The following results showed:

Table (5) Long- and short-term relationship results (Y)

Panel PMG				
Long Run Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
X1	0.138	0.041	3.307	0.001
X2	0.698	0.226	3.083	0.003
X3	0.229	0.067	3.394	0.001
Short Run Equation				
COINTEQ01	-0.513	0.171	-2.989	0.004
$D(X_1)$	-0.115	0.104	-1.113	0.269
$D(X_2)$	0.401	0.181	2.216	0.030
$D(X_3)$	-0.231	0.202	-1.142	0.257

Source: Prepared by the researcher based on the outputs of the E-Views 12 program.

1. The sign is negative and means that there is an inverse relationship, but it is not significant at the level of (5%) between (X1) and (Y).
2. The sign is positive and means that there is a positive and significant relationship at the level of (5%) between (X2) and between (Y) in the current year (t) and the following year (t-1) in the short term, and that (X1) increases by (1%) This year, it will lead to an increase in (Y) in the following year by (0.401%).
3. The sign is negative and means that there is an inverse relationship, but it is not significant at the level of (5%) between (X3) and (Y). See Table (5).

The third section: results and recommendations

Results:

The results for the sample of countries (the United States of America, Britain, Japan, Germany, France, Sweden, Canada) showed that the unconstrained error correction coefficient (ECM) reached, respectively, (-0.203), (-1.444), (-0.531), (-0.299), (-0.705) (-0.195) (-0.213) These are negative and significant values at a significance level (1%). This means that there is a balanced relationship between the study variables in the short term towards a long-term balanced relationship. This means that the imbalances in The independent variables can be treated in the short term on the dependent variable (Y), according to the error correction factor for these countries, which is (20%), (144%), (53%), (29%), (70%), (19%). (21%), and this means that the imbalance in the previous period (t-1) can be corrected by the current period (t) between the dependent and independent variables, which can be stated according to each country as follows:

A. United State of America:

1. There is an inverse and significant relationship at the level of (5%) between patents (Y) and spending on research and development (X1) with a ratio of (-0.685).
2. There is a direct and significant relationship at the level of (5%) between patents (Y) and workers in research and development (X2) with a ratio of (0.473).

3. There is an inverse and significant relationship at the level of (5%) between patents (Y) and technicians working in research and development (X3), with a ratio of (-0.685).

B. Britain:

1. There is an inverse and significant relationship at the level of (1%) between patents (Y) and spending on research and development (X1) with a ratio of (-0.180).

2. There is a positive, non-significant relationship at the level of (5%) between patents (Y) and workers in research and development (X2).

3. There is an inverse and significant relationship at the level of (1%) between patents (Y) and technicians working in research and development (X3), with a ratio of (-0.036).

C. Japan:

1. There is a direct and significant relationship at the level of (1%) between patents (Y) and spending on research and development (X1), at a rate of (0.084).

2. There is a non-significant inverse relationship at the level of (5%) between patents (Y) and workers in research and development (X2).

3. There is a positive, non-significant relationship at the level of (5%) between patents (Y) and technicians working in research and development (X3).

D. Germany:

1. There is a direct and significant relationship at the level of (1%) between patents (Y) and spending on research and development (X1), at a rate of (0.088).

2. There is a direct and significant relationship at the level of (5%) between patents (Y) and workers in research and development (X2) with a ratio of (0.568).

3. There is an inverse and significant relationship at the level of (1%) between patents (Y) and technicians working in research and development (X3) with a ratio of (-0.079).

E. France:

1. There is a direct and significant relationship at the level of (1%) between patents (Y) and spending on research and development (X1), at a rate of (0.061).

2. There is a direct and significant relationship at the level of (5%) between patents (Y) and workers in research and development (X2) with a ratio of (1.206).

.3There is an inverse and significant relationship at the level of (1%) between patents (Y) and technicians working in research and development (X3), with a ratio of (-1.372).

F. Sweden:

1. There is an inverse and significant relationship at the level of (1%) between patents (Y) and spending on research and development (X1), at a rate of (-0.163)

2. There is a direct and significant relationship at the level of (1%) between patents (Y) and workers in research and development (X2) with a ratio of (0.335)

3 .There is an inverse and non-significant relationship at the level of (5%) between patents (Y) and technicians working in research and development (X3)

G. Canada:

1. There is an inverse and non-significant relationship at the level of (5%) between patents (Y) and spending on research and development (X1)

2. There is a positive and insignificant relationship at the level of (5%) between patents (Y) and workers in research and development (X2)

3 .There is a direct and significant relationship at the level of (1%) between patents (Y) and technicians working in research and development (X3), with a ratio of (0.284)

Recommendations:

In light of the conclusions reached, the researcher can make a number of recommendations related to research, development, and patenting, as follows:

1. Increasing the amounts spent on research and development in order to achieve the maximum possible benefit from scientific research and access to products and goods that have competitive advantages.

2. Work to increase the allocations allocated to scientific research and technological development from the national income, allocate a percentage of grants and foreign aid for research and scientific purposes, and encourage the beneficiary sectors to contribute to financing research and development projects. In order to create a balanced and stable financial system for scientific research, and its success depends on providing sufficient financial allocations for it, the government must allocate a separate budget for research, development and patenting, on the basis of which the winning scientific projects are funded in competitions to choose the best research project.

3. Introducing a system for evaluating the performance of scientific research through special indicators based on measuring the Impact Factors of research, which is a global measure to measure the importance of research and the degree of its impact on the development of research and patents in any specialty.

4. Establishing a financial system for patents within each institution that takes responsibility for developing and innovating new products, staffed by individuals with high specializations in the field of marketing scientific research carried out by research centers and institutes, allocating the revenue to support scientific research and development, and motivating workers through the system. Incentives and rewards are specific to individuals who contribute to the patent process in order to motivate its employees with the patent.

References

1. Afcha, S., & Lucena, A. (2020). The effectiveness of R&D subsidiaries in fostering firm innovation: The role of knowledge-sourcing activities. Business Research Quarterly, 1-22.
2. Pegkas, P., Staikouras, C., & Tsamadias, C. (2019). Does research and development expenditure impact innovation? Evidence from the European Union countries. Journal of Policy Modeling, 41(5), 1005-1025.
3. Al-Banna, Muhammad, 2009, The Economics of Public Finance - A Modern Introduction, second edition, University House for Printing and Publishing, Egypt.
4. Al-Janabi, Taher, 2011, Science of Public Finance and Financial Legislation, fourth edition, Al-Atak Book Industry Publishing, Cairo.
5. Al-Jubouri, Sarmad Hamid Yassin, 2015, Quantitative Analysis of the Impact of Public Spending on Economic Growth in Selected Developing Countries - Analytical Study for the Period (2009-2012), Master’s Thesis in Economics, College of Administration and Economics, Tikrit Universit
6. Al-Obaidi, Sabah Jundi Mansour, 2012, Analysis and Evaluation of the Impact of Public Spending on Domestic Savings - Iraq, a Case Study for the Period (1995-2010), Master’s Thesis in Economics, College of Administration and Economics, University of Baghdad.
7. Abdullah, Abdul Karim and Hamid, Ali Hadi, 2017, Measuring Public Expenditure in Employment for the Period (2003-2014), Al-Kout Journal of Economic and Administrative Sciences, Issue (26), June, College of Administration and Economics, Wasit University.

8. Al-Taie, Walid Khalif Jabara, 2011, Public Expenditures in Rentier Economies, Trends and Implications, Iraq, a Case Study for the Period (2003-2009), Master's Thesis in Economics, College of Administration and Economics, Al-Mustansiriya University.

9. Al-Husseini, Abdul Hassan, 2008, Human Development and Building a Knowledge Society - A Reading of the Experiences of Arab Countries, Israel, China, and Malaysia, first edition, Arab House of Science, Beirut, publishers.

10. Mustafa, Abdel Latif and Abdel Qader Murad, 2013, The impact of research and development strategy on the profitability of the economic enterprise, Algerian Enterprise Performance Journal, fourth issue, p. 28.

11. Al-Khikani, Nizar Kazem Sabah, 2010, Research and development capabilities in selected Arab countries and their role in enhancing competitiveness, Journal of Administrative and Economic Sciences, Volume 12, Issue 1.

12. Friedrich, Christoph von Pradan, 2000, The War of Creativity - The Art of Managing with Ideas, translated by Abdel Rahman Tawfiq, Center for Professional Management Expertise, Cairo.

13. Ghailan, Mahdi Sahar, 2009, The role of knowledge on the most important human and economic development indicators, research presented to the first conference of the Faculty of Management and Economics - Al-Qadisiyah University for the period March 17-18, Volume Two.

14. Shehata, Hassan, 2002, Scientific and Educational Research between Theory and Practice, Arab Book House Library, first edition.

15. Khalaf, Falih Hassan, 2007, The Knowledge Economy, Irbid, The World of Modern Books, first edition.

16. Al-Khalil, Farsi Ibrahim, Karim Bou Issa, 2019, Creativity and Innovation Management and the Role of Research and Development in the Economic Corporation (Sidal Complex Case Study), Social Empowerment Journal, second issue, pp. 94-111.

17. Zahid, Adnan Hamza and others, 2007, Guide to Writing University Theses, Scientific Publishing Center, King Abdulaziz University, Kingdom of Saudi Arabia.

18. Al-Kubaisi, Abdul Wahed Hamid and Adel Saleh Al-Rawi, 2010, Scientific research production of faculty members at Anbar University and its obstacles to humanities specializations, research presented at the Scientific Research Strategy Conference in the Arab World at the University of Baghdad, College of Education for Girls for the period February 16-18.

19. Khader, Jamil Ahmed Mahmoud, 2011, Marketing scientific research outcomes as a major requirement for quality and community partnership, a working paper presented to the International Conference for Quality Assurance in Higher Education held at Zarqa Private University - The Hashemite Kingdom of Jordan, for the period May 9-13.

20. Shaker, Muhammad Al-Arabi, and Rais Abdel Haq, 2011, International Forum on Creativity and Organizational Change in Modern Organizations, study and analysis of national and international experiences for the period 18-19/2011.

21. Qandilji, Amer, Scientific research and the use of traditional and electronic information sources - its foundations - its methods - its concepts - its tools, first edition, Amman, 2008.

22. Al-Safadi, Muhammad, and Ghaleb Awad, 2006, Scientific Research and Administrative Development in the Arab World, Reality and Future Aspirations, Research Conference on Scientific Research in the Arab World and Publishing Problems, Arab Organization for Administrative Development, Egypt.

23. Al-Rifai, Ahmed Hussein, 2009, Scientific Research Methods, Administrative and Economic Applications, sixth edition, Amman, Jordan.

24. Awad, Adel, 1998, Arab Scientific Research and the Challenges of the Next Century, A Proposed Program for Communication and Linkage between Arab Universities and Development Institutions, first edition, Emirates Center for Strategic Studies and Research, Abu Dhabi, United Arab Emirates.

25. Okil, Saeed, 1992, Functions and Activities of the Industrial Corporation, Office of University Publications, Algeria.
26. Saudi Ministry of Higher Education, 2012, Deputy Ministry for Planning and Information, General Administration of Planning and Statistics, Kingdom of Saudi Arabia, the reality of spending on research and development in the Kingdom.
27. United Nations Development Programme, Economic and Social Commission for Western Asia, New Technology to Enhance Competitiveness and Productivity in Selected Sectors, New York 2003.
28. Saeed, Awad Saeed, 2006, Obstacles and problems of administrative and environmental scientific research in Yemeni universities from the point of view of a faculty member (applied case, University of Aden), Arab Organization for Administrative Development, Egypt.
29. Al-Tanir, Akram, 2001, The global repercussions of information technology on manufacturing systems, Journal of Economic Cooperation among Islamic Countries.
30. Al-Aghbry, Badr Saeed, 2002, Priorities of Scientific Research in the Arab World, research presented to the Second Symposium on Horizons of Scientific Research and Technological Development in the Arab World, Sharjah.
31. United Nations Development Programme, Arab Human Development Report 2003.
32. Abu Arafa, Adnan Ghazi and Ali Abdul Karim Muhammad Ali, 2000, Plans and priorities for scientific research in the Gulf Cooperation Council countries, a working paper presented to the symposium on scientific research in the Gulf Cooperation Council countries, reality, obstacles and aspirations, Riyadh, for the period 12-14/ 11/2000.
33. Al-Qahtani, Mansour bin Awad, 2005, Spending on university scientific research, reality and aspiration, research presented for a workshop on activating the opinions document of Prince Abdullah bin Abdulaziz Al Saud on higher education, King Abdulaziz University, Jeddah.
34. Al-Sharrah, Ramadan, 2000, Spending on research and development and ways to diversify its sources in the State of Kuwait, Symposium on Scientific Research in the Arab Gulf Cooperation Council Countries, Reality, Obstacles and Aspirations, Riyadh, for the period 11/12-14/2000.
35. Yaghi, Mohamed Al-Sayed, 2006, The reality of university scientific research in the Arab world and its development to serve administrative development in the industrial sector, Research Conference on Scientific Research in the Arab World and Publishing Problems, Arab Organization for Administrative Development, Egypt.
36. United Nations Development Programme, Arab Knowledge Report for 2009.
37. Qanoo, Nizar and others, 2005, Scientific research in the Arab world, its reality and its role in technology transfer, Tishreen University Journal for Applied Studies and Research, Economic and Legal Sciences Series, Volume 27, Issue 4.
38. Al-Nasser, Abdel and Muhammad Ali, 2003, Labor mobility in light of globalization, Scientific Journal of the Faculty of Commerce, Assiut University, No. 34, twentieth year, June 2003.
39. Nayfa, Adnan, 2001, Science and Technology in the Contemporary World, Symposium on Science and Technology in the Arab World: Reality and Ambition, Abdul Hameed Shoman Foundation, for the period 10/20-21/2001.
40. www.Competitiveness.Gov.jo/
41. www.Mohyssin.com/forum/showthread.pdf
42. www.Compertitiveness.Gov.jo
43. http://iraqilaws.dorar-aliraq.net