

Research Universities and Their Role in Advancing Scientific Research in the Context of the Knowledge Economy

– The Higher Education System in the State of California as a Model –

الجامعات البحثية ودورها في النهوض بالبحث العلمي في ظل اقتصاد المعرفة

– نظام التعليم العالي في ولاية كاليفورنيا أنموذجا –

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Abstract:

This research aims to study the higher education system in the State of California, which is considered one of the most successful academic models worldwide, and to highlight its importance in strengthening the knowledge-based economy through the analysis of statistics of the most important indicators of the knowledge economy and research universities in California for the period (2011–2020).

Among the findings of the research is that the higher education system in California contributes effectively to driving the wheel of the knowledge-based economy, not only within the state but also at the national level. Furthermore, thanks to the efforts of research universities in California, scientific discoveries have been transformed into goods and services marketable in the marketplace through the development of products and manufacturing processes, in addition to significantly increasing production efficiency.

Keywords: Knowledge Economy; Research University; Higher Education; Scientific Research.

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I- Introduction:

The knowledge economy constitutes a fundamental driver of creativity and economic progress in the present era. It is characterized by the shift from reliance on natural resources and simple labor toward reliance on knowledge, information, and specialized expertise. As a result, new knowledge is generated and applied in innovations and technology. This new knowledge is transformed into marketable products and services, which contributes to increasing productivity, improving the quality of products and services, and enhancing economic competitiveness both nationally and internationally. To achieve this end, we find that the knowledge-based economy encompasses scientific research, technological advancement, the information industry, support for innovation and entrepreneurial projects, in addition to the development of human skills and capacities. Accordingly, universities are considered the main engine of this type of economy, serving as generators of knowledge, disseminators of it, and developers of technologies and innovations. Moreover, they work on strengthening the knowledge capacities of students, researchers, and local, regional, national, and even international communities.

Although research universities represent a small part of any academic system, they are by far the most important, as these universities place scientific research and innovation at the core of their activities, giving them greater focus compared to teaching. They are distinguished from other universities by providing the latest technologies and scientific tools in research and development, in addition to sufficient funding, excellent infrastructure, and a stimulating environment for conducting research and development in various academic and scientific fields.

In this context, the United States of America, and specifically the State of California, stands out among the countries that realized the importance of research universities in the knowledge economy since the 1960s, as it proceeded to design a unique system globally, consisting of three levels in higher education. The first level includes distinguished research universities that focus on scientific research, innovation, and academic excellence, and receive the largest funding. The second level includes teaching and research universities aimed at meeting the needs of students and local communities by providing high-quality education at reasonable costs. As for the third level, it includes institutes and colleges that offer two-year study programs qualifying students to obtain a professional diploma or transfer to a four-year university to complete their undergraduate degree.

The design of this system has contributed to strengthening research and innovation, with a focus on high-quality research. It has also led to the allocation of significant government and private sector funding for scientific research, enabling researchers and scientists in universities to conduct research and experiments and to develop new technologies and innovations.

I.1. Research Problem

Based on the above, we can pose the following fundamental question:

How have research universities contributed to the development of scientific research in light of the knowledge-based economy in the State of California?

I.2. Research Questions:

Based on the main problem, a set of detailed questions emerges as follows:

- What is the precise definition of a research university?

- What are the factors that distinguish a research university from traditional universities?
- What are the potential impacts of applying the higher education system in the State of California on both the economic and social aspects?

I.3. Research Hypotheses

To achieve the goal of answering the posed question, we set the following hypotheses:

- Research universities are prestigious entities that perform their educational and social functions through their continuous and intensive production of knowledge and its transformation into technologies;
- Research universities are distinguished by their strong focus on scientific research, whereas traditional universities are more concerned with education and teaching;
- Institutions of higher education, especially research universities in the State of California, play a highly significant role in the development of the knowledge economy.

I.4. Research Objectives

This research aims to:

- Identify the concept and nature of research universities;
- Highlight the role of research universities in developing scientific research in the context of the knowledge economy;
- Analyze the model of higher education in research universities in the State of California.

II– The Conceptual Framework of the Knowledge Economy:

The knowledge economy is a major economic field that emphasizes the critical importance of knowledge and creativity in the development and progress of the economy. It is often referred to by different names to highlight multiple aspects of knowledge, such as the information society, the digital economy, or the knowledge economy in the information age.

II.1. The Concept of the Knowledge Economy

The World Bank defines this type of economy as one that employs knowledge efficiently to achieve economic and social development. This includes importing and applying external knowledge, as well as adapting and developing knowledge to meet local needs (Al-Shammari & Al-Laithi, 2007, p. 87). For its part, the Organization for Economic Cooperation and Development defines it as an economy that relies on the production, dissemination, and use of knowledge and information (Al-Hashemi & Al-Azzawi, 2010, p. 2015). Meanwhile, others see it as an economic system in which the process of generating and exploiting knowledge is at the forefront of wealth creation (Castells, 1996, p. 03).

Based on the above, we can say that the knowledge economy is an economy in which investment in knowledge plays a central role in creating wealth. It relies on the availability of information and communication technologies and the use of innovation and digital

transformation. This is in contrast to the traditional production-based economy, where knowledge plays a secondary role and growth is driven by traditional factors of production. Moreover, qualified and highly skilled human resources, or what is called human capital, along with technical knowledge, creativity, intelligence, and information, are among the most valuable assets in the knowledge economy.

The United Nations points out that the knowledge economy currently represents 7% of the global gross domestic product and is growing at a rate of 10% annually. It is worth noting that 50% of productivity growth in the European Union is directly due to the use and production of information and communication technology. This confirms what economist Robert Solow, Nobel Prize winner in Economics in 1987, stated, where he mentioned that 34% of economic growth is mainly due to the growth of new knowledge, in addition to 16% of economic growth resulting from investment in human capital through education. Thus, 50% of economic growth is linked to knowledge (El-Din & Jaber, 2016, p. 160).

II.2. Characteristics and Requirements of the Knowledge Economy

The most important features that distinguish the knowledge economy can be highlighted in the following points (Ali, 2014, pp. 107-109):

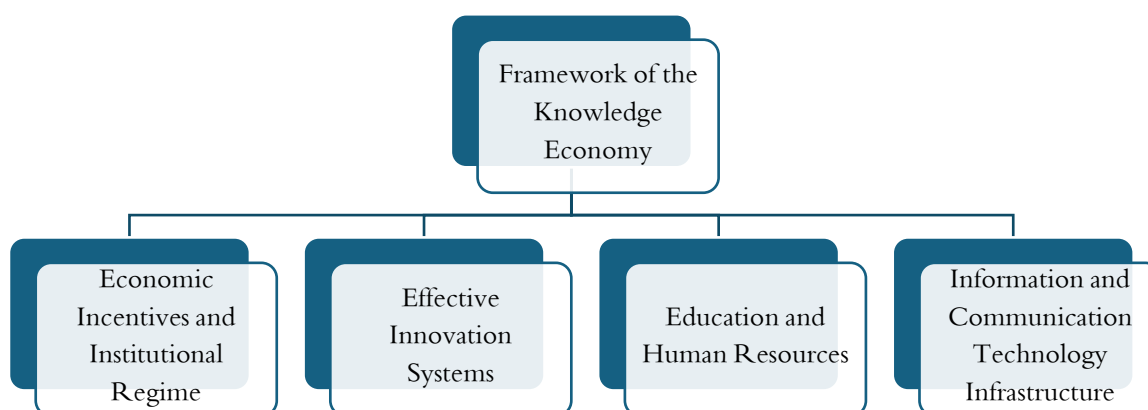
- This type of economy relies heavily on investment in knowledge and innovation, considering them the main drivers of economic progress. This requires building a solid foundation for research and development, as well as the necessary technological infrastructure, which must allow for the generation of knowledge, its wide dissemination, and the qualification of specialized human resources;
- This type of economy is characterized by the ability to adapt quickly to rapid developments in the fields of information and communication technology, in addition to the ability to keep up with continuous changes in global markets;
- It encourages continuous innovation in all aspects of work and management, including production processes, marketing strategies, and distribution systems;
- It places utmost importance on investment in human capital, as qualified and trained labor in scientific, technological, and administrative fields is considered the foundation upon which this type of economy is built, since they represent the true intellectual and knowledge capital;
- It focuses on collecting and carefully analyzing data, and using this information to make sound decisions and improve the overall performance of operations;
- It gives great attention to the development of the education sector, the promotion of a culture of innovation and scientific research, and the facilitation of access to the necessary funding for projects;
- It emphasizes the importance of transparency and accountability, aiming to improve the business environment through the development of laws and regulatory frameworks, which enhances innovation and supports economic growth;
- It works on strengthening effective partnerships between the government sector, private companies, universities, and civil society institutions, with the aim of supporting innovation, developing infrastructure, and achieving sustainable economic development.

II.3. The Knowledge Economy Index

It is a measure developed by the World Bank, aimed at assessing a country's capacity and readiness to advance within the framework of the knowledge economy. This measure is based on four main pillars, considered as the fundamental foundations of the knowledge economy, and the index presents a variety of factors related to these pillars, such as education systems, innovation capacity, information and communication technology infrastructure, as well as research and development activities and the supporting environment for knowledge-based industries. This index is used to compare the performance of countries and to identify the areas that require improvement with the aim of enhancing knowledge-based economic growth.

The World Bank represented it in the following figure:

Figure (1): The World Bank's Four Pillars of the Knowledge Economy



Source: (Summad, Al Kindi, Shamsuzzoha, Sujan, & Mohammad, 2018)

These pillars can be explained as follows:

II.3.1. Economic Incentives and Institutional Regime:

This refers to providing the economic framework and incentives for the business community and other conditions that contribute to enhancing the knowledge economy, in addition to the actual performance of the economy. It includes sub-indicators such as economic freedom, ease of doing business, regulatory quality, political stability, and control of corruption;

II.3.2. Effective Innovation Systems:

This is a measure of the level of technical research and development, which reflects the capacity for innovation and the application of new technologies. It includes some sub-indicators such as the percentage of high-tech exports, total researchers in research and development, total expenditure on research and development as a percentage of gross national product, and the annual average number of patents granted.

II.3.3. Education and Human Resources:

This is considered the primary input for the knowledge-based economy, as it focuses on human capital. It includes some sub-indicators such as total expenditure on education per individual, enrollment in secondary education, enrollment in higher education, quality of education, as well as the student-to-teacher ratio.

II.3.4. Information and Communication Technology Infrastructure:

This element includes everything related to the dissemination of information through media and communication means, and it incorporates sub-indicators such as the amount of investment in communication means, telephones used per thousand inhabitants, telephone subscriptions per thousand inhabitants, televisions and radios per thousand inhabitants, and periodicals and daily newspapers per thousand inhabitants.

Here we can review the levels of countries and their ranking based on the Knowledge Economy Index through the following table:

Table (1): Ranking and Level of Some Countries in the Knowledge Economy Index Series

Country	Rank / 143 Countries	Index Value / 10	Level
Switzerland	1	8.49	Very High Level
Sweden	2	8.43	
United States of America	3	8.28	
United Kingdom	4	8.16	
Singapore	5	8.14	
Finland	6	8.06	
Denmark	7	8.04	High Level
Netherlands	8	7.96	
Norway	9	7.9	
Germany	10	7.84	
United Arab Emirates	24	6.15	
Malaysia	33	6.46	
Saudi Arabia	47	5.11	Medium Level
China	50	5.82	
India	76	4.91	
Algeria	103	3.42	Low Level
Yemen	134	1.89	
South Sudan	135	1.82	
Niger	142	1.59	
Liberia	143	1.54	

Source: (World Bank, 2020)

The table above shows that Algeria's Knowledge Economy Index reveals significant weaknesses, indicating major challenges. Despite the slight progress recorded in areas such as education and information and communication technology infrastructure compared to previous periods, the overall picture remains below the required level.

III– The Conceptual Framework of Research Universities

The concept of the research university has undergone a remarkable transformation. In the nineteenth century, universities primarily focused on providing academic education to students, with scientific research being limited in scope and impact, often confined to specific

fields such as medicine and engineering. Then, universities shifted in an unprecedented way toward enhancing their role in scientific research and elevating their knowledge contribution. This transformation included expanding the scope of research, diversifying it to cover various fields, encouraging research activities, as well as technological development, and considering it as an integral part of their academic mission. Universities also sought to provide an ideal scientific environment for specialized researchers and scholars.

This trend is not limited to universities aspiring to improve their status only, but also includes the world's leading universities, which strive diligently to maintain their leadership in research and innovation.

III.1. The Concept of Research Universities

A research university is defined as an institution that directs a significant portion of its resources and financial capabilities toward scientific research, starting from the undergraduate (bachelor's) level up to the doctorate. These universities may be private or public, and they often attract outstanding students with high scores in university entrance exams. Faculty members holding doctoral degrees must primarily be researchers, and they are required to conduct research and publish it in accredited international journals or register patents to maintain their positions (Khoja, 2019, p. 07).

(Kerr, 2001) defines them as academic institutions committed to the creation and dissemination of knowledge in a wide variety of disciplines and fields, where they include laboratories, libraries, and other infrastructure that enable teaching and research at the highest levels. While some research universities are large and multidisciplinary, others may also be smaller in size with a narrower focus of subjects. These universities teach students at all degree levels and rely primarily on full-time academics holding doctoral degrees.

Research universities play complex and intertwined roles in the academic system. Their main tasks are to provide an appropriate research environment, supply the necessary financial and technical support for conducting research and experiments, and train and qualify students to participate in research, which is often carried out in collaboration with and funded by external entities (Altbach, 2009).

In this context, the Carnegie Foundation in the United States issued in 1994 a classification system used in the U.S. to categorize universities according to their level of scientific research. According to this classification, a research university was defined as a university that has the following characteristics (Al-Mutairi, 2012, p. 51):

- Offers a large number of bachelor's degree programs;
- Has a commitment to graduate education up to the doctoral level;
- Gives primary priority to scientific research;
- Awards more than 50 doctoral degrees annually at that time;
- Receives annual federal financial support of more than 40 million dollars at that time.

It is mentioned that the Carnegie Foundation indicated that 59 universities in the United States met these criteria in 1994.

According to the latest Carnegie classification, universities are divided into three main categories (Carnegie Classifications, 2018):

- **Major Research Universities (R1):** Universities that conduct the highest levels of scientific research and receive substantial funding from the U.S. federal government and major private institutions.
- **Comprehensive Research Universities (R2):** Universities that conduct high-quality scientific research with less funding than (R1), and are distinguished by their focus on both basic and applied research.
- **Basic Research Universities (R3):** Universities that conduct scientific research on a smaller scale, focusing mainly on undergraduate education.

Although some educational systems have developed clear mechanisms to distinguish between their higher education institutions—between research universities and teaching universities—many still suffer from ambiguity in distinguishing between educational institutions and the roles assigned to them (Al-Ghaban & Zaman, 2013).

III.2. The Tasks of Research Universities

The tasks of the research university are diverse and numerous, and they include the following:

- Providing a suitable educational environment for students and researchers, and offering the necessary academic programs to qualify students and equip them with academic and scientific skills and knowledge;
- Conducting scientific research and technological development and producing new knowledge in various fields of sciences, technologies, and humanities;
- Publishing the research and the scientific and technological results produced in prestigious scientific journals and presenting them at international and national scientific conferences;
- Expanding the scope of scientific and technological research in society and strengthening the relationship between the university and the community through organizing events, conferences, seminars, training, and providing scientific and technical consultations;
- Strengthening partnerships with institutions, companies, and governmental and private entities for the exchange of knowledge and expertise, and for the development of technologies and innovative solutions in various fields;
- Providing a suitable research environment and the necessary financial and technical support to conduct research and applied experiments and achieve scientific and technological advancement;
- Providing opportunities for continuing education and professional training for researchers, faculty members, and university staff.

III.3. The Elements of Success of Research Universities

According to (Weerts & Ronca, 2008) and the Institute of Research and Consulting, the elements of success of research universities are summarized in the following:

III.3.1. Funding:

Undoubtedly, the prosperity of a research university primarily depends on its ability to support research and provide the university's needs for suitable infrastructure to conduct research, such as laboratories, equipment, research libraries, advanced computer centers,

internet facilities, and financial capability to attract outstanding students through scholarships, as well as employing a number of PhD holders and researchers to dedicate their time to research without being preoccupied with teaching.

Adequate funding to build the foundations of research universities requires great effort in securing stable income, in addition to obtaining the necessary income for the development of the university from diverse sources and not relying solely on grants and research contracts that are subject to fluctuations beyond the control of university administrators. Moreover, prudence is required in managing the annual budget, controlling research expenses according to contracts, and the specific conditions of research grants.

III.3.2. Good Governance and Strategic Vision:

No matter how much funding and other elements are available, the research university will not succeed unless accompanied by good governance and a strategic vision that works on setting clear objectives, providing effective organizational structures, and directing resources efficiently, in addition to developing excellent team management, implementing strong control measures, making strategic decisions that support achieving the set goals, and enhancing development, excellence, academic distinction, innovation, as well as contributing to economic and social development.

III.3.3. Human Capital:

The research university must attract the best qualified professors and researchers in various fields of research, develop a suitable working environment for them, and ensure the development of their capacities and motivate them toward scientific production.

III.3.4. Students:

The research university must attract talented students and outstanding researchers, select them based on precise criteria, provide them with a suitable educational environment, and motivate them toward creativity and scientific production.

III.3.5. Intellectual Climate:

The intellectual environment, or what is known as research culture, represents the fertile ground in which research universities can invest in order to enter new fields and create the appropriate intellectual climate. To enable the university to optimally achieve its research mission, it must work on expanding the scope of meetings, conferences, and regular scientific events, in addition to enhancing the spirit of positive competition among researchers.

III.3.6. Academic Freedom:

Without academic freedom, the researcher's work becomes merely routine and lacks productivity. This freedom requires that researchers have the right to determine their research field of interest, free from any coercion or pressure. In addition, it must include the freedom to choose research methods and methodologies, while taking into account the requirements of the entities funding the research.

III.3.7. Infrastructure:

The research university must provide suitable infrastructure in terms of modern academic facilities, equipment, software, as well as intelligent systems and all the necessities and requirements of scientific research and production.

III.3.8. Partnerships:

Universities that focus on scientific research must strengthen their capacities through building cooperative relationships. This includes collaboration with other universities and similar institutions, in addition to partnerships with the industrial and commercial sectors. Also added to this are joint projects with governmental and scientific institutions, whether local or international.

IV- Research Review of the Relationship Between Higher Education and the Knowledge Economy in the University of California System

IV.1. Establishment

In 1960, the establishment of the higher education system in the State of California was announced after merging three separate educational entities. These entities were the University of California, the California State Universities, and the California Community Colleges. This merger, enacted under laws from both the federal government and the California state government, aimed to establish a high-quality higher education system and unify efforts in the field of higher education. It also sought to improve efficiency and effectiveness, save money, in addition to supporting research and innovation and providing services to society as a whole.

The management of this system falls under the Board of Regents of the University of California. As for funding, it relies on diverse sources, including funding from the federal government and the state government, as well as private organizations and commercial and research institutions. This diversity in funding aims to secure additional sources through partnerships with companies and training programs, and through collaboration in the fields of research and innovation ([Douglass, 2000](#)).

The higher education system in California gives significant attention to developing modern educational programs and advanced teaching methods, and to providing stimulating and culturally diverse educational environments. It also aims to strengthen communication and cooperation between students, professors, the local community, and the business sector. In addition, the system seeks to support research and innovation, develop public services in local, regional, and international communities, as well as to promote values of citizenship and contribution to community service.

IV.2. Components of the Higher Education System in the University of California

This system consists of three main systems: the University of California system, the California State Universities system, and the California Community Colleges system.

IV.2.1. University of California System

It is a university educational system that includes ten university campuses, considered among the most prestigious academic institutions worldwide, all of which belong to the parent University of California. These universities attract a significant proportion—one in every eight—of the state's top high school graduates, who have research ambitions or an inclination toward innovation. These universities are known for offering high-level educational programs that cover a wide range of fields, including sciences, engineering, medicine, arts, humanities, economics, and more. These institutions are distinguished by their strong focus on research and innovation, as they establish specialized research centers in various fields and disciplines.

Clark Kerr, the chief architect of this educational system, envisioned the basic features that distinguish the research university, which are all embodied in the University of California. The first of these features is that internal university management lies in the hands of the faculty, so that crucial decisions are made by academics. The second is extreme rigor in the selection and promotion of faculty members and in student admissions. The third feature is related to advanced scientific research, where great importance is given to scientific research and innovation, with the necessary infrastructure and resources provided for scientists and researchers in various fields. Finally, there is the focus on offering diverse academic programs in different areas, enabling students to choose educational and research pathways that match their interests and ambitions.

Both research and teaching constitute core missions in this university, but research enjoys tremendous importance and stands at the top of priorities.

IV.2.2. California State University System

It is an academic structure comprising twenty-three educational institutions distributed across the state. It enrolls approximately 457,992 students. It is distinguished by offering diverse curricula in various fields at costs affordable to students. It focuses on improving learning outcomes and enhancing students' abilities and practical experience.

These institutions award bachelor's, master's, and doctoral degrees, and include research universities classified as R2/R3. However, faculty members are not required to maintain the same level of research activity expected of academics in the University of California system.

IV.2.3. California Community Colleges System

It is a tuition-free higher education system consisting of 116 colleges spread across the state. This system receives more than two million students, making it the largest of its kind in the United States. These colleges focus primarily on workforce preparation, with limited research capabilities.

V- Research Universities and Their Relationship with the Knowledge Economy in California

The higher education system in California has played an important role in stimulating economic development in the state and across the United States as a whole. This system has provided the labor market with the technical expertise and skills required, which has enhanced innovation and economic growth, contributed to the creation of more job opportunities, and attracted investments. This is evident through statistics indicating that 84% of the state's population holds a high school diploma or higher, while the unemployment rate does not exceed 3.9%. Moreover, this positive impact has been reflected in the state's economic situation. California enjoys the largest economy in the United States, and it is among the largest economies in the world. The state's total GDP reached 3.37 trillion U.S. dollars according to 2022 statistics. If California were an independent country, it would rank fifth globally in terms of economy size, ahead of the United Kingdom.

In addition, the higher education system has contributed to expanding access to education and improving the educational and cultural level of society as a whole. It has also encouraged researchers and students to conduct advanced research and participate in various fields of knowledge, with California consistently ranking at the top over the years in terms of

the number of research publications annually, representing 14% of the total published research in the United States. It also holds a leading position in the number of patents it receives from the United States Patent and Trademark Office.

To assess the position of research universities in California and their impact on the knowledge economy, a set of criteria was used that collectively describe the research universities in California. These criteria included research publications from the University of California and California State Universities, university rankings in the Academic Ranking of World Universities, the Times Higher Education ranking, in addition to the total number of patents granted to research universities in California, overall expenditures on university research in California, and the number of faculty members in the state's research universities.

In addition, the criteria included another set of indicators that reflect the knowledge economy in California in general, such as the number of researchers in the field of research and development, research and development expenditures in California, California's exports of high-tech products, and the total number of patents granted to California universities. Statistics were collected for some of these indicators for the period from 2011 to 2020, as shown in the following table:

Table (2): Statistics of Some Indicators of the Knowledge Economy and Research Universities in the State of California (2011–2020)

Some Indicators of the Knowledge Economy and Research Universities Used	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of researchers in research and development in California	143,484	146,023	147,485	151,388	155,130	157,763	159,663	162,561	165,500	169,103
California's exports of high-tech products (million dollars)	138	143	147	153	154	152	161	175	182	190
Total number of patents granted by (USPTO) to the State of California	36,778	37,141	41,235	44,033	45,116	47,421	49,919	50,272	51,656	52,717
Research publications of the University of California	44,939	47,430	49,879	52,106	54,516	56,923	58,823	60,744	62,970	63,345
Research publications of California State Universities	3,142	3,238	3,423	3,523	3,641	3,689	3,723	3,741	3,845	3,939
California/State of California universities ranked in the Academic Ranking of World Universities	7	7	8	8	9	9	9	9	9	9
California/State of California universities ranked in Times Higher Education Ranking	7	7	8	9	10	10	11	12	12	12
Total number of patents granted by (USPTO) to research universities in California	875	908	909	952	984	998	981	1,018	1,008	1,024

Source: (US Bureau of Economic Analysis), (FRED Economic Data), (USPTO, 2021)

By analyzing the table above, it becomes clear that California is distinguished by superiority and technological and knowledge advancement, based on a wide range of indicators related both to research universities and the knowledge economy as a whole. It is also observed that all indicators are in a state of continuous and upward growth. For example, the number of patents obtained by the University of California alone in 2020 exceeded what all Arab countries combined obtained in 2021, as the Arab countries collectively received 878 patents from the United States Patent and Trademark Office, 80% of which were held by Saudi Arabia. As for Algeria, it obtained approximately one patent annually from the same office.

Regarding the number of universities in California ranked in the Academic Ranking of World Universities, it reached 9 universities in 2020, while no Arab country was listed among the top 200 universities worldwide. Likewise, research publications and articles from the University of California represent about 14% of the total publications of the United States of America, approximately equivalent to the collective output of the Arab countries in all fields.

It is noteworthy that California's exports of high-tech products account for about 7% of total world exports in this field, which is a significant proportion reflecting the state's technological superiority. These statistics reflect the great attention California gives to research universities and the resulting improvement in its knowledge economy indicators, which also explains its global ranking as the world's number one local economy and fifth as an economic power when compared with countries.

VI- Conclusion

The focus on research and development in research universities is a vital matter to enhance scientific and technological progress, support innovation and economic advancement, in addition to raising the level of global competitiveness. These factors make these universities a supporting nucleus for the knowledge economy in all societies. A prime example of this is the tremendous transformation witnessed by the State of California in social, economic, and demographic aspects, leading to technological progress and economic prosperity that positioned it among the strongest economies in the world. Based on this, California is considered a model to be emulated by countries and economies that aspire to achieve a qualitative leap in their economy and transition toward a knowledge economy, particularly in the higher education sector, where the State of California grants the highest priority to research universities.

VI.1. Findings

- The higher education system in the State of California has greatly contributed to driving the wheel of the knowledge-based economy, not only within the state but also at the national level;
- The higher education system in California works on preparing and equipping graduates with the expertise required by the labor market, and it is distinguished by offering multiple and advanced academic programs. These programs cover various fields such as science and technology, in addition to medicine and engineering. Furthermore, it includes programs in business, arts, and diverse humanities;
- Thanks to the efforts of universities specialized in scientific research within the higher education system in California, scientific discoveries have been transformed into goods and services available in markets. This has contributed to the development of products and manufacturing processes, in addition to significantly increasing production efficiency;
- The role of the higher education system in California is not limited to stimulating the knowledge-based economy within the state only, but extends to include promoting this type of economy across the United States as a whole. The renowned research

universities in California are famous for their close cooperation with leading companies, government institutions, and academic circles, whether at the national or international level. This cooperation enhances the exchange of expertise, the dissemination of knowledge, and technology transfer, which benefits everyone.

VI.2. Recommendations

- Developing countries in general, and Algeria in particular, should strive to reform the higher education system and intensify research and innovation efforts in universities;
- Strive toward building research universities, where the core of their work is scientific research and innovation, with the provision of all necessary factors and infrastructures that ensure their prosperity and achievement of their goals;
- Focus on initiatives that enhance research and support researchers, investing in them from the outset, such as paying attention to selecting talented and outstanding students and guiding them, providing support and mentorship throughout their studies, with the aim of forming a generation with research and creative inclinations. This generation will serve as the nucleus for the future generation of researchers;
- The current higher education system must focus greatly on developing the research and creative capacities of faculty members, involving them in the decision-making process related to the development of universities, with the aim of transitioning to distinguished research universities. This requires providing sufficient funding for research and innovation by increasing the percentage of GDP allocated to it. On the other hand, it is necessary to enhance cooperation with the private sector, whether at the local or international level, to encourage investment in research and development fields and provide the necessary support for these efforts;
- Efforts must be focused on developing economic sectors that rely on knowledge, such as modern technology, creative industries, knowledge services, and technological tourism.

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