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Knowledge Economy and its Impact on Economic Growth and Per-Capita Income: Evidence from Arab Countries

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ABSTRACT

Purpose: This study aims to analyze the development of the Global Knowledge Index (GKI) (published by the United Nations Development Program (UNDP) and Mohammed Bin Rashid Al Maktoum Foundation (MBRF)) for Arab countries according to their income levels and to assess the impact of the level of knowledge on economic growth and per capita GDP in Arab countries during the period (2017-2021). **Methodology:** The study covers a sample of the following Arab countries: (UAE, Qatar, Bahrain, Saudi Arabia, Kuwait, Oman, Jordan, Algeria, Lebanon, Tunisia, Egypt, and Morocco). Two econometric models were conducted using panel data based on the (GKI) reports: the first model estimates the impact of knowledge on GDP in Arab countries, while the second model estimates the impact of knowledge on GDP per capita for the same sample. **Findings:** Although the study results reveal a noticeable decline in the level of knowledge in the Arab countries at their various income levels during the study period, the best performance was positively associated with income level. It is also found that the level of knowledge is

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statistically significant and positively affects the gross domestic product; meanwhile, it does not have a statistically significant impact on per capita GDP. **Conclusions and Recommendations:** Several factors could explain why the knowledge index has a statistically significant impact on GDP growth, while no significant impact on per capita GDP in Arab countries; among them: high population growth, structural issues like unemployment and skill mismatches, heavy reliance on specific sectors such as oil and gas, income inequality, weak governance, and cultural barriers. The study recommends that Arab countries should direct their economies towards more reliance on knowledge which will be reflected positively in their economic growth. In addition to creating partnerships with the private sector to convert research and innovations into successful economic opportunities that increase the knowledge-added value.

Keywords: Knowledge Economy, Economic Growth, Global Knowledge Index, GDP, GDP Per Capita.

واقع اقتصاد المعرفة وأثره على النمو الاقتصادي ومستوى دخل الفرد: دراسة تحليلية على الدول العربية

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ملخص

الهدف: تهدف هذه الدراسة إلى تحليل تطور مؤشر المعرفة العالمي (الصادر عن برنامج الأمم المتحدة الإنمائي ومؤسسة محمد بن راشد آل مكتوم) للدول العربية وفقا لمستويات دخلها، وتقييم أثر مستوى المعرفة على النمو الاقتصادي وعلى نصيب الفرد من الناتج المحلي الإجمالي في الدول العربية خلال الفترة (2017-2021). **المنهجية:** تغطي الدراسة عينة مكونة من الدول العربية التالية: (الإمارات العربية المتحدة، قطر، البحرين، المملكة العربية السعودية، الكويت، عمان، الأردن، الجزائر، لبنان، تونس، مصر، والمغرب). تم تقدير نموذجين قياسيين باستخدام بيانات سلاسل زمنية مقطعية (panel data)، إذ يقدر النموذج الأول تأثير مستوى المعرفة على الناتج المحلي الإجمالي، بينما يقدر النموذج الثاني تأثير مستوى المعرفة على نصيب الفرد من الناتج المحلي الإجمالي. **النتائج:** على الرغم من أن نتائج الدراسة تكشف عن انخفاض ملحوظ في مستوى المعرفة في الدول العربية على اختلاف مستويات دخلها، إلا أن أفضل أداء ارتبط بشكل إيجابي بمستوى الدخل. كما وجدت الدراسة أن مستوى المعرفة ذو دلالة إحصائية ويؤثر إيجابًا على الناتج المحلي الإجمالي في جميع الدول العربية، في حين أن مستوى المعرفة ليس له تأثير ذو دلالة إحصائية على مستوى نصيب الفرد من الناتج المحلي الإجمالي فيها. **الاستنتاجات والتوصيات:** هناك عدة عوامل ممكن أن تفسر سبب تأثير مؤشر المعرفة بشكل كبير ومعنوي على نمو الناتج المحلي الإجمالي، في حين لم يكن أثره ذا دلالة إحصائية على نصيب الفرد من الناتج المحلي، من أبرز هذه العوامل: معدلات النمو السكاني المرتفعة، والمشاكل الهيكلية مثل البطالة، والاعتماد الشديد على قطاعات محددة مثل النفط والغاز، وعدم المساواة في الدخل، وضعف الحوكمة، والحواجز الثقافية. توصي الدراسة بأن توجه الدول العربية اقتصاداتها نحو مزيد من الاعتماد على المعرفة التي ستنعكس إيجابًا في نموها الاقتصادي، بالإضافة إلى خلق شراكات مع القطاع الخاص لتحويل البحوث والابتكارات إلى فرص اقتصادية ناجحة تزيد من القيمة المضافة للمعرفة.

الكلمات المفتاحية: اقتصاد المعرفة، النمو الاقتصادي، مؤشر المعرفة العالمي، الناتج المحلي الإجمالي، الناتج المحلي الإجمالي للفرد.

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Introduction

The global economy underwent several stages of development over the past three decades, due to changes in inputs that affect the competitiveness of economies. The changes take place in terms of the level of technology and knowledge possessed by the economy and its impact on the growth of economies, leading to the emergence of the knowledge-based economy (KBE) (Barkhordari, et al. 2018). Researchers have found that intellectual capital and knowledge positively impact the performance and wealth of nations, where they have become essential elements for the success of any organization in the knowledge economy (Nour, et al. 2022).

This is a main characteristic of the current scenario of global economic development. World economies have begun to shift towards being more knowledge-based (Tadros, 2015). The recent trend of globalization has led to the active participation of all continents, regions, or countries in the global economy, where knowledge becomes the key driver of progress (Mhamed & Hbib, 2022). Knowledge can be defined as "the final stage of transforming data into information, which turns into knowledge through the availability of a strong knowledge environment, where ideas are its products, data its raw materials, and the human mind its tool." (Abdel Monem & Qa'oul, 2019, P.7). Knowledge can also be defined as the perception and awareness of new developments and ideas that can be applied and transformed into a product (Al-Janabi & Al-Zubaidi, 2018).

The knowledge-based economy will be a cornerstone for maintaining a fast economic growth rate (Lightfoot, 2011), enhancing international competitiveness, and increasing international trade between countries by developing strategies to strengthen links with production sectors to encourage imports and exports (Bousrih, et al. 2020). This enables these countries to obtain foreign currencies, finance additional investments, and acquire knowledge and skills (Traore & Saqfalhait, 2021).

The Research Problem

Despite the importance of the knowledge economy, developing countries, including many Arab countries, face challenges in keeping up with the development of the knowledge economy. Many Arab countries

suffer from poor educational levels, high illiteracy rates, lack of technical infrastructure, poor socio-economic conditions, a decline in the level of investments, low level of spending on research, and weak innovation systems. The Global Knowledge Index has experienced a decline for most Arab countries. The Index highlighted the modest performance of the knowledge economy in Arab countries, with most of them ranking poorly in terms of their knowledge economy level. Hence, the study problem can be expressed in the following questions:

1. How did the Global Knowledge Index and its sub-indices evolve in Arab countries during the period (2017-2021)?
2. What is the impact of knowledge levels on economic growth in Arab countries?
3. To what extent does the level of knowledge influence an individual's share of the Gross Domestic Product in Arab countries?

The Importance of Research

This study analyzes the level of Knowledge Index in the Arab countries, based on the latest available data, and its relationship to economic growth and the level of per capita income in them. The study sheds light on this important aspect that has not yet received sufficient attention in Arab countries, and this can give a clearer vision of the problem to decision-makers and researchers in this field.

The Research Objectives

This study aims to achieve the following objectives:

1. Analyze the evolution of the Global Knowledge Index in Arab countries
2. Estimate the impact of knowledge levels on economic growth in Arab countries.
3. Estimate the impact of knowledge levels on per capita income in Arab countries.

Theoretical Framework and Literature Review

Literature Review

At the global level, various methods have been employed to examine the impact of the knowledge economy on economic growth and per capita income. (Mhamed & Hbib, 2022) aimed to analyze the effect of knowledge on economic growth in China during the period from 1985 to 2020. The study utilized the cointegration test and the Error Correction Model (ECM). The results indicated that knowledge plays a significant role in China's long-term economic growth. The results also indicated a positive relationship between (Foreign Direct Investment, mobile phone users, education expenditure, and trade openness) and GDP per capita. However, other variables such as patent holders among residents and non-residents and fixed phone users had a negative impact on economic growth in China during the study period.

(Aouar & Kerrouchen, 2021) aimed to analyze the impact of knowledge on economic growth in 88 developing countries during the period from 2000 to 2018 using the Generalized Method of Moments (GMM) for estimation. The study utilized Gross Domestic Product (GDP) as a dependent variable, while the explanatory variables included: innovation, information, and communication technology, total labor force, gross fixed capital formation, human capital stock, and trade openness. The results indicated the positive impact of knowledge economy variables on GDP growth in those countries.

(Phale, et al. 2021) provided an analysis of the relationship between the knowledge-based economy and economic growth between 1998 and 2018 in the Southern African Development Community (SADC) by using the Cobb-Douglas production function. The study relied on sub-indices of the Knowledge Economy Index (education, institutions, innovation, information and communication technology infrastructure), along with other explanatory variables (capital, labor force). The main dependent variable was GDP per capita. The study used panel data to estimate the Fixed Effects model and the Generalized Method of Moments (GMM) to interpret the relationship between the sub-indices of the Knowledge

Economy Index and GDP per capita, among other explanatory variables. The results indicated that education and institutions indices had the most significant impact on economic growth, while innovation and infrastructure indices had the most effect on economic growth and per capita income, demonstrating the significant role of the knowledge economy in impacting their economies. The study also revealed that both the labor force index and capital index positively influenced economic growth in the SADC.

(Širá, et al. 2020) examined the relationship between knowledge economy indicators and the competitiveness index in European Union countries over 11 years using the CV–TOPSIS Method and Subsequent Regression Model. The results showed that all EU countries were able to increase the level of competitiveness and economic sustainability by relying on a knowledge economy, through increased spending on research and development and the positive impact of the level of higher education and patents.

(Bousrih, et al. 2020) aimed to evaluate the impact of the knowledge economy on economic growth in Saudi Arabia between 1992 and 2018. By estimating the VAR model, the results indicated that "education and human resources" were the most influential pillars impacting economic growth.

(Nour, 2019) provided an in-depth and comprehensive analysis to discuss the relationship between knowledge economy and economic development in selected Arab countries by studying income level. The results indicated that there is a positive relationship between the level of per capita income, Knowledge Index, and knowledge economy in the selected Arab countries, but with differences in terms of knowledge dependence and orientation towards a knowledge-based economy.

In Algeria, a study conducted by (Mohamed & Ben Omar, 2019) aimed to measure the impact of the knowledge economy on economic growth from 1980 to 2017. The study employed a VAR model and Granger causality tests. The results showed a negative impact of ICT infrastructure, which expresses the Knowledge Economy Index on economic growth.

(Abdellaoui et al. 2018) study explored the impact of knowledge economy on economic growth and employment from 2007 to 2016 in several Arab countries (Saudi Arabia, UAE, Kuwait, Egypt, Morocco, and Tunisia). . Using Fixed Effects and OLS, the results indicated the existence of a positive relationship between economic growth and the Global Innovation Index, which expresses the pillar of innovation, education, training, research and development, and ICT infrastructure in the knowledge economy, implying positive impact of the knowledge economy on economic growth in those countries.

(Barkhordari, et al. 2018) examined the relationship between knowledge-based economy and economic growth in the Middle East and North Africa (MENA) from 2010 to 2015. Using the Generalized Method of Moments (GMM), the study found that institutions, human capital, research, infrastructure, and business development as the pillars of the knowledge economy had a significant positive impact on economic growth in the MENA region.

(Kaur & Singh, 2016) analyzed the impact of the knowledge economy on economic growth in 42 selected developing economic countries between 2000 and 2012. The study was based on the Barro & Sala-Martin model using Panel Data to achieve the study objectives. The results indicated that there is a positive relationship between the Knowledge Economy Index and economic growth, but with differences between countries.

(Skrodzka,, 2016) analyzed the level of development of the knowledge economy and its impact on economic growth in European countries during the years 2000-2013. The results highlighted variations in the level of development in the knowledge-based economy across European countries and indicated a positive relationship between the pillars of the knowledge-based economy and the knowledge-based economy index in these nations.

(Gyekye & Oseifuah, 2015) investigated the relationship between a knowledge-based economy and economic growth in three sub-Saharan African regions during the period 2000 to 2012. The study utilized the World Bank's Knowledge Assessment Methodology (KAM). It also

employed the Pooled Ordinary Least Squares (OLS) method to analyze the impact of pillars of knowledge economy on index, and Knowledge Economy on GDP per capita and representing Economic growth. The findings indicated that among the Knowledge Index (KI) indicators, education was the weakest pillar, while information and communication technology (ICT) was the second weakest. Conversely, innovation emerged as the most robust pillar among the Knowledge Index indicators for the sub-Saharan African region. The economic and institutional system pillar exhibited superior performance in the sub-Saharan South African region compared to the West, East, and Central sub-regions. Overall, sub-Saharan African countries showed weak performance across all knowledge economy indicators. Additionally, the results suggested a weak effect of the knowledge economy index on per capita GDP.

(Tchamyou, 2014) assessed the role of a knowledge-based economy in commercial business across 53 African countries from 1996 to 2010. The study used Panel Data and the Generalized Method of Moments (GMM) to achieve the objectives of the study. It utilized the pillars of the knowledge economy defined by the World Bank, including education, innovation, economic incentives, institutional systems, and information and communication technology (ICT). Additionally, the study employed the Business Index, encompassing trade openness, technological exports, and intellectual property institutions. The findings showed that the education index had a negative impact on commercial business, while the ICT index had a positive effect. Furthermore, the institutional system index had a positive impact, whereas the economic incentives index had a negative one on commercial business. However, the innovation index had a positive influence on commercial business. This indicates a positive relationship between the knowledge economy and economic growth in those countries.

Based on the previous studies, the current study provides a recent investigation that examines the knowledge economy index and its sub-indicators during the period (2017-2021) in a group of Arab countries.

Theoretical Framework

Knowledge-Economy: Recently, the world has witnessed new changes in various fields including the rapid development brought about by the revolution in technology and information (Malik & Latif, 2021). This in turn provided greater opportunities for small and large countries to increase their competitive advantage through knowledge-based economies (Tadros, 2015), where the ability to produce and progress has come to depend on creativity and innovation (Gupte, 2018). Due to converting information into knowledge, and then transforming that knowledge into a distinct product, the present era is now referred to as the knowledge era (Nour, 2019). “The concept of knowledge is not a new thing, knowledge has accompanied man since his existence and developed with him from its primitive levels until it reached its current form, but what is new is the magnitude of its impact on economic and social life and the growth of human life in general, because of the scientific and technological revolution, where it experienced the last quarter of the twentieth century witnessed the greatest change in the life of humanity is the third transformation or the third revolution” (Abdel Aal, 2016, P. 5). Thus, knowledge economy can be defined as an economy capable of producing and distributing knowledge, where Knowledge is considered the cornerstone of growth, by relying on intangible capital through embodiment of creativity, innovation, and the generation of new ideas with the help of technology (Cavusoglu, 2016). The Organization for Economic Cooperation and Development (OECD) defined it as an economy that directly relies on knowledge, information production, distribution, and use (OECD, 1996).

Dominique Foray defines knowledge economy as "a subfield of economics primarily concerned with knowledge" and describes it as a recent economic phenomenon characterized by changes in economic growth and organization, often referred to as a post-capitalist economy (Foray, 2004, p. 124). Meanwhile, (Al-Rahimi, 2011, p. 3) views knowledge economy as "a branch of economics concerned with factors contributing to general welfare by studying systems for designing and producing knowledge, and subsequently applying the necessary

procedures for its development and modernization". The Kauffman Foundation's 2007 report on the New Economy referred to it as "a set of qualitative and quantitative changes that emerged over the past fifteen years, altering economic structures, jobs, and rules" (Kauffman Foundation, 2007, p. 3). It represents an organized global economy based on knowledge, where success factors lie in the ability of entities to employ knowledge, technology, and innovation to produce high-value-added goods and services (Skrodzka, 2016).

Knowledge Economy & Economic Growth: Traditionally, land, labor, and capital were the three fundamental production factors. Conversely, in the new economy or knowledge economy (Al-Shammari, 2009), the essential assets and factors include technical knowledge, creativity, intelligence, information, and human capital (Drucker, 1969). The term "new economy" or "knowledge economy" emerged in the 1950s when researchers began noticing the ascending development of new sectors appearing in advanced countries at the expense of the agricultural and industrial sectors. These new sectors were described as the core of the new economy or, at that time, labeled as the "post-industrial phase" (cited in Laila & Djillali, 2014, p. 2). Economists sought to directly integrate knowledge into theories, particularly concerning the New Growth Theory, in an attempt to understand the role of knowledge and technology in driving productivity and economic growth through channels and key mechanisms such as investment in research and development, education, and training, and effective management models (Barkhordari, et al. 2018).

The knowledge revolution had tangible implications for economic systems, prompting comprehensive restructuring of economic structures by shifting toward knowledge production sectors and high-tech industries (Wirba, 2017). In contrast, traditional agricultural and industrial production sectors experienced declines (Abdel Monem & Qa'oul, 2019). Anticipated outcomes of the knowledge revolution include increased production levels, productivity, and competitiveness due to the evolution of cognitive skills among workers, accumulation of capital and knowledge, efficient production methods, and the presence of high-tech, low-cost services (Nour, et al. 2022). Consequently, the world is expected to witness

notable growth in supply levels of goods and services, aligning with rapid changes. Moreover, there will be tangible increases in income and living standards (Al-Fehaid & Shaili, 2021), along with a growing demand for labor in engineering, mathematics, sciences, analytical fields, and creative thinking. The knowledge revolution will also bring about favorable changes in healthcare, education, and technology-oriented infrastructure (Abdel Monem & Qa'oul, 2019).

The first study of the New Economy or Knowledge Economy appeared in the 1960s and was authored by the economist Fritz Machlup, who pointed out in his book "The Production and Distribution of Knowledge in the United States" that the new economy is based on knowledge, and that the number of workers in the knowledge-producing sectors exceeds that of workers in other economic sectors. Machlup identified five basic economic sectors within the framework of the new economy: education, research, development, communications, and information, as well as information services (Laila & Djillali, 2014). In 1977, researchers Marc Uri Porat and Michael Rubin presented a comprehensive theoretical contribution to the new economy or knowledge economy concept in their nine-part book entitled "The Information Economy". The researchers explained that the world is moving towards dealing with knowledge industries through the idea of the product, whose raw materials are data, and whose tool is the human mind (Gorji & Alipourian, 2011). They also stated that knowledge-producing sectors use knowledge and produce information, while traditional sectors use raw materials and energy in production processes such as agriculture and industry (Abdel Monem & Qa'oul, 2019).

Previous studies and economic theories have varied in identifying the most important factors that influence the knowledge economy of each country, which include Gross Domestic Product (GDP), per capita share of GDP, inflation rate (expressed through the Consumer Price Index - CPI), total labor force, net foreign investment, total formation of fixed capital, and human development. Based on this, we will briefly review and discuss these factors.

Gross Domestic Product (GDP) and Per Capita Share of GDP

Knowledge economy is not just a theoretical concept; it is rather a new era that differs from the era of agricultural and industrial economies in terms of its impact on all economic and social journals (Pale, et al. 2021). Knowledge is an important measure of economic growth in terms of GDP and GDP per capita and naturally serves as an indicator of economic growth by efficiently utilizing production factors to generate real increases in output (Mhamed & Hbib, 2022). Many economic theories and studies have linked the new economy or what is known as the knowledge economy to the technological factor; their theoretical frameworks have provided conceptual structures to understand the dynamics and mechanisms operating in the knowledge-based economy. They have also presented valuable perspectives on how the processes of knowledge creation, dissemination, innovation, and cooperation contribute to enhancing economic growth and competitiveness (Kamara, et al. 2007)

The Solow Model (1958) revealed the significance of factors other than capital and labor in increasing production (Kaur & Singh, 2016). These factors include education, knowledge, technological progress, and scientific research (Bousrih, et al. 2020). The Solow theory is one of the most common theories for measuring the total productivity of production factors. It also attributes economic growth to three main sources, namely: fixed capital stock (representing physical capital), the labor force (representing human capital), and technological progress (Aljunidi & Hanafi, 2022). The equations of the standard model of growth theory are derived from the Cobb-Douglas production function as follows:

$$Y_{it} = A_{it}K_{it}^{1-b}L_{it}^{b}, \quad 0 < b < 1 \quad ,$$

where Y represents production, A is technological progress, K is capital, and L is labor.

Solow confirmed that these factors are the main determinants of the production process (Aouar & Kerrouchen, 2021). The technological factor has a positive impact on economic growth. It has been translated into inputs on the economic supply level in the form of capital production factor (Gyekye & Oseifuah, 2015). This enhances the production process,

technological progress, the quality of the workforce. and thus economic growth, and is consequently reflected in the high level of education, health, and poverty reduction (Gomes, et al. 2022). This theory also helps to understand the continuous transition from a resource-based economy to an information-based economy. Moreover, the assumption that its forces outside the economy determine technology is the reason why the Solow model is considered an external model of growth (al-Najjar, 2016).

Some prior studies utilized GDP and per capita share of GDP as primary variables in analyzing the relationship between economic growth and the knowledge economy. Studies such as (Gyekye & Oseifuah, 2015; Barkhordari, et al. 2018) demonstrated that knowledge economy plays a positive role in economic growth. It is effective in positively influencing economic growth by relying on non-material factors like human capital, knowledge, technology, and innovation (OECD, 1996).

Total Formation of Fixed Capital and Labor Force

Several studies and theories have underscored the significant role of capital and labor as crucial elements in economic growth and their contribution to knowledge economy through investments in information technology, communications, and talents (Arab Business Community, 2018) as well as to supporting innovators and creators who require encouragement and attention (Ben Hassan, 2021). Models such as Harrod (1939) and Domar (1946) have emphasized the importance of capital and labor as factors contributing to economic growth (Ebghaei, 2022). Economist Romer (1986) affirmed in his ideal competitive growth model with increasing returns that external factors, alongside knowledge, capital, and labor, are vital contributors to production, resulting in increased returns and economic growth (Kaur and Singh, 2016, p. 4). Romer (1990) also confirmed that an economy that allocates a significant part of investments to research and development and human capital achieves long-term growth (Mohammed & Ben Omar, 2019).

Growth in human capital is also increasing through education, human skills development, and investment, which is reflected in the increase in the productivity of the college (Kamara, et al. 2007). Lucas (1988) also

studied the differences between rich and poor countries by including human capital in his analysis, considering that the marginal productivity of human capital is decreasing (Mohammed & Ben Omar, 2019); the reason is due to the extent of countries' dependence on knowledge through the use of human resources. Therefore, achieving economic growth based on knowledge requires exploiting the potential of human capital, innovation, and new technologies, as these potentials affect the development of workforce skills, along with more innovators and creators, thereby constituting a positive impact on economic growth (Phale, et.al. 2021).

The theory of endogenous growth emphasizes the importance of knowledge and innovation as the main drivers of economic growth. It maintains that internal rather than external factors primarily drive the economic development of a nation. Enhanced productivity of a country can be achieved through investments made by both the government and the private sector in such areas as human capital, innovation, and knowledge (Romer, 1994). This theory questioned the neoclassical perspective that economic development depends mainly on external factors such as the accumulation of Labor and capital (Romer, 1990). It has also significantly influenced our understanding of the knowledge-based economy by clarifying the pivotal role of knowledge and innovation as fundamental catalysts of economic growth. In sum, the endogenous growth theory emphasizes the importance of intellectual capital and intangible assets within a knowledge-based economy by integrating knowledge into the growth equation. (Nour, et al. 2022).

Some previous studies have utilized capital and labor in addition to knowledge in analyzing the relationship between knowledge economy and economic growth. Studies conducted by (Barkhordari, et al. 2018; Phale, et al. 22021; Aouar & Kerrouchen, 2021) employed capital and labor as governing variables in their analyses, demonstrating their positive impact on economic growth, further reinforcing the inclination toward reliance on knowledge.

Net Foreign Investment

Net foreign investment is one of the important factors in achieving economic development by attracting capital, closing the financing gap (Ali, 2020), enhancing competitiveness, facilitating the transfer of technology and knowledge, contributing to improving productivity, creating job opportunities, and developing human skills (Saray, 2011). The Global Knowledge Index also showed that the countries that came at the top of the ranking are the most attractive for foreign direct investment (Mohammed bin Rashid Al Maktoum Knowledge Foundation and the United Nations Development Program, 2017-2021).

According to new economic theories, many studies have used net foreign investment as a decisive variable in analyzing the relationship between knowledge economy and economic growth. Foreign direct investment is a key factor in the transfer of capital, technology, and knowledge, and the development of Human Resources (Mohamed & Hbib, 2022), thereby improving productivity factors, including increasing the productivity of the economy. (Ebghaei & Wigley 2018), clarified the role of foreign direct investment in economic growth in the Middle East region, except for some countries.

(Ali, 2020) also explained the importance of foreign investment in the transition from traditional economy to knowledge economy in an analytical study of the Egyptian economy, underscoring the direct impact of foreign investment on economic growth through supporting innovation and improving intangible (human) capital based on knowledge and technology. Similarly, (Mhamed & Hbib 2022) further emphasized the importance of net foreign investment in economic growth and its positive contribution to knowledge economy.

Inflation rate

The stability of inflation rates is essential to achieve economic growth through price stability and contributes to the overall progress of the economy (Anidiobu, et al. 2018). Instability and high inflation negatively affect long-term economic growth and limit GDP per capita (Barro, 2013). Economic theories and previous studies have confirmed that stability is a

crucial element in the process of economic growth and the transformation of economies into knowledge-based economies. This was further confirmed by a study conducted by (Mohammed & Ben Omar, 2019) in Algeria, which maintained the positive impact of inflation rates on economic growth and knowledge.

Although the general average price stability is undoubtedly a vital determinant, there are different views on the impact of inflation on economic growth, according to Mondale (1965) and Tobin (1965). "Higher inflation will prompt economic agents to hold assets instead of money, which in turn will raise investment levels, and therefore lead to more economic activities. (Sirag et al, 2023. p: 8). This is confirmed by (Sirag, et al. 2023) who indicate that the generally low level of prices positively affects the economic growth in the Arab region. In turn, Fischer (1993) explained that high inflation rates might be good for economic growth (Saimeh & Abu Orabi, 2013).

Human Development

Theoretical frameworks linking economic growth and knowledge economy include the Lucas Model (1988), which considers human capital, achieved through education and workforce training (Barkhordari, et al. 2018), an important factor contributing to economic growth. Romer (1992) also affirmed that developing countries facing a lack of physical capital can rely on human capital to advance their economies towards a knowledge-based direction (Kaur & Singh, 2016, P:4). Additionally, some studies have utilized human development as a variable in examining the relationship between knowledge economy and economic growth, indicating its positive impact on economic growth through reducing unemployment rates (Abdellaoui, et al. 2018).

The Romer model (1990) is considered one of the first realistic models of internal growth, indicating that the accumulation of knowledge and technological development leads to productivity through the sale of patents (Wirba, 2017). It also stresses the importance of cooperation, dissemination of knowledge and integration of resources and capabilities

between organizations as crucial engines of innovation and economic development (Abdul Ghuni, 2020).

The same model (1990) represents one of the earliest modern endogenous growth models which contributed to the emergence of knowledge economy. It distinguished itself through two premises: the first emphasizes education and training, implying the acquisition of knowledge through investment in human capital, and the second focuses on technological knowledge, treating it as a collective commodity. The result was that countries acquiring technological knowledge tend to grow faster than others that do not (Laila & Djillali, 2014, p. 3).

Tracking the Global Knowledge Index for Arab Countries According to Income Groups

The Global Knowledge Index (GKI) (published by the United Nations Development Program (UNDP) and Mohammed Bin Rashid Al Maktoum Foundation (MBRF)) is an important addition to development indicators that helps decision-makers understand the real transformations and challenges facing countries and ways to confront them. Countries are evaluated by the degree scale by taking values from (0-100) so that the value of (100) is "the best" and the value of (0) is "the worst" for the Global Knowledge Index and all its sub-indices. According to the 2021 report, the Global Knowledge Index for countries is measured based on seven main pillars: pre-university education, vocational and technical education and training, higher education, research and development and innovation, information and communication technology, economy, and enabling environment (Mohammed bin Rashid Al Maktoum Knowledge Foundation and the United Nations Development Programme, 2017-2021). The appendix shows the development of the Global Knowledge Index and all its sub-indices in Arab countries during the study period.

Countries in the high-income group accomplished the best performance during the study period. These countries witnessed an increase in the level of knowledge, as they directed their economies towards knowledge by depending on human capital rather than physical capital and transforming from a traditional economy to a knowledge-based

economy. These countries have appropriate infrastructure, huge oil reserves, low unemployment rates, and improvements in education and health levels. The increase in the level of knowledge in these countries led to an increase in the per-capita income and economic growth (Abdul Razzaq, 2013).

On the other hand, countries in the middle-income group experienced a decline in their level of knowledge due to regional and international conflicts, unstable economic conditions, and high unemployment rates (Al-Jilani, 2016). More information about the development of the sub-indicators of the Global Knowledge Index for Arab countries by income groups is available in the appendix.

Methodology

Study Population and Sample

The population of this study consists of all 23 Arab countries, and the sample is composed of the following 12 Arab countries: UAE, Qatar, Bahrain, Saudi Arabia, Kuwait, Oman, Jordan, Algeria, Lebanon, Tunisia, Egypt, and Morocco. These countries were selected because of the availability of their data in reports by the Mohammed bin Rashid Al Maktoum Foundation and the United Nations Development Programme's Global Knowledge Index, during the period (2017-2021).

Some Arab countries such as Syria, Libya, Sudan, Yemen, and Somalia were excluded due to the unavailability of data for specific variables. These countries had been grappling with wars as well as political, economic, and social problems. Additionally, they are classified as low-income countries where the per capita share of the national income is less than 1,018.5 dollars annually. This situation has led to a decline in various economic indicators' performance and a lack of available data for some years. Hence, relying on these countries to achieve the objectives of our study is not feasible. Moreover, these nations may need several years to improve their economic situation.

Study Variables

Dependent Variables: GDP: Gross Domestic Product in Purchasing Power Parity (GDP PPP)

The Gross Domestic Product represents the total market value of all final goods and services produced within a country during a specific period. It serves as a comprehensive performance indicator of the economic health of a particular country, often calculated annually. Data was obtained based on reports from The World Bank (2021); the GDP is measured for a country in current US dollar prices.

GDP per capita: Gross Domestic Product per capita in Purchasing Power Parity (GDP per capita PPP). This indicates the economic output per individual within a country and is computed by dividing the Gross Domestic Product of a country by its population. Data was obtained based on reports from The World Bank (2021); GDP per capita is measured in current US dollar prices.

Explanatory Variables

GK: Global Knowledge Index: This is an alternative index to the Knowledge Economy Index, created through a partnership between the United Nations Development Programme and the Mohammed bin Rashid Al Maktoum Knowledge Foundation. The Global Knowledge Index is a significant addition to the developmental indicators, providing diverse and reliable data. It helps in understanding and addressing real challenges, thereby exploring prospects and potential paths. Countries are evaluated on a scale of 0-100, with 100 being the "best" and 0 being the "worst" (Mohammed bin Rashid Al Maktoum Knowledge Foundation and the United Nations Development Programme, 2017-2021).

INF: Inflation Rate: The Inflation Rate is measured by the Consumer Price Index (CPI), which indicates the percentage change in the price of a basket of goods and services consumed by households. Data was obtained based on reports from The World Bank (2021).

HDI: Human Development Index: This index reflects social and economic development levels across different countries and is utilized by

the United Nations to assess individual human development levels in each country. Data was obtained from reports by the United Nations Development Programme (UNDP, 2021). The index is assessed on a scale from 0 to 1, where 1 represents the best and 0 represents the worst level of development.

Control Variables

TLF: Total Labor Force: The labor force represents the total number of individuals currently employed, unemployed, and actively seeking employment. Data was obtained from reports by The World Bank (2021).

GCF: Gross Fixed Capital Formation: Gross Fixed Capital Formation refers to the acquisition of productive assets (including the purchase of used assets) and their production by producers for their use, excluding disposals. Data was obtained based on reports from The World Bank (2021); GCF is measured in current US dollar prices.

FDI: Foreign Direct Investment Net Inflows: Foreign Direct Investment Net Inflows refer to direct investment capital flowing from non-resident investors into an economy. Data was obtained based on reports from The World Bank (2021), and FDI is measured in current US dollar prices.

The control variables were selected based on previous studies and economic theories. The study worked on the use of manpower variables and investment in the two models to research the impact of the knowledge economy on economic growth. Some previous studies have relied on economic theories in the selection of variables as decisive factors in economic growth with the presence of knowledge, such as the Cobb-Douglas and Solow theory. They have shown an important role of investment and human capital in the influence of knowledge on economic growth (Phale, et al. 2021).

Model and Estimation Methods

Using panel data for the Arab countries during the period 2017-2021, two models have been estimated in this study. The first estimates the

impact of knowledge level on Gross Domestic Product (GDP); the second estimates the impact of knowledge level on the per-capita GDP.

Model One: The impact of knowledge level on Gross Domestic Product (GDP)

To estimate the impact of knowledge level on GDP, which reflects overall economic performance, a multiple linear regression model was estimated for panel time series data as follows:

$$GDP_{it} = B_0 + B_1GK_{it} + B_2TLF_{it} + B_3FDI_{it} + B_4INF_{it} + E_{it} \quad \text{..... (2)}$$

This model was based on a set of previous studies such as (Phale, et al. 2021; Barkhordari, et al. 2018; Mhamed & Hbib, 2022; Aouar & Kerrouchen, 2021; Kaur & Singh, 2016) with necessary adjustments made.

The model was estimated using the logarithmic formula, where (t) refers to time and (i) refers to country, while (E) indicates the random error in estimating the first model.

Model Variables

GDP: Gross Domestic Product at Purchasing Power Parity (PPP)- the dependent variable.

Explanatory Variables include:

GK: Global Knowledge Index.

TLF: Total Labor Force.

INF: Inflation Rate.

FDI: Foreign Direct Investment net inflows.

Statistical Tests for Study Variables: ***The Correlation:*** The presence of multicollinearity among variables negatively affects the credibility of regression results. Strong correlation among explanatory variables leads to an increase in the standard error, resulting in a decrease in the statistical value (t), and consequently impacting the significance of estimated parameters. Therefore, the Spearman correlation was conducted to examine the extent of multicollinearity among independent variables.

To ensure the absence of this problem, it is essential to consider that the correlation coefficient between independent variables does not exceed the value of (0.70) (Phale, et al. 2021). The results indicated no issue of multicollinearity among the independent variables of the first model, as all values were less than (0.70), as illustrated in Table (1) below.

Table (1): The Correlation between Variables, (1st model).

Variable	Correlation			
	GK	**INF**	**LFDI**	**LTLF**
LTLF	-0.20	-0.08	0.16	1.000
LFDI	0.46	-0.18	1.000	0.16
INF	-0.15	1.000	-0.18	-0.08
GK	1.000	-0.15	0.46	-0.20

The results were further validated using the Variance Inflation Factor (VIF) test, taking into consideration that the VIF values should not exceed (10). Additionally, ensuring that the variance values (Tolerance value) (1/VIF) are greater than (10) and no tolerance index values are less than (0.10) is essential (Phale et al, 2021). These criteria indicate the absence of multicollinearity issues among the independent variables of the model, as demonstrated in Table (2) below:

Table (2): VIF Test (1st model).

Variable	1/VIF	VIF
GK	0.97	1.031
INF	0.98	1.021
LTLF	0.97	1.031
LFDI	0.98	1.021

Hausman Test

This test was conducted to determine which of the effect models (Random or Fixed Effect) is suitable for estimating the model in the study, relying on the significance level and the probability value of the Chi-square test. If the significance value is less than (5%), the Fixed Effect is

used. Conversely, if the significance value is greater than (5%), the Random Effect is employed (Kaur and Singh, 2016). Table (3) below illustrates that the probability values for the first model are greater than (5%), hence the Random Effect is utilized, as it is deemed more appropriate to examine the impact of the knowledge level on Gross Domestic Product (GDP) levels.

Table (3): Hausman Test, (1st model).

probability	0.784
Effects	Random Effects

The Results of Estimating the First Model: The extent of the impact of the level of knowledge on GDP, which represents economic growth in Arab countries, was estimated. The model was estimated using the logarithmic formula, where GDP is the dependent variable. The model included four explanatory variables: the global knowledge index, the total labor force, net foreign direct investment flows, and the inflation rate. The model was estimated using the Random Effects model for the period (2017-2021) in twelve Arab countries. The results are shown in Table (4) below:

Table (4): The Results of the Estimation of REM, (1st model).

Random Effects				
Variable		**Coefficient**	**T-statistic**	**Prob.**
C		-2.35	-1.12	0.295
GK		0.032	2.32	0.024
LTLF		0.85	6.92	0.0000
LFDI		0.07	2.13	0.0385
INF		0.010	4.022	0.0002
E(ln GDP) = -2.35 + 0.032 GK + 0.85 lnTLF + 0.07 lnFDI + 0.010 INF				
Obs	**D.W**	**F-Statistic Prob**	**Adjust R^2**	**R-square**
54	1.87	18.05 0.000	0.56	0.60

Discussion of Estimation Results: The results of the panel data analysis for the first model across all countries, as depicted in Table (4) above, demonstrate that the explanatory power of the model reached (60%). Furthermore, the statistical significance (F) indicates that the regression model, as a whole, holds statistical significance at a level of (1%). The estimation results also reveal that all explanatory variables are statistically significant at a level of (1%) and have a positive impact on Gross Domestic Product (GDP). Below is a summary of the estimation results:

1. Knowledge Level and Gross Domestic Product (GDP)

The results indicate that an improvement in the level of knowledge leads to a corresponding enhancement in Gross Domestic Product (GDP). Thus, if the global level of knowledge increases by 1%, it leads to an increase in GDP by (0.032 %) in the long term at a statistical significance of (5%). This result is consistent with the theoretical framework that indicates that the reliance on knowledge in economic growth reflects positively on economies. Solow pointed out in the modern growth model, which exceeded the idea of the classical theory depending on capital and manpower in production, that the introduction of the technological factor in the long term is a key factor in economic growth and a new engine in the factors of production. Romer (1988) also emphasized in his internal growth model that knowledge contributes to the impact on economic growth by compensating the decrease in capital (Širá, et al. 2020).

Previous studies, such as (Aouar & Kerrouchen, 2021), concluded that the impact of knowledge level on GDP was significant and positive across 88 developing countries. The findings are also consistent with those by (Abdellaoui, et al. 2018; Nour, 2019) for some Arab countries. The studies have confirmed that knowledge is a fundamental driving force of the economy, enabling countries to generate new ideas and high-quality products at low cost.

Similarly, these results are confirmed by the findings in (Phale et al, 2021), who reveal a statistically significant impact of the Global Knowledge Index on economic growth in South African countries. The

study emphasizes the prominent role and crucial importance of knowledge economy in supporting economic growth in developing countries, through transition from a traditional economy to a knowledge-based one, which encourages creativity and innovation among individuals, raises the level of spending on research and development, and invests in knowledge and technology, thereby accelerating economic growth in the Middle East and Africa. Additionally, the results align with (Kaur & Singh, 2016), who demonstrate a statistically significant effect of the Knowledge Economy Index on economic growth in 42 developing countries.

2. Inflation Rate and Gross Domestic Product (GDP)

The results suggest that an improvement in the inflation rate, measured using the Consumer Price Index, leads to an enhancement in Gross Domestic Product (GDP). So, if the inflation rate level increases by 1%, it leads to an increase in GDP by (0.010 %) in the long term at a statistical significance of (5%). This indicator reflects on the role of inflation in the transfer of knowledge and its positive impact on economic growth, as the Arab countries witnessed an increase in inflation rates during the study years, attributed to factors such as increased aggregate demand, raised consumption tax rates in some Arab nations, currency depreciation against major currencies, and other inflationary influences varying from one Arab country to another (International Monetary Fund, 2021). Economic theories and previous studies have confirmed that INF is a crucial element in the process of economic growth and the transformation of economies into knowledge-based economies. The present results are consistent with findings by (Tchamyou, 2015) for 53 African countries, which found a statistically significant impact of inflation rate on economic growth. This was also confirmed by a study conducted by (Mohammed & Ben Omar, 2019) in Algeria, which indicated a positive impact of inflation rates on economic growth and knowledge. However, the results contradict findings by (Gyekye & Oseifuah, 2015) for some African countries, which reported no statistically significant effect of inflation rate on economic growth. In their study, high inflation was found to negatively affect the economy, leading to instability in the market, preventing companies from making large investment decisions, hoarding of necessary goods and goods by

individuals, ultimately leading to lower GDP growth rates (Sirag, et al. 2023).

3. Labor Force and Gross Domestic Product (GDP)

The results indicate a positive relationship between the total labor force and Gross Domestic Product (GDP). So, if the total labor force increases by 1%, it leads to an increase in GDP by (0.85 %) in the long-term at a statistical significance of (5%). The results of this study correspond to those of several studies and theories that have underscored the significant role of labor as a crucial element in economic growth and its contribution to knowledge economy, Models such as Harrod (1939) and Domar (1946) have also emphasized the importance of capital and labor as factors contributing to economic growth. In contrast, with the neoclassical theory and the internal growth model, Romer (1988) confirmed that the labor component within the knowledge economy is a key factor in economic growth as it exploits labor force skills and their positive impact regarding job creation, innovation, and creativity.

These findings are also consistent with those by (Phale, et al, 2021), who revealed a positive impact of labor force on GDP in South African countries. All these results confirm that human capital plays a very important role in economic growth based on the internal growth model, and its direct and positive impact on the knowledge-based economy as part of sustainability and competitiveness. They also align with a study by (Aouar & Kerrouchen, 2021) for 88 developing countries, which demonstrated a statistically significant effect of labor force on the Gross Domestic Product (GDP) representing economic growth in those countries. This once again underscores the role of human capital, represented by education mainly, in raising economic growth rates in developing countries.

4. Net Foreign Direct Investment Flows and Gross Domestic Product (GDP)

The results indicate there is a positive relationship between net foreign direct investment and Gross Domestic Product (GDP). So, if the Net Foreign Direct Investment Flows increases by 1%, it leads to an increase

in GDP by (0.07) in the long term at a statistical significance of (5%). Many previous studies also agree that the knowledge economy is very much affected by the presence of foreign direct investment flows. These findings further align with those by (Barkhordari, et al. 2018; Mohamed & Ben Omar, 2019), who concluded that the impact of net foreign direct investment on economic growth was significantly positive in the Middle East and North Africa. This is because a large part of these flows from medium and long-term investments lead to promoting knowledge, the transfer of advanced technology, innovation, and skilled labor. As a result,, foreign direct investment contributes to the increase of capital stock, the creation of management skills, the introduction of new technologies, and the transformation of economies towards knowledge dependence (Ebghi & Wigley, 2018).

Model Second: The Impact of Knowledge Level on Per-Capita GDP

To estimate the impact of knowledge level on per-capita GDP, which reflects individuals' living standard, a multiple linear regression model was estimated using panel data as follows:

$$\text{GDP per capita}_{it} = B_0 + B_1 GK_{it} + B_2 GCF_{it} + B_3 FDI_{it} + B_4 HDI_{it} + e_{it} \quad (3)$$

This model was based on several previous studies such as (Phale, et al. 2021; Tchamyou, 2014; Abdellaoui, et al. 2018; Mhamed & Hbib, 2022; Nour, 2019; Aouar & Kerrouchen, 2021) with necessary adjustments made.

The model was estimated using a log formula, where (t) refers to time (i) refers to country, and (e) to random error in estimating the second model.

The variables of the model are

GDP per capita: Individual's share of GDP in purchasing power parity - (dependent variable) (Gross domestic product per capita. PPP)

The explanatory variables include:

GK: Global Knowledge Index.

FDI: Foreign Direct Investment net inflows.

GCF: Gross Fixed Capital Formation.

HDI: Human Development Index.

Statistical Tests for Study Variables: To obtain an estimate that possesses the desired characteristics for the second model, a correlation test between the independent variables and a Hausman test were performed.

The Correlation

The results showed no problem of Correlation between the independent variables of the second model, as all values were less than 0.70, as shown in table (5) below.

Table (5): The Correlation between Variables, (2nd model).

Variable	Correlation			
	GK	HDI	LFDI	LGCF
LGCF	0.05	0.05	0.36	1.000
LFDI	0.46	0.62	1.000	0.36
HDI	0.75	1.000	0.62	0.05
GK	1.000	0.75	0.46	0.05

These results were also confirmed using the Variance Inflation Factor (VIF) test, as shown in table (6) below:

Table (6): The VIF Test, (2nd model).

Variable	1/VIF	VIF
GK	0.72	1.38
HDI	0.96	1.04
LFDI	0.74	1.36
LGCF	0.93	1.07

Hausman Test

Table (7) below shows that the p-values for the second model are less than 5%; the fixed effects model is the appropriate model for estimating the relationship between the level of knowledge and the individual's share of GDP.

Table (7): The Results of the Hausman Test, (2rd model).

Probability	0.000
Effects	Fixed Effects

The Results of Estimating the Second Model: The extent of the impact of knowledge level on per capita Gross Domestic Product (GDP) in the Arab countries under study was estimated using a logarithmic formula. Per capita GDP was considered the dependent variable, while the model included four explanatory variables: knowledge level, human development, net foreign direct investment flows, and total fixed capital formation. The regression model for per capita GDP was estimated using the Fixed Effects model for the period (2017-2021). The results are presented in Table 8 below:

Table (8): The Results of the Estimation of the FEM, (2nd model).

Fixed Effects				
Variable	**Coefficient**	**T-statistic**	**Prob.**	
C	5.19	7.15	0.0000	
GK	-0.003	-1.55	0.129	
HDI	1.97	2.39	0.022	
LFDI	0.012	2.37	0.0000	
LGCF	0.47	7.04	0.023	
E (ln GDP PC) = 5.19 - 0.003 GK + 1.97 HDI + 0.012 LFDI + 0.47 LGCF				
Obs	**D.W**	**F-Statistic Prob**	**Adjust R^2**	**R-square**
54	0.957	1208.46 0.000	0.997	0.997

Discussion of Estimation Results: The results of the panel data analysis of the second model for all countries, as shown in the table above, indicate that the explanatory power of the model reached (99.7%). The statistical significance (F) also indicates that the regression model as a whole is statistically significant at a level of significance (1%). The estimation results showed that variables with a significance level of (1%) have a positive impact on the per capita Gross Domestic Product (GDP), while the Global Knowledge Index did not show statistical significance on the per capita GDP. Here are the details of the estimation results:

1. Knowledge Level and per capita GDP

The results indicate that there is a negative relationship between the level of knowledge and the per capita share of GDP. This is contrary to Solow's theory and new growth theories, which stress that the introduction of the knowledge factor contributes to raising the share of the productivity level of each worker. The present finding shows that Arab countries are still suffering from a low level of innovation, creativity, and knowledge transfer. The sub-indicators of the Global Knowledge Index like (Research and Development and Innovation, Development of Vocational and Technical Education and Training) showed the decline of some Arab countries in the ranking.

The current results also contradict those by (Bousrih, et al. 2020; and Phale, et al. 2021), who pointed out that there is a positive relationship between knowledge and per capita GDP, and the study by (Mohamed & Hbib, 2022), which found a statistically significant impact of level of knowledge on per capita GDP in China. In contrast, the current results are consistent with findings by (Mohamed & Ben Omar, 2019; Gyekye & Oseifuah, 2015), who found no statistically significant impact of the Knowledge Economy Index on per capita GDP and a weak effect of the Knowledge Economy Index on per capita GDP in a number of African countries.

2. Human Development Index and per capita GDP

Findings by (Aouar & Kerrouchen, 2021) conducted in 88 developing countries,align with the results of this study. They found a significant

impact of human capital stock on economic growth in these countries. The results support the theory of internal growth (Lucas, 1988; Romer, 1990), which stipulates that investing in human capabilities and their development contributes to the growth of knowledge, new gains for individuals and long-term economic growth.

However, the current results contradict findings by (Abdellaoui, et al. 2018) for a group of Arab countries, which did not show a statistical significance for the Human Development Index and its impact on per capita GDP. It turned out that Arab countries still needed to exploit human resources, as they did not harness material and human factors in innovation and invention and exhibited weakness in research and development journals; therefore, the relationship between the two indicators was negative.

3. Net Foreign Direct Investment Flows and per capita GDP

The results indicate that an improvement in Net Foreign Direct Investment Flows leads to an improvement in the per capita GDP. So, if the Net Foreign Direct Investment Flows increase by 1%, it leads to an increase in the per capita GDP by (0.012 %). The interpretation of the result is that foreign investment works efficiently to transfer and disseminate advanced knowledge and technology, and contributes positively to the growth of the economy, entailing an increase in the volume of total production.

The results of this study align with findings by (Mohamed & Hbib, 2022; Mohammed & Ben Omar, 2019), who found a statistically significant impact of Net Foreign Direct Investment Flows on per capita GDP. It has been shown that the positive impact of the level of knowledge on the per capita share of GDP contributes to increasing individual productivity, providing employment opportunities, and improving the level of unhappiness. All these contribute to raising the level of knowledge economy. However, these findings contradict those by (Gyekye & Oseifuah, 2015) for a group of African countries, who found no statistically significant impact of Net Foreign Direct Investment Flows on per capita GDP.

4. Total Fixed Capital Formation and per capita GDP

The results indicate that an improvement in Total Fixed Capital Formation leads to an enhancement in per capita GDP. So, if the Total Fixed Capital Formation increases by 1%, it leads to an increase in the per capita GDP by (0.47 %). The results agree with those of many studies and theories on the role of investment in the growth of per capita share. Indeed, the growth theory of the production function in the Cobb-Douglas equation confirmed the role of the investment factor as an important factor in growth in the presence of manpower and technology and in raising the level of individual and total productivity, which are due to raising the level of knowledge and economic growth.

These results also align with those by (Phale, et al. 2021), who found a statistically significant impact of Total Fixed Capital Formation on per capita GDP in South Africa, and with (Abdellaoui, et al. 2018), who found a statistical significance of Total Fixed Capital Formation and its positive impact on per capita GDP in a group of Arab countries. Additionally, the study's findings align with those by (Aouar & Kerrouchen, 202, who demonstrated a statistically significant impact of Total Fixed Capital Formation on economic growth in 88 developing countries.

These results further confirm the role of investment in knowledge, innovation, and human capital, as it plays a very important role as positive external factor of knowledge-based economy in economic growth according to the internal growth model, and promotes economic development (Nour, 2019). Most studies have confirmed that continuous investments in the pillars of the knowledge economy will help to increase the growth rate of the overall productivity factor and ultimately enhance economic growth.

Summary, Conclusions and Recommendations

Summary and Conclusions

Two standard models were estimated using panel data from the World Knowledge Index reports for 12 Arab countries in the years (2017-2021). The first model was used to estimate the level of knowledge on the gross

domestic product, which reflects economic growth. The second was used to estimate the impact of knowledge level on the individual's share of gross domestic product, for the twelve Arab countries (UAE, Oman, Bahrain, Qatar, Saudi Arabia, Kuwait, Jordan, Algeria, Tunisia, Lebanon, Egypt, and Morocco) during the period (2017-2021).

The results of the study confirm that the level of knowledge had a positive impact on economic growth in Arab countries; however, the level of knowledge was not significant regarding its effect on the per-capita GDP. The specific reasons for the knowledge index having a statistically significant impact on GDP growth but no significant impact on per capita GDP in Arab countries vary and might be influenced by several factors. Here are a few possible explanations:

Population growth: Arab countries often experience high population growth rates, which can dilute the impact of knowledge and innovation on a per capita basis. Even if the overall GDP grows due to increased knowledge, the benefits might be spread over a larger population, resulting in a limited impact on per capita GDP.

Skill mismatch: While the knowledge index might be improving, there could be a disconnection between the skills and knowledge acquired and the needs of the labor market. This mismatch can hinder the efficient utilization of knowledge in productive activities, limiting the impact on per capita GDP.

Structural challenges: Arab countries might be facing structural challenges that impede the translation of knowledge into per capita GDP growth. These challenges may include limited access to finance, insufficient infrastructure, inadequate institutions, regulatory burdens, and political instability. Such factors can undermine the effective implementation and diffusion of knowledge throughout the economy.

Economic diversification: Some Arab countries heavily rely on specific industries such as oil and gas, which may not be directly linked to the knowledge index. In these cases, the impact of increased knowledge and innovation might be overshadowed by the dominant role of resource-based sectors. Economic diversification efforts to move towards more

knowledge-intensive industries might take time to materialize and subsequently contribute to per capita GDP.

Inequality and inclusivity: Arab countries, like many others, can face significant income inequality and limited inclusivity in accessing opportunities. The benefits of increased knowledge and innovation might be concentrated among certain segments of society, leading to a limited impact on per capita GDP for the broader population.

Recommendations and Policy Implications

1. Investment in Knowledge Development: Since the study confirms a positive impact of knowledge on economic growth in the Arab countries under study, governments and stakeholders should prioritize investment in education, research, and development. This could include policies aimed at improving access to quality education, promoting innovation and technology adoption, and supporting research institutions.
2. Focus on Economic Diversification: While knowledge is shown to have a positive impact on overall economic growth, the results suggest that it may not significantly affect per-capita GDP in Arab countries. This highlights the importance of diversifying economies beyond traditional sectors and natural resources. Governments could implement strategies to foster a knowledge-based economy by supporting industries such as technology, healthcare, and education services.
3. Promotion of Knowledge Sharing and Collaboration: Arab countries could benefit from promoting knowledge sharing and collaboration both domestically and internationally. This could involve initiatives such as partnerships between universities and businesses, knowledge exchange programs, and participation in international research networks. By leveraging collective knowledge and expertise, countries may enhance their capacity for innovation and economic development.
4. Addressing Knowledge Inequality: While knowledge may contribute to overall economic growth, it is important to address any disparities

in access to education and opportunities within Arab countries. Policies aimed at reducing educational inequality, promoting lifelong learning, and providing support for marginalized communities could help ensure that the benefits of knowledge development are more widely distributed across society.

5. Long-term Monitoring and Evaluation: Continual monitoring and evaluation of knowledge-related policies and initiatives are essential to track progress and identify areas for improvement. Governments and organizations should regularly assess the effectiveness of their strategies in promoting knowledge development and economic growth, making adjustments as needed to achieve long-term sustainable development goals.

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