Investigating the Impact of Research and Development on Exports and GDP Per Capita (Evidence from the World Market)[1]

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ABSTRACT

Economic growth is a main purpose that every country aims to achieve, Egypt has been focusing on economic growth as a primary objective, particularly in recent years. Investments in research and development (R&D) represent an important variable that could affect the country's economic growth. The current study aims to test the impact of R&D on GDP per capita and exports as two indicators of economic growth by selecting a sample of countries worldwide. The results of the analysis supported the relationship between R&D and exports. On the contrary, the analysis did not support the relationship between R&D and GDP per Capita. This study takes a multidimensional approach using indicators such as R&D intensity, trade openness, and export diversification. By identifying the key drivers of economic productivity through this analysis, a framework is developed to help the Egyptian companies employing R&D to boost Exports and hence the GDP per Capita. This study advances the academic discourse on determinants of economic performance and provides actionable recommendations for policymakers, businesses, and international organizations to enhance productivity. Finally, the current research has some limitations related to the years included in the data collection, as well as the independent variables that could affect economic growth.

Keywords: *Research and Development - Economic Growth – GDP per Capita – Exports – Trade Openness – Control Variables*

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1. INTRODUCTION

The present age is characterized by globalization and technological progress, where international trade and innovation are fundamental in shaping the economic outlook of nations across the globe. Research and development (R&D) spending is key to this discourse as a driver for wealth creation (Wang et al., 2021).

Several researchers have investigated how R&D can drive economic growth in different countries. The studies encompass a range of theoretical frameworks as well as empirical studies (Boeing et al., 2022; Celli et al., 2024; Kahouli, 2018; Shahbaz et al., 2022; Song et al., 2019). For example, Yazgan and Yalçinkaya (2018) presented the idea of endogenous growth theory, which states that R&D expenditures promote long-term economic growth and improve technology. According to this concept, R&D endeavors boost output, promote creativity, accelerate the accumulation of capital, and eventually raise GDP per capita.

Achieving sustainable economic growth is a main aim for all countries, regardless of their development status. While there are many variables that affect a nation's ability to expand economically, R&D spending—which forms the cornerstone of technical advancement—is believed to play a significant role in determining economic growth. Economic growth is realized as a result of the technological knowledge produced by R&D operations, which pervades the whole economy (Sezgin, 2020).

Developed nations are seen to approach problems from an innovative standpoint, focusing on the R&D and infrastructural needs that are essential to innovation (Zoo et al., 2017). It is therefore feasible to conclude that these characteristics have a beneficial impact on the countries' ability to become developed nations (Sezgin, 2020).

The infrastructure and R&D activity needed for innovation are lacking in poor nations, hence the results are not large-scale. Developing countries can only generate economic value through R&D and innovation; in fact, it is the developing countries that require placing a greater emphasis on these areas in order to address their economic issues (Lema et al., 2018). Developing countries must ultimately make a difference in the global competitive environment by introducing new products and new production methods to new markets (Sezgin, 2020).

Although previous studies have highlighted the effect of R&D on GDP per capita and exports there is no previous study that combined the three variables together in one framework, as well as there are no previous studies that included the control variables in the relationship between these variables (Kalın, 2023). It is also worth noting that although previous studies have provided valuable

insights into the topic of the study, their scope has generally been limited to data collection from one or two countries. In contrast, the current paper addresses this gap by gathering secondary data from 266 countries, offering a more comprehensive and internationally representative analysis.

The main aim is to evaluate how R&D investment affects economic efficiency measured through exports and GDP per Capita. Through scrutinizing an assorted set of nations worldwide, this research seeks to verify the robustness of the conceptual framework and elucidate the nuanced dynamics underlying the relationship between R&D, exports, and GDP per Capita.

This study advances the academic discourse on determinants of economic performance and provides actionable recommendations for policymakers, businesses, and international organizations to enhance productivity.

2. LITERATURE REVIEW

Economic growth is usually a key issue in economic literature (Trinh, 2017). Many indicators are related to economic growth, the most two popular indicators are GDP per capita and exports (Mohamed et al., 2022).

Growth analysis necessitates measuring the economy's GDP, and the GDP formula represents one of the main factors that measure economic growth (Trinh, 2017). GDP as a measure of economic size and productive capacity gave rise to the most often used technique for quantifying people's quality of life and overall economic welfare: GDP per capita (Atkinson et al., 2015). It is often used to compare the economic well-being of countries; the rise in GDP per capita is considered an effect of good economic policy (Dědeček & Dudzich, 2022).

Looking for exports, previous studies indicated that exports are an important indicator of economic growth. Exports promote the usage of resources in the economy to generate products and services, and the surplus may be sold abroad to fulfill international demand, while also boosting national production and producing foreign exchange earnings that can be utilized to finance economic growth. Many Least Developed Countries fail to achieve economic development due to large savings and/or foreign exchange gaps. In that circumstance, exports are proposed as a method to cover the deficit. The reason why trade policy, once established, must take into account export-led growth policy, which is thought to generate resources to increase the country's revenues, which finance a country's development process, while also repaying external loans and increasing a country's foreign exchange reserves (Al Hemzawi & Umutoni, 2021).

Based on the above, GDP per capita and exports are examined in the current study, where the researcher tries to identify the variables that could affect these two factors. From previous studies (Altiner et al., 2022; Banelienė, 2021;

Czarnitzki & Giebel, 2021; Polat, 2017; Sandu & Ciocanel, 2014; Yang & Chen, 2012), it is noticed that R&D has a significant link with exports and GDP per Capita.

2.1 The Effect of R&D on the GDP per Capita

For many years, the correlation between R&D and GDP per capita has been a crucial topic of interest in economic research. Policymakers seeking to boost economic growth and enhance living standards should comprehend this connection. This review analyzes various empirical studies up until 2023, consolidating constructive as well as adverse claims about how R&D influences GDP per capita (Braconier, 2000; Sylwester, 2001).

Empirical evidence overwhelmingly supports the positive correlation between R&D and GDP per capita. (Coe & Helpman, 1995; Grossman & Helpman, 1993) conducted a landmark study showing that R&D expenditures greatly increase productivity, leading to higher GDP per capita. Their analysis of OECD countries also uncovered substantial international spillover effects from domestic investment in R&D, amplifying the global economic impact. Subsequent research has validated these findings– (Guellec & Van Pottelsberghe de la Potterie, 2004) found that both public and private investments in R&D positively affect economic growth. They emphasize that effective utilization of R&D spending is dependent on institutional frameworks - well-designed policies have been shown to maximize returns on such investments.

In their analysis of the impact of R&D investment on economic growth in 27 member states of the European Union (EU), (Czarnitzki & Giebel, 2021) employed panel data analysis. Their findings indicated that a 1% increase in R&D spending was associated with a 0.039% rise in per capita GDP growth. Furthermore, the study revealed that high-tech industries benefited more from R&D investment than low-tech ones. Similar findings were made by (Aizenman et al., 2013), who discovered that in high-income nations, a 1% increase in R&D spending as a proportion of GDP resulted in a 0.12% rise in economic growth (Agezew, 2024).

A 1% increase in patenting was demonstrated to be associated with a 0.017% rise in GDP per capita growth, further supporting the conclusion that patenting has a significant effect on economic growth. Conversely, several empirical investigations have discovered no correlation or even inverse relationships between research spending and economic growth. (Keller, 2004) demonstrated that high-income economies are better able to absorb and utilize technology more effectively than developing countries, due to their superior technological infrastructures, skilled labor forces, and established institutions.

Kafouros and Wang (2008) conducted a comprehensive study using panel data from various countries, providing strong support for the positive relationship between R&D intensity and economic growth. Their analysis concludes that R&D intensity, measured as the ratio of R&D expenses to GDP, is a significant predictor of GDP per capita growth. Wang and Tsai's research further suggests that high-income nations with greater absorptive capacity benefit more from their R&D investments, as they are better positioned to integrate new technologies into their economies. This finding aligns with the views of Bloom et al. (2020), who affirm that technological advancements driven by R&D are crucial for sustaining long-term economic growth, even though there may be diminishing returns to such investments over time.

Agezew (2024) established a significant link between GDP per capita growth, patents, and technology exports, highlighting these factors as essential drivers of economic growth. These findings have important policy implications, underscoring the need to focus on specific R&D initiatives that directly contribute to economic development.

Extensive documentation supports the crucial role of R&D in fostering innovation and technological advancement, both critical for economic growth. Through R&D activities, innovative breakthroughs lead to the developing of new products, processes and services that increase productivity resulting in higher economic output (Griliches, 2007). Moreover, R&D also accelerates the creating of high-value industries such as information technology or biotechnology generating substantial revenue while providing excellent employment opportunities and boosting GDP per capita (Fagerberg, 1994).

Despite its positive influence on GDP per capita, there are criticisms regarding the impact of R&D. Research suggests that investing solely in R&D could lead to negative effects and limitations such as diminishing returns. (Bloom et al., 2020) findings indicate that as technological complexity increases, significant breakthroughs become more difficult and expensive to achieve; thus, resulting in reduced productivity gains from additional investment into R&D spending. Therefore, while still having a crucial role in driving growth, the marginal benefits may decline over time making it necessary for increased investments to maintain parity with previous achievements.

Furthermore, the benefits of R&D may not be evenly distributed, leading to an increase in income inequality among and within countries. Countries with higher incomes that have advanced technology infrastructures and better absorptive capacities are more likely to reap the rewards of R&D investments. This discrepancy can worsen economic disparities by leaving lower-income regions behind (Guo et al., 2022). In addition, (Czarnitzki & Giebel, 2021)

observed that inefficient allocation of public investment into R&D could result in suboptimal outcomes. When targeted strategies or institutional frameworks for such investments are lacking there is a risk that anticipated economic gains will fail to materialize resulting in wasted resources as well as a limited impact on GDP per capita.

To sum up, the evidence indicates that R&D positively impacts GDP per capita by driving technological advancement and economic development. However, one must acknowledge its inherent drawbacks such as decreasing returns to R&D investment, unequal distribution of advantages, and inefficiency in spending that may hinder its overall impact on GDP per capita. Policymakers need to examine these factors critically while devising plans concerning the optimization of R&D investments so they can ensure equitable allocation of benefits along with their maximization at an economic level.

Based on the above, the first sub-hypothesis of the study can be developed as follows;

H1: There is a significant relationship between the R&D and GDP per capita.

2.2 The Effect of R&D on Exports

The relationship between R&D and export performance has garnered significant attention in economic literature. Empirical studies have consistently shown that R&D investment plays a pivotal role in enhancing a country's export capabilities, primarily through the development of innovative products and the improvement of production processes.

Numerous studies have established a positive correlation between R&D investment and export performance. For instance, Aw et al. (2011) highlighted that firms engaging in R&D activities are more likely to enter export markets due to their superior product quality and innovation capabilities. This assertion is supported by empirical evidence from various countries. In their study on Turkish manufacturing firms, Atalay et al. (2013) found that firms with higher R&D intensity exhibited greater export performance compared to their counterparts with lower R&D investment. Similarly, Basile (2001) observed that Italian firms investing in R&D were more competitive in international markets, attributing this to enhanced product differentiation and technological advancements.

The mechanisms through which R&D affects exports can be broadly categorized into product innovation and process innovation. Product innovation, resulting from R&D activities, leads to the development of new or significantly improved products, which can command higher prices in international markets and meet diverse consumer preferences. In their study, Wakelin (1998) demonstrated that UK firms with a strong emphasis on product innovation were more successful in

penetrating foreign markets. Process innovation, on the other hand, enhances production efficiency, reduces costs, and improves product quality. These improvements make firms more competitive globally, as evidenced by Roper and Love (2002), who found a significant positive relationship between process innovation and export performance in German and Irish manufacturing firms.

R&D investment also contributes to export sophistication and market diversification. Export sophistication refers to the complexity and value-added of exported products. Lederman and Maloney (2012) showed that countries investing heavily in R&D tend to export more sophisticated and technologically advanced products. This is particularly evident in the case of high-tech industries, where R&D investment is crucial for maintaining a competitive edge in global markets. Moreover, R&D activities enable firms to diversify their export markets by adapting products to meet the specific needs and regulations of different countries.

Cassiman and Golovko (2011) provided evidence that Spanish firms with higher R&D expenditure were more likely to export to a diverse range of countries, thereby reducing their reliance on any single market. In a more recent study, Gkypali et al. (2012) examined the endogeneity between internationalization and knowledge creation among global R&D leaders, emphasizing a cyclical relationship where increased R&D investment enhances export capabilities, which in turn stimulates further R&D activities. This highlights the reinforcing nature of R&D and exports, suggesting a virtuous cycle of innovation and market expansion.

The positive impact of R&D on exports is further amplified by knowledge spillovers and trade openness. Knowledge spillovers occur when firms benefit from the research outputs and innovations of other firms or institutions, enhancing their own export performance. Aghion (1990) emphasized that countries with robust R&D ecosystems experience greater knowledge spillovers, leading to higher export growth. Trade openness facilitates these spillovers by exposing domestic firms to international best practices and technological advancements. Crespi et al. (2008) argued that trade openness, combined with substantial R&D investment, creates a conducive environment for innovation and export growth.

Despite the overwhelming evidence supporting a positive relationship between R&D and exports, some studies have reported challenges and inverse relationships in specific contexts. For example, Gorodnichenko et al. (2010) found that in transition economies, the benefits of R&D investment in exports were limited due to inadequate institutional frameworks and market inefficiencies. Similarly, Zhou et al. (2023) observed that in China, the

relationship between R&D spending and export performance was not significant, suggesting that other factors, such as market access and government policies, played a more crucial role.

Recent studies have continued to investigate the nuanced dynamics of R&D and exports. Ren and Gao (2023) focused on Chinese manufacturing enterprises, revealing that digital finance can amplify the benefits of R&D by promoting exports. This study suggests that integrating digital finance with R&D activities can further enhance export performance by facilitating easier access to international markets and streamlining transactions.

Based on the above, the second sub-hypothesis of the study can be developed as follows;

H2: There is a significant relationship between R&D and Exports.

2.3 The Effect of R&D on the GDP

One of policymakers and researchers' main goals is achieving economic growth. In order to develop effective strategies, it's crucial to understand the factors that influence such growth. R&D plays a critical role since it has great potential for driving technological advancements, increasing productivity, and ultimately boosting GDP. This literature review analyzes how R&D investment affects GDP by synthesizing information from different theoretical and empirical studies - thus clarifying the mechanisms through which R&D influences economic growth (Boeing et al., 2022).

The relationship between R&D and economic growth has been firmly established in the field of economics. According to endogenous growth theory, which is mainly based on Aghion (1990); Romer (1990) models, long-term economic development relies heavily on technological progress stimulated by R&D activities. Knowledge spillovers from R&D play a critical role as per Romer's model indicating that investment in research leads to novel ideas and innovations benefitting society at large. Aghion (1990) expanded upon this concept through their "creative destruction" model highlighting how new technologies replace outdated ones resulting in continuous advancements for the economy over time.

Research based on empirical evidence has consistently shown that there is a strong correlation between increased expenditures in R&D and the growth of GDP. One pivotal study conducted by Coe and Helpman (1995) established compelling proof of how R&D contributes to enhancing productivity levels. This extensive analysis focused on OECD nations, revealing an additional effect where investments channeled towards R&D not only bolstered local productivity but also triggered cross-border spillover impacts. Such positive externalities came because of countries benefiting from technological

breakthroughs developed elsewhere, thereby amplifying the overall global impact brought about by concerted efforts directed at R&D activities.

Altıntaş and Mercan (2015) attempted to determine the connection between economic growth and R&D investment, and 21 OECD countries were taken into consideration to accomplish this goal. In this work, panel co-integration analysis was also employed. They concluded that investing heavily in R&D can significantly boost economic growth. Additionally, countries benefit from R&D investments to boost economic growth. Firstly, increased exports are a result of R&D investment, which promotes economic growth. Since exports make up a portion of GDP, an increase in export volume leads to an increase in economic growth. Furthermore, it enhances economic growth by boosting investment in countries. The primary cause of this aspect is that, like exports, investment is another part of GDP.

Further investigations have supported these discoveries. Guellec & Van Pottelsberghe de la Potterie (2004) investigated the correlation between R&D expenditure and productivity growth in diverse institutional environments with different funding sources. Their findings revealed that both public and private investments in research positively impact GDP expansion but to varying extents based on institutional framework efficiency as well as context. They deduced that optimal returns from R&D expenses are attainable only with a competent institutional system set up for this end purpose.

Recent research supports the notion that R&D has a beneficial influence on GDP. Kafouro and Wang (2008) analyzed panel data from various nations to investigate the lasting consequences of R&D for economic progress. Their results substantiated those higher levels of R&D, as measured by the ratio between expenditure in this area and GDP, have considerable predictive capabilities regarding GDP growth. The authors also pointed out how much more significant its effect can be within high-income countries where there is a greater ability to embrace new technological advances through strong absorptive capacity.

Bloom et al. (2020) conducted additional empirical research to investigate the decreasing returns of R&D. The results indicated that although R&D is still a crucial contributor to economic growth, its efficiency has decreased over time due to the mounting difficulty and expense involved in achieving substantial technological advancements. This emphasizes the importance of long-term and potentially heightened investment into R&D for maintaining optimal rates of expansion.

Further research has honed in on the function of certain categories of R&D funding. Czarnitzki and Giebel (2021) conducted a study analyzing the influence of public versus private R&D spending on economic growth among European nations. Their findings revealed that, although both forms contribute positively to GDP, public investment in R&D yields a greater effect due to its wider-reaching spillover consequences and its support for fundamental research forming the basis for innovation within private enterprises.

Additionally, emerging economies have examined the correlation between GDP and R&D. Hu et al. (2024); Kafouros and Wang (2008); Zhang et al. (2024) research delved into China's economic growth by analyzing the influence of investment in R&D while emphasizing government policies that fostered such activities. Their discoveries revealed that designated governmental backing for R&D, particularly within high-tech industries, has been crucial to propelling China's swift advancing economy.

Gaidhani et al. (2022) found a significant but negative impact of R&D expenditure on GDP growth, while Fraumeni and Okubo (2005) and Khoirudin (2023) both reported a positive impact. Fraumeni and Okubo (2005) estimated that returns to R&D capital accounted for 10% of growth in real GDP, and Khoirudin (2023) confirmed a positive and significant effect of R&D spending on economic growth in developed countries. Ali et al. (2021) further supported this, finding a strong positive association between R&D expenditure and economic growth in both developing and developed economies. However, the impact was lower in developing countries. These findings suggest that while R&D can have a positive impact on GDP growth, the specific nature of this relationship may vary across different countries and regions.

To sum up, evidence from empirical studies strongly affirms that R&D plays a crucial role in driving GDP growth. Both theoretical models as well as empirical findings emphasize the considerable and favorable influence of R&D investments on economic outcomes. By promoting technological progress, improving productivity, and establishing high-value sectors, R&D is instrumental in ensuring sustainable economic expansion. Therefore, policymakers must prioritize investing in R&D while creating supportive conditions to maximize returns from such investments for the long-term prosperity of economies.

2.4 The Relationship between Exports and GDP per Capita

The relationship between exports and GDP per capita is a well-documented subject in economic literature. Over the years, numerous studies have searched for how export activities contribute to economic growth, focusing on various mechanisms, regions, and periods. This review synthesizes recent findings on the

impact of exports on GDP per capita, highlighting theoretical frameworks, empirical evidence, and current trends up to 2024.

Classical and neoclassical trade theories form the foundation of understanding the link between exports and economic growth. Ricardo (1821) posited that international trade allows countries to specialize according to their comparative advantage, leading to increased efficiency, productivity, and overall economic output. This specialization theoretically translates into higher GDP per capita as countries optimize their resource allocation.

Vera (2023) examined Latin American economies and found that export diversification, especially in high-value-added sectors, significantly boosts GDP per capita. Their dynamic panel model demonstrated that countries with a diverse export base experienced higher economic growth rate compared to those reliant on a narrow range of export products. In contrast, Hu et al. (2024) and Zhang et al. (2024) focused on China's manufacturing sector and showed that high-tech exports have a more substantial impact on GDP per capita growth than traditional manufacturing exports. This is attributed to the higher value-added and productivity levels associated with high-tech industries, which generate greater economic benefits.

Conversely, Mohanty (2024) analyzed the agricultural export sector in South Asia and discovered that while agricultural exports positively impact GDP per capita, their effect is smaller compared to industrial and service exports. The lower value-added nature of agricultural products and their susceptibility to external shocks, such as weather conditions and global price volatility, account for this difference.

The impact of exports on GDP per capita varies significantly across differentsectors. High-tech and industrial exports generally have a more pronounced effect due to their higher value-added and productivity levels. For instance, Acar and Kesici (2024) found that in Turkey, a 1% increase in R&D spending, which often correlates with high-tech exports, led to a rise in per capita GDP by 0.039%. The manufacturing sector benefitted more from R&D investments compared to the services sector, highlighting the sectoral differences in export impacts.

Recent trends indicate that digitalization and innovation are becoming increasingly significant in shaping the export-GDP per capita relationship. Wen and Li (2024) highlighted that digital exports have become a substantial driver of GDP per capita growth in advanced economies. Countries investing in digital infrastructure and skills development are better positioned to capitalize on the economic benefits of the digital economy. Moreover, the COVID-19 pandemic has underscored the resilience of digital and high-tech exports. Studies by Zhang

et al. (2024) showed that countries with a strong digital export base experienced less economic contraction during the pandemic compared to those reliant on traditional exports.

3. RESEARCH FRAMEWORK AND HYPOTHESES

From the above literature review, the research framework and hypotheses could be developed as follows;

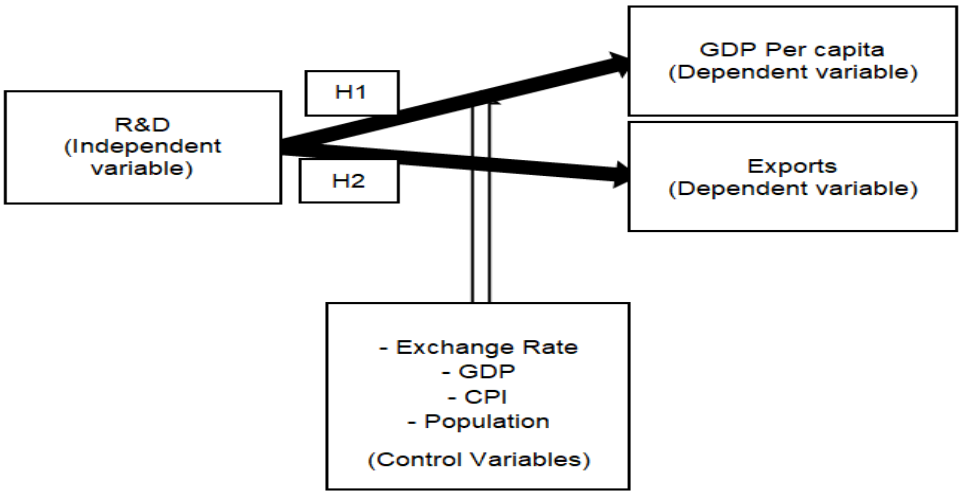

Figure 1: Research Framework

Source: The Author

Based on this framework, the research hypotheses are;

H_1: There is a significant relationship between the R&D and GDP per capita.

H_2: There is a significant relationship between R&D and Exports.

4. METHODOLOGY

This research aims to investigate the effect of R&D on the GDP per Capita by facilitating international trade and increasing the GDP. The research will contribute to the existing body of knowledge by verifying the significance of R&D and Exports on GDP per Capita. Through verifying this effect, a framework will be developed to help the Egyptian companies employing R&D to boost Exports and hence the GDP per Capita. To explain this effect, the current study used secondary data. Secondary data encompassed a comprehensive review of previous studies to identify the research dependent, independent, and control variables upon which the research conceptual framework is formulated.

Furthermore, this investigation will be verified using Secondary data from the WB. Due to the nature of the topic in the investigation, this research applied a quantitative research approach, using panel data analysis. The dataset obtained

from the WB includes all countries (266 countries), spanning the period from 2003 to 2019. A total of 266 countries were selected as they represented the total number of countries that their data are available in the WB. According to the targeted period, the research collects its data starting from 2003, to collect data about the economic situation before the financial crisis occurred in 2008. While the original intention was to focus on the past decade, the analysis was conducted till 2019, excluding the past four years. This exclusion was due to the global health conditions which had ripple effects on the global economy over the last four years. Accordingly, the study applied its model to the period from 2003 to 2019.

This data was analyzed using the OLS Model on E-Views software. The ordinary least-squares (OLS) model assumes that the analysis fits a model of a relationship between one or more explanatory variables and an outcome variable that is either continuous or at least interval. The goal of this model is to minimize the sum of square errors, which are defined as the discrepancy between the outcome variable's actual and predicted values (Burton, 2021).

Based on the formulated framework, the research considered Exports and GDP per Capita as the dependent variables, while R&D was identified as the independent variable. In addition, the research incorporated several control variables that were deemed to have a significant impact on the dependent variables. These control Variables are GDP, CPI, Population, and Exchange rate. To conduct a thorough analysis, it is crucial to define the variables involved in this research. After that, the current study proposes the hypothesis test to assess the significance of the assumptions. The hypothesis-testing process will utilize the OLS model implemented in E-Views software to provide a robust statistical framework for the collected data.

5. DATA ANALYSIS AND FINDINGS

This section analyzes the collected data and tests the research hypotheses through the following three sub-sections.

5.1 Descriptive Statistics

This research aims to investigate the effect of R&D on the GDP per Capita by facilitating international trade and increasing the GDP. The research uses Secondary data from the WB. Due to the nature of the topic in the investigation, this research uses a quantitative research approach, using panel data analysis. The dataset obtained from the WB includes 266 countries from 2003 to 2019. The current section presents the descriptive analysis of the research variables, which includes; mean, minimum, maximum, standard deviation, Jarque-Bera, and skewness and kurtosis.

Table 1: Descriptive Statistics

	LGDPPC	LEXP	LRD	LGDP	LEX	LPOP	LCPI
Mean	3.577	6.768	-0.091	10280	0.896	1.838	1.393
Median	3.692	9.998	0.000	10.590	0.412	1.849	1.959
Max	5.281	15.892	0.717	13.928	9.827	4.316	4.197
Min	0.000	0.000	-2.072	0.000	-0.687	-0.864	0.000
Std. Dev.	1.001	5.674	0.355	2.626	1.150	0.677	0.938
Skew	-1.957	-0.276	-1.861	-2.713	1.147	-0.071	-0.767
Kurt	8.141	1.231	7.826	11.475	3.778	5.055	1.718
Jarque-Bera	7867.421	646.8175	7001.736	19083.51	1105.927	800.1779	752.8192
Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: LGDPPC= LOG GDP per Capita, LEXP= LOG Exports, LRD= LOG R&D, LGDP= LOG GDP, LEX= LOG Official Exchange Rate, LPOP= LOG Population, LCPI= LOG CPI

Source: The Author

The descriptive statistics in Table 1 reveal important insights into the relationship between GDP per capita (LGDPPC), exports (LEXP), and research and development (LRD). The descriptive statistics for the variables show varied patterns. The mean value of LGDPPC and its standard deviation indicate moderate variability, while LEXP has a higher mean with a wider dispersion suggesting significant fluctuations. Moreover, LRD has a mean close to zero, in addition to a moderate standard deviation indicating slight deviations from the mean, however, LGDP has a high mean with significant variability. LEXP, LPOP, and LCPI show moderate means with standard deviations, reflecting varied dispersion in the dataset. Overall, these values reflect different levels of stability and dispersion across the variables, with some exhibiting high variability and others remaining closer to their means.

On the other hand, LGDPPC is skewed negatively with a high kurtosis, suggesting a long-left tail and extreme outliers, while LEXP showing less negative skewness and relatively low kurtosis, indicating a fairly normal distribution. LRD revealed a negative skewness with high kurtosis, showing outliers on the left, however, LGDP shows an extreme negative skewness and high kurtosis, suggesting a heavy-tailed distribution. LEXP shows positive skewness with moderate kurtosis, indicating some rightward bias. The other variables, LPOP, LCPI, and their respective skewness and kurtosis values, reflect different degrees of distribution shapes. This suggests the presence of skewness and kurtosis outside normal ranges, with most variables showing either negative or positive skewness, indicating asymmetry in their distribution. The high kurtosis values for certain variables, such as LGDPPC and LGDP, suggest the presence of outliers or extreme values in the dataset. It is also worth mentioning that all variables have significant Jarque-Bera statistics (Prob = 0.000), indicating non-normal distributions for each variable.

5.2 Correlation Analysis

The data was analyzed using the OLS Model on E-views software. E-Views is a contemporary econometric, statistics, and forecasting application that provides sophisticated analytical capabilities through a user-friendly interface. E-Views enables researchers to handle research data quickly and efficiently, do economic and statistical analysis, make predictions or model simulations, and create high-quality graphs and tables for publication or inclusion in other applications (Maiti, 2021). To achieve this aim, two main equations will be carried out:

Equation.1

$$LogGDPPC = ß0 + ß1LogRD + ß2LogGDP + ß3LogEX + ß6LogPOP + ß7LogCPI \quad (1)$$

Equation.2

$$LogEXP = ß0 + ß1LogRD + ß2LogGDP + ß3LogEX + ß6LogPOP + ß7LogCPI \quad (2)$$

Where: R&D= R&D expenditure (% of GDP), EXP= Exports as a capacity to import (constant LCU), GDP= GDP (current US$), POP= Population, total, GDPPC= GDP per capita (current US$), EX= Official exchange rate (LCU per US$, period average), CPI= Consumer price index (2010 = 100).

In the first equation, the dependent variable is the GDP per Capita while the independent variable is the R&D. For the second equation, the dependent variable is the exports while the independent variable is R&D.

The current study transformed the values of the variables to logarithms which resulted in two advantages during the analysis. First, this ensures that the variables remain almost silent. Second, the parameters can be interpreted as the elasticity of the dependent variable to changes in the independent variable. Since the two equations have the same variables, one correlation matrix will be calculated for the two equations in Table 2.

Table 2: Correlation Matrix

		LGDPPC	LEXP	LRD	LGDP	LEX	LPOP	LCPI
LGDPPC	r	1						
	Sig.	-						
LEXP	r	0.1990	1					
	Sig.	0.0000	-					
LRD	r	0.1007	-0.1462	1				
	Sig.	0.0000	0.0000	-				
LGDP	r	0.7652	0.1625	0.0675	1			
	Sig.	0.0000	0.0000	0.0000				
LEX	r	-0.1927	0.4672	-0.1796	-0.0376	1		
	Sig.	0.0000	0.0000	0.0000	0.0113	-		
LPOP	r	0.1278	0.0059	-0.0264	0.0097	-0.0719	1	
	Sig.	0.0000	0.6872	0.0754	0.5120	0.0000	-	
LCPI	r	0.1587	0.6130	-0.1508	0.0435	0.4235	0.0333	1
	Sig.	0.0000	0.0000	0.0000	0.0034	0.0000	0.0251	-

Note: LGDPPC= LOG GDP per Capita, LEXP= LOG Exports, LRD= LOG R&D, LGDP= LOG GDP, LEX= LOG Official Exchange Rate, LPOP= LOG Population, LCPI= LOG CPI
Source: The Author

The correlation matrix illustrated in Table 2 reveals that LGDPPC has a weak positive correlation with LEXP (r = 0.1990, p = 0.0000), suggesting that higher exports slightly contribute to higher GDP per capita. Similarly, LGDPPC has a weak positive correlation with LRD positive (r = 0.1007, p = 0.0000), indicating a small positive relationship between R&D and GDP per capita. On the other hand, the results revealed that there is a strong positive correlation between LGDPPC and LGDP (r = 0.7652, p = 0.0000), indicating that as GDP increases, GDP per capita tends to rise significantly. Additionally, there is a weak positive correlation between LGDPPC and LCPI (r = 0.1587, p = 0.0000), showing that higher Consumer price index (CPI) is modestly associated with increases in GDP per capita.

Moreover, the findings of the correlation analysis indicates that there is a strong positive association between LEXP and (LEX, and LCPI) (r = 0.467 and 0.6130, p = 0.0000), indicating that higher exports are closely related to the official exchange rate and CPI. However, there is a weak negative correlation between LRD and LEXP (r = -0.1462, p = 0.0000) suggesting that higher R&D might reduce exports slightly. Similarly, the relationship between LGDP and LEXP is a weak positive correlation (r = 0.1625, p = 0.0000) suggesting that higher exports contribute somewhat to overall GDP growth.

LRD shows significant, but negative, correlations with LEX, LPOP, and LCPI (r = -0.179, -0.026, and -0.150, p = 0.0000), while there is a positive significant correlation between LRD and LGDP (r = 0.067, p = 0.0000). It is worth mentioning that LPOP shows mostly weak correlations with the other variables, suggesting that its relationship with economic variables like GDP and the Official exchange rate is minimal. Accordingly, LGDP and LGDPPC are strongly positively correlated, reflecting that GDP growth drives GDP per capita. LEXP has notable positive correlations with both LCPI and LGDPPC, indicating that the Official exchange rate contributes to the Consumer price index and economic growth. On the other hand, LRD has a weak but significant impact on both LEXP and LGDPPC, while LPOP shows only minor influences on the other variables.

5.3 Hypotheses Testing

Data analysis was conducted using OLS. Ordinary Least Squares regression (OLS) is a popular technique for estimating coefficients in linear regression equations that describe the relationship between one or more independent quantitative variables and a dependent variable (simple or multiple linear regression) and is frequently evaluated using r-squared. The term "least squares" refers to the minimal squared error (SSE). Alternative techniques to OLS include maximum likelihood and the generalized method of moment estimator (Orme & Combs-Orme, 2009). The OLS approach seeks to minimize the sum of

squared differences between observed and projected values while accounting for potential multicollinearity difficulties (Ferré-Baldrich & Boqué-Martí, 2009). The current section shows the analysis of the research variables.

5.3.1 Unit Root Test

The current study tested the dependent, independent, and control variables for stationary using (Levin et al., 2002) and Fisher tests, Phillips-Perron (PP), and augmented Dickey-Fuller (ADF) (Choi, 2001) to ensure that all variables are stationary (have no unit root) at level or integrated of the same order (Barakat et al., 2016; Onafowora & Owoye, 1998). Using three tests, the results in Table 3 demonstrate that all variables are stationary at level.

Table 3: Unit Root Test

	PP		ADF		Levin	
	Statistic	Probability	Statistic	Probability	Statistic	Probability
LGDPPC	2127.68	0.0000	846.726	0.0000	-21.8332	0.0000
LEXP	2125.85	0.0000	596.800	0.0000	-20.4302	0.0000
LRD	2181.13	0.0000	670.198	0.0000	-20.4429	0.0000
LGDP	2097.51	0.0000	895.982	0.0000	-14.6407	0.0000
LEX	1952.69	0.0000	657.757	0.0000	-18.2473	0.0000
LPOP	2244.43	0.0000	760.830	0.0000	-11.7205	0.0000
LCPI	2083.07	0.0000	591.284	0.0000	-17.5617	0.0000

Source: The Author

In Table 3, the three tests of Fisher tests, Phillips-Perron (PP) and augmented Dickey-Fuller (ADF) are applied and the results demonstrated that all variables are stationary at level, where the probability of all the variables equal to 0.000, which are less than 0.05, meaning there are no unit roots and the variables do not have trends over time. This stationarity implies that these variables are suitable for use in time-series modeling without the need for differencing to achieve stationarity.

5.3.2 Hausman Test

The current study conducted a Hausman Test to test the hypotheses first and identify whether to run the model under the fixed or random effect (Hausman, 1978). The demonstrated test result in Table 4 indicates that the random effect is most appropriate since the p-value is not significant (more than 0.05).

Table 4: Hausman Test Result

	Equation (1)		Equation (2)	
	Probability	Chi-sq statistic	Probability	Chi-sq statistic
Hausman Test	0.5032	4.327822	0.8856	1.726048

Source: The Author

Table 4 shows the results of the Hausman test, where the results for both equations show high p-values (0.503 for Equation 1 and 0.885 for Equation 2), both of which are greater than the standard significance level of 0.05. This indicates that the null hypothesis, which assumes that the random effects model is appropriate, cannot be rejected. Therefore, the random effects model is preferred over the fixed effects model in both equations, suggesting that individual-specific effects are not correlated with the independent variables in the model. This means that a random effects approach is more efficient for analyzing the data.

5.3.3 Hypotheses Test

The OLS results for the two equations will be illustrated in Tables 5, and 6, respectively. As mentioned before, in the first equation, the dependent variable is the GDP per Capita while the independent variable is the R&D. In the second equation, the dependent variable is the exports while the independent variable is R&D.

Table 5: Random Effect Regression for the First Equation

Random Effect Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.263935	0.043273	6.099328	0.0000
LRD	0.125533	0.024682	5.086101	0.0000
LGDP	0.282872	0.003283	86.16573	0.0000
LEX	-0.217574	0.008348	-26.06185	0.0000
LPOP	0.141882	0.012727	11.14804	0.0000
LCP	0.251793	0.010179	24.73762	0.0000
Effect Specifics				
R-Square		0.669791		
Adjusted R-square		0.669426		
S.E. of regression		0.576039		
F-statistics		1832.038		
Prob(F-statistics)		0.000000		

Source: The Author

Table 5 shows the relationship between R&D and GDP per Capita. The random effect regression results show significant relationships between GDP per Capita and all independent variables. The results indicated that LRD has a positive and significant coefficient (0.1255, p = 0.000), indicating that increases in R&D positively affect the dependent variable. LGDP also shows a strong positive effect (0.282, p = 0.000), suggesting that economic growth substantially contributes to the growth of GDP per Capita. On the other hand, LEX has a negative and significant coefficient (-0.217, p = 0.000), showing that a higher Official Exchange Rate might have a negative impact in this context. Both LPOP

and LCPI are positively and significantly related to the dependent variable, with coefficients of 0.141 and 0.251 respectively. Furthermore, the R-squared value of 0.669 indicates that approximately 66.98% of the variation in the dependent variable is explained by the model, showing a good fit. The F-statistic of 1832.038, with a p-value of 0.000, confirms that the model is highly significant overall, meaning that the independent variables collectively have a strong explanatory power.

Table 6: Random Effect Regression for the Second Equation

Random Effect Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-2.064275	0.315741	-6.537866	0.0000
LRD	-0.583441	0.180091	-3.239706	0.0012
LGDP	0.331301	0.023954	13.83091	0.0000
LEX	1.277737	0.060914	20.97606	0.0000
LPOP	0.048729	0.092864	0.524735	0.5998
LCPI	2.969277	0.074268	39.98056	0.0000

Effect Specifics	
R-Square	0.452322
Adjusted R-square	0.451715
S.E. of regression	4.201783
F-statistics	745.9438
Prob(F-statistics)	0.000000

Source: The Author

Table 6 shows the relationship between R&D and Exports. The results of the random-effect regression analysis indicate that most of the independent variables significantly impact the dependent variable. The findings revealed that LRD has a negative coefficient (-0.583) and is significant (p = 0.001), suggesting that higher R&D negatively affects Exports. Additionally, both LGDP and LEX have positive and significant coefficients (0.331 and 1.277 respectively), indicating that economic growth and official exchange rate are strong positive contributors. On the other hand, LPOP shows an insignificant coefficient (0.048, p = 0.599), implying that population size has no statistically meaningful impact. On the other hand, LCPI is highly significant and positively impacts the dependent variable (2.969, p = 0.000), showing that Consumer price index has a substantial effect. Moreover, the R-squared value of 0.452 suggests that about 45.23% of the variance in the dependent variable is explained by the model, which is moderate but leaves room for other influencing factors not captured in the model. The F-statistic of 745.943, with a p-value of 0.000, confirms the overall significance of the model, indicating that the independent variables collectively explain a significant portion of the variance.

6. RESULTS AND DISCUSSION

This research aims to investigate the effect of R&D on Exports and GDP per Capita by facilitating international trade and increasing the GDP. The research uses Secondary data from the WB. Due to the nature of the topic in the investigation, this research applied a quantitative research approach, using panel data analysis. The dataset obtained from the WB includes 266 countries from 2003 to 2019. This data was analyzed using the OLS Model on E-Views software. To achieve this aim, two main equations have been carried out.

H1: There is a significant relationship between R&D and GDP per Capita

The analysis aimed to investigate the relationship between R&D and GDP per Capita. The regression results, as presented in Table 5, provide valuable insights into this relationship. The findings of the random-effect regression analysis indicated that R&D has a positive and significant impact on GDP per capita, suggesting that increased investment in research and development contributes to economic growth. These findings imply that the variation in R&D have a substantial impact on the GDP per Capita. On the other hand, it is important to consider additional variables or alternative models that could better explain the dynamics of economic growth and its relationship with R&D.

Additionally, the analysis shows that GDP also has a significant and positive influence on GDP per capita, this suggests that overall economic growth and GDP are critical factors influencing the standard of living. Conversely, Official exchange rates are proven to have a negative effect on GDP per capita, indicating that a higher Official exchange rate may not always correspond to higher per capita GDP in this context. Other variables such as population and the Consumer Price Index (CPI) also show significant positive relationships, emphasizing their influence on economic performance. Overall, the model demonstrates the important role of R&D, GDP, and other factors in shaping economic growth and living standards.

In this context, previous research has consistently shown a positive and significant relationship between R&D expenditure and overall GDP. This implies that countries with higher R&D investments tend to experience higher levels of economic output. In a study by Falk (2007), a novel perspective on the impact of R&D investment on long-term economic growth is provided. The research investigates whether the specialization of R&D activities exerts an additional effect on GDP per working-age population. The findings reveal strong effects of both the ratio of business enterprises' R&D expenditures to GDP and the share of R&D investment in the high-tech sector on the GDP per Capita and GDP per hour worked in the long term.

In their study, Acar & Kesici (2024) directed their intention towards investigating the relationship between R&D expenditure and economic growth in Turkey spanning the years 1990 to 2021. The findings from their analysis indicate a substantial and statistically significant positive correlation between Turkey's R&D expenditures and economic growth. Specifically, the data reveals that a 1% augmentation in R&D spending corresponds to an average increase of 0.16 percent in economic growth. This underscores the importance of R&D investment as a driver of economic expansion, highlighting its potential to contribute significantly to sustained economic development.

Therefore, the first hypothesis that "**There is a significant relationship between R&D and GDP per Capita"** is fully supported according to the results of the current research.

H2: There is a significant relationship between R&D and Exports

Based on the statistical analysis conducted, the random-effect regression results showed that LGDP, LEX, and LCPI have significant positive relationships with the Exports. This suggests that increases in GDP, Exchange Rate, and Consumer price index positively impact the dependent variable. However, LRD has a negative and significant effect, indicating that higher R&D negatively impacts the dependent variable. LPOP, however, shows an insignificant relationship, suggesting that population size has little to no impact in this model. These statistical results provide strong evidence for the significant negative relationship between R&D and Exports. The negative coefficient for R&D and the associated statistical significance indicate that an increase in R&D is associated with a decrease in the level of Exports. This finding suggests that R&D investments may have implications for the competitiveness and market reach of a country's exports.

Additionally, these findings indicate that the economic variables, such as GDP, Exchange Rate, and Consumer price index, play a significant role in influencing the dependent variable, with positive relationships suggesting that as these factors grow, the dependent variable increases as well. The population size, however, does not seem to have a meaningful impact in this model, as its relationship with the dependent variable is statistically insignificant. Overall, the model provides a strong explanation for the variation in the dependent variable based on these key economic indicators.

It is worth noting that several literatures confirmed the association between R&D and Exports. In this regard, Aw et al. (2011) highlight that firms engaging in R&D activities are more likely to enter export markets due to their superior product quality and innovation capabilities. This assertion is supported by empirical evidence from various countries. In their study on Turkish

manufacturing firms, Atalay et al. (2013) found that firms with higher R&D intensity exhibited greater export performance compared to their counterparts with lower R&D investment.

In their study, Lederman and Maloney (2012) showed that countries investing heavily in R&D tend to export more sophisticated and technologically advanced products. Moreover, R&D activities enable firms to diversify their export markets by adapting products to meet the specific needs and regulations of different countries. On the other hand, Zhou et al. (2023) observed that in China, the relationship between R&D spending and export performance was not significant, suggesting that other factors, such as market access and government policies, played a more crucial role. This highlights the importance of R&D investment as a driver of Exports.

Accordingly, the second hypothesis "**There is a significant relationship between R&D and Exports"** is fully supported according to the results of the current research.

7. CONCLUSION AND RECOMMENDATIONS

Through this research, the current study uncovered the crucial importance of R&D in fostering capital accumulation and driving economic growth and technological progress. The expansion of R&D activities has a significant impact on advancing economies - especially emerging ones- by boosting domestic economic activity and productivity levels.

Additionally, the evaluation revealed the crucial significance of R&D in promoting economic expansion and per capita GDP. By instigating a cycle of innovation and cultivating demand for more R&D personnel, investments made in R&D, as well as patents and technology exports facilitate economic growth. These results underscore the need for strategic efforts aimed at stimulating economic progress through targeted investment into furthering advancements via research activities while illuminating beneficial ties between heightened focus on R&D ventures to accelerate high-tech exporting initiatives leading to improved overall financial stability within nations' economies.

The first hypothesis proposed that there is a direct relationship between R&D and GDP per capita. While some studies such as Altıntaş and Mercan (2015) found a positive impact of R&D on GDP per capita, the overall evidence from the literature suggests this direct relationship may be insignificant. However, the review highlighted an indirect pathway through which R&D can influence GDP per capita. Through examining the first hypothesis, it was observed that several control variables contributed to enhancing the relationship between R&D and GDP per capita. It was demonstrated that LGDP, LPOP, and LCPI have a

strong positive effect on GDP per Capita. On the other hand, LEX has a negative and significant coefficient.

The second hypothesis predicted a relationship between R&D and exports. The analysis revealed R&D to have a positive and significant relationship with exports. Higher R&D levels were found to enhance a country's export performance. This is in line with the literature, which frequently demonstrated R&D as a driver of exports, especially for technology and high-tech goods. Private sector R&D in particular was evidenced to influence export volumes (Sandu & Ciocanel, 2014; Panda & Sharma, 2020). Studies also highlighted how R&D spurs innovation to increase the international competitiveness of exports (Panda & Sharma, 2020; Sandu and Ciocanel, 2014). The literature consistently showed the importance of R&D in bolstering export capabilities and volumes, validating the research findings.

Based on the findings of this research, several recommendations can be proposed. The following table shows the action plan done based on the findings of the study. This action plan provides some recommendations for decision-makers, where the duration for applying each recommendation is determined.

Table 7: Recommendations for Decision Makers

Recommendation	Decision Maker
It is important to focus on increasing R&D spending to stimulate economic growth through higher GDP levels. While R&D does not directly impact individuals' prosperity, it can indirectly do so by expanding the overall economy.	Governments and Corporates' owners
It is recommended to develop R&D by determining the main goals and objectives for the development of R&D. These goals and objectives can be achieved by creating a main structure of the R&D department that suits these goals and works on achieving them effectively.	Policymakers
Another recommendation to develop R&D is creating and sustaining efficient quality assurance methods inside the R&D, in which helps in offering a high level of provided service.	Policymakers and High management-level at Corporates
The development of R&D could be achieved also through getting help from external partners. But before contacting these partners, it is a must to be sure about their professionalism and efficiency.	Policy makers and High management level at Corporates
It is also recommended that any development happening in R&D must be consistent with the market dynamics and the global insights.	Governments, Policy makers, and High management levels at corporations
Some targeted policies and incentives must be implemented to promote export-oriented industries. Fostering exports can help improve standards of living as captured by GDP per capita.	Governments and policymakers
Financial support mechanisms for R&D activities in export sectors should be prioritized. This will leverage the positive relationships	Governments and policymakers

Recommendation	Decision Maker
between R&D, exports, GDP, and ultimately GDP per capita.	
The government should encourage industries to put more focus on implementing R&D by explaining its importance related to the company's performance as well as its benefits on the country's economy.	Governments
Regional economic cooperation and trade agreements can be strengthened to provide access to larger foreign markets for exports. This will maximize the benefits of R&D in boosting trade and income.	Governments and Corporates' owners
To strengthen the economy, fight poverty, and decrease unemployment, the government should keep putting more money into the economy and attracting more foreign investors.	Governments
Expanding energy-mix alternatives, to cope with the future industrial electricity demand arising from increased economic growth	Policymakers
Raising R&D expenditure, particularly private R&D expenditure can significantly boost high-tech exports and competitiveness in the country	Governments And Policymakers
Employ experienced workers to improve exports	Governments
Invest in both domestic and foreign R&D efforts to improve national productivity.	Governments
Invest in human capital development, as it has a positive impact on human productivity growth.	Governments

Source: The Author

8. CONTRIBUTION AND IMPLICATIONS

The implications of this research are significant for policymakers, researchers, and businesses. Specifically, the connections uncovered between exports, R&D expenditure, and GDP per capita underscore the necessity for export-focused measures as well as focused initiatives on innovation to augment economic progress and technological advancement. Governments alongside international organizations ought to prioritize investments in R&D acknowledging their input towards promoting sustainable economic development.

This research sheds light on the crucial role of R&D in elevating exports and GDP per Capita for companies operating in Egypt. By comprehending how these two aspects interact with one another, businesses can devise effective plans to utilize their investments in R&D towards enhancing their export potential, thus making a valuable contribution towards enriching the country's economic growth.

Moreover, examining control variables provides key understandings about how they affect the dependent variables. This understanding can aid policymakers in crafting effective economic policies that take into account elements such as GDP, exchange rates, Population, and consumer price index. These insights lead to a

more complete comprehension of the intricate interplay between these factors and facilitate economic advancement.

Furthermore, the current paper contributes to the existing literature by addressing the identified research gap through the collection of secondary data from 266 countries. This approach provides a more comprehensive and internationally representative analysis, allowing for a deeper understanding of the impact of R&D in elevating exports and GDP per Capita across diverse cultural, economic, and regulatory contexts.

9. LIMITATIONS AND SUGGESTIONS FOR FUTURE WORK

Although there are limitations to this research, it lays the groundwork for future studies to expand upon. Primarily, the analysis relied on aggregate country-level data and did not account for potential variations across industries and economic sectors. As such, it did not fully capture heterogeneity in the relationships under examination that may be present at more disaggregated levels. Data constraints also restricted the sample period, and analyzing a longer time series incorporating additional years of observations may have yielded different statistical results. Finally, the study was unable to fully control for the impact of recent global shocks such as the COVID-19 pandemic on trade, R&D activities, and economic performance.

Therefore, while offering broad support for the hypothesized relationships, the results must be interpreted with an awareness of these limitations in mind. Addressing such shortcomings through enhanced data and refined methodologies can help corroborate and strengthen the findings in future related research endeavors.

Finally, the current study provides some recommendations for future research. The first recommendation is adding other independent variables than R&D development that could affect GDP growth and exports. It is also recommended to extend the period of collecting the data, the data of the current study is collected from 2003 to 2019. The current study starts with year 2003 as it aims to collect data that shows the economic situation before the financial crisis. The global financial crisis of 2007–2009 turned out to be the most serious economic crisis since the Great Depression. After starting as a US subprime mortgage crisis in 2007 and spreading to an international banking crisis on September 15, 2008, it was caused by Lehman Brothers' failure. The crisis was followed by a global economic slowdown, the Great Recession (Levy et al., 2022). The collection of data stopped at 2019 because the economic situation become unstable after the corona virus. The coronavirus disease 2019 (COVID-19) first appeared in late 2019. It was first identified in Wuhan City, Hubei Province, China, on 12 December 2019. In the beginning of 2020, the virus has since spread over

numerous nations and territories, posing a threat to international health. On February 11, 2020, the World Health Organization (WHO) declared that the current CoV-associated disease is COVID-19, caused by SARS-CoV-2 (Dhama et al., 2020). Thus, it is recommended to collect data through more years and include the period of Coronavirus, to be able to notice the difference that had happened as a result of this pandemic that had affected the economy globally.

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دراسة تأثير البحث والتطوير على الصادرات ونصيب الفرد من الناتج المحلي (أدلة دولية)

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ملخص البحث باللغة العربية

النمو الاقتصادي هو هدف رئيسي تسعى كل دولة إلى تحقيقه، وقد ركزت مصر على النمو الاقتصادي كهدف أساسي لها، وخاصة في السنوات الأخيرة. تمثل الاستثمارات في البحث والتطوير متغيرًا مهمًا يمكن أن يؤثر على النمو الاقتصادي للبلاد. تهدف الدراسة الحالية إلى اختبار تأثير متغير البحث والتطوير على نصيب الفرد من الناتج المحلي الإجمالي والصادرات كمؤشرين هامين للنمو الاقتصادي. اعتمدت الدراسة على اختيار عينة من البلدان في جميع أنحاء العالم. دعمت نتائج التحليل العلاقة بين البحث والتطوير والصادرات. على العكس من ذلك، لم يدعم التحليل العلاقة بين البحث والتطوير والناتج المحلي الإجمالي للفرد. اعتمدت الدراسة الحالية على العديد من المتغيرات التي قد تلعب دور الوساطة في العلاقة بين المتغير المستقل والمتغيرين التابعين. تتخذ هذه الدراسة نهجًا متعدد الأبعاد باستخدام مؤشرات مثل كثافة البحث والتطوير والانفتاح التجاري وتنويع الصادرات. تمكنت نتائج التحليل أيضا من تحديد المحركات الرئيسية للإنتاجية الاقتصادية، والتي بناءا عليها تم تطوير إطار لمساعدة الشركات المصرية التي تستخدم البحث والتطوير لتعزيز الصادرات وبالتالي الناتج المحلي الإجمالي للفرد. تعمل هذه الدراسة على تعزيز الخطاب الأكاديمي حول محددات الأداء الاقتصادي وتقدم توصيات قابلة للتنفيذ لصناع السياسات والشركات والمنظمات الدولية لتعزيز الإنتاجية. وأخيرا، فإن البحث الحالي يعاني من بعض القيود المتعلقة بالسنوات المشمولة في جمع البيانات، فضلا عن المتغيرات المستقلة التي يمكن أن تؤثر على النمو الاقتصادي.

الكلمات الدالة: البحث والتطوير - النمو الاقتصادي - نصيب الفرد من الناتج المحلي الإجمالي - الصادرات - الانفتاح التجاري – متغيرات الوساطة.

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