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Digital Transformation as a Strategic Imperative for Strengthening National Economic Development in the Era of Artificial Intelligence and Global Competitiveness

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Abstract

The contemporary world is undergoing an unprecedented digital revolution that has profoundly reshaped economic structures, governance models, production systems, and social interactions. Digital transformation has emerged as a central driver of national economic development, competitiveness, and resilience, particularly in developing economies striving to integrate into global markets. This study examines digital transformation as a strategic and structural necessity for fostering sustainable national economic growth, with particular emphasis on communication technologies, cybersecurity, financial technology, and artificial intelligence applications.The research highlights how digital transformation enhances productivity, optimizes resource allocation, strengthens institutional efficiency, and expands access to international markets. It further explores the evolution of artificial intelligence technologies and their integration into key economic sectors, including finance, agriculture, healthcare, and public administration. Special attention is given to the role of investment in digital infrastructure, electronic security, and human capital development as fundamental pillars supporting the digital economy.Adopting a descriptive-analytical approach complemented by an analytical review of recent empirical studies, the paper identifies both opportunities and constraints facing digital transformation in developing countries. The findings indicate that sustained investment in digital technologies, regulatory adaptation, data governance, and innovation ecosystems significantly contributes to national economic diversification, export competitiveness, and long-term development. However, challenges related to data availability, institutional capacity, and technological readiness continue to hinder the full realization of digital transformation benefits. The study concludes by emphasizing the necessity of coherent digital strategies, inclusive policies, and international cooperation to ensure that digital transformation effectively supports national economic development.

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I. Introduction:

In a world characterized by increasing economic interdependence and accelerating globalization, export competitiveness has become a cornerstone of economic development and national prosperity, particularly in the agricultural sector. Exports are no longer merely a means of generating additional revenue; they have transformed into a vital indicator reflecting the

efficiency of a nation's production structure and its ability to effectively integrate into the global economy, increase its share of international trade, achieve higher rates of economic growth, and create jobs. However, this competitiveness is not achieved automatically. It is influenced by a range of interconnected and multifaceted factors, including economic and technological determinants, the efficiency of production institutions and the quality of their products, production costs, the suitability of the legislative environment and institutional support, the strength of infrastructure and supporting services, and the role of innovation and technology. This integrated network of internal and external factors must work harmoniously to create a competitive advantage for agricultural products, serving as a fundamental pillar for achieving sustainable economic development and enhancing a nation's position in the global market.

In this context, the need arises to study the determinants of export competitiveness in the agricultural sector. This will allow us to understand the nature of the relationships between these determinants, identify strengths that can be enhanced, weaknesses that need addressing, opportunities that can be exploited, and challenges that must be overcome. The ultimate goal is to strengthen the export competitiveness of agricultural products in developing economies.

Study Problem: What are the most important factors that contribute to enhancing export competitiveness in developing economies?

To answer this research question, we will employ a descriptive-analytical approach and a standard experimental approach, measuring the relationship between variables using various statistical tests.

II. Previous Studies: There are many studies that have addressed the topic of export competitiveness and its determinants, including:

1. The study by Ahmad et al. (2024) entitled "Export Competitiveness of Major Agricultural Products in Pakistan: An Assessment Through Revealed Comparative Advantage Indices." This paper focuses on measuring the competitiveness of Pakistani agricultural exports (2001–2021) using three indicators: the Revealed Competitive Advantage (RCA) Index, the Relative Competitive Advantage (RC), and the Relative Trade Advantage (RTA) Index. It examines different categories of agricultural exports and analyzes the competitiveness of Pakistani agricultural commodities. The results show that rice, dates, mangoes, and citrus fruits have strong competitive advantages, while corn and dairy products suffer from disadvantages. The clear comparative advantage of agricultural products indicates untapped potential. Reorganizing agricultural exports according to modern standards is essential to increasing export competitiveness. The study recommended improving value chains, developing storage and transportation, and diversifying export products. (Ahmad et al., 2024).

2. The study by Yadav & Chattopadhyay (2024), entitled "Identifying the Factors of Export Competitiveness for Agricultural Products," aimed to identify the factors that contribute to the competitiveness of agricultural product exports. The study contributed to clarifying the competitiveness of Indian agricultural products in the global market through a comprehensive review of the literature. It is one of the most recent studies that presents an analytical framework for the economic variables affecting export competitiveness at the agricultural sector level. This study concluded that market size, production volume, production cost, export price, in addition to the local currency exchange rate and trade openness, are among the main factors that can enhance the competitiveness of Indian agricultural products, as trade openness encourages more efficient allocation of resources. In short, trade liberalization positively impacts the competitiveness of agricultural exports by expanding market access, enhancing efficiency, and enabling better resource allocation (Yadav and Chattopadhyay, 2024).

3. The study by Liew et al. (2021) entitled "Determinants of Export Competitiveness of Agricultural Products in Malaysia" aims to evaluate the competitiveness of exports of 186 agricultural products in Malaysia during the year (1988–2014), using the ARDL model to measure long-term and short-term determinants. The study also used Balasa's (1965) Apparent Comparative Advantage (RCA) index to measure competitiveness and examined the following determinants: export prices, production volume, GDP per capita, employment, and capital formation. The most important results were as follows: 56 products have a comparative advantage. The results also show that commodity prices, GDP per capita, and the economic crisis of 2008 are negatively correlated with competitiveness, while employment and capital formation are positively correlated with it and improve the competitiveness of exports. (Liew et al., 2021).

4. The study by Narayan & Bhattacharya (2019), entitled "Relative export competitiveness of agricultural commodities and its determinants: Some evidence from India," aimed to measure the relative competitiveness of Indian agricultural exports (rice, wheat, cotton, and sugar). It also examined the determinants of relative competitiveness for these products, relying on long-term data and econometric models from 1981 to 2012. The study used the Relative Export Competitiveness (REC) index instead of the traditional RCA index and focused on the most important factors affecting export competitiveness, such as total available resources (including production volume and labor), domestic prices of agricultural products, export prices of agricultural products, per capita GDP, preferential trade agreements, and restrictions on agricultural exports in India. The most important findings were that India has a clear competitive advantage in some products (rice and cotton)

and that its export competitiveness improves with increased production and openness, while it is negatively affected by export restrictions and price fluctuations. (Narayan et Bhattacharya, 2019)

5. The study (2021) by Tamás Mizik, entitled "Agri-Food Trade Competitiveness: A Review of the Literature," was a systematic review of international literature on competitiveness in agricultural and food trade. It aimed to highlight the measurement tools used globally in analyzing the competitiveness of agricultural exports and to identify the main factors affecting countries' ability to compete in international markets. The researcher used data from Scopus and Web of Science databases and followed the PRISMA methodology to select articles related to competitiveness in agricultural trade. The most important findings were that the globally used metrics for assessing the competitiveness of agricultural exports, which are applied at different levels such as product, country, or region, include: the Revealed Comparative Advantage (RCA) index and its derivatives; adjusted competitiveness indices such as Revealed Trade Advantage, Normalized RCA, and Revealed Symmetric Comparative Advantage; and other indices such as the Grubel-Lloyd index and the balance of trade index. The study also found that international studies tend to agree on a set of fundamental factors affecting the competitiveness of agricultural exports. These include: supportive policies and trade legislation (such as trade agreements, export subsidies, and export facilities), which have a strong impact on enhancing competitiveness; the added value of agricultural products, which in turn increases the ability to maintain competitive advantages in target markets; productivity and production efficiency; and research, development, and innovation, which enhance quality and increase opportunities to access markets with higher standards. Furthermore, a developed export infrastructure, represented by advanced logistics infrastructure (ports, cold chains, and integrated transport), improves logistics services, reduces costs and losses, and enhances overall efficiency. Product quality upon reaching foreign markets, and finally trade support such as the existence of governmental or institutional support programs for exports such as financing policies, credit facilities, joint marketing, etc., increase the competitiveness of products. (Mizik, 2021)

Table 01: The Historical Development of Artificial Intelligence

The Beginnings of Artificial Intelligence 1950	– Acadicians are started defining artificial intelligence.- This term was coined in 1956 by John McCarthy while in America at Dartmouth Collegeence; – The term "artificial intelligence" was coined by John McCarthy in 1956.
Initial Progress 1960	– Develop the first smart software such as ELIZA; – Initiate research into the field of vision of the machine and robots.
1970 recession	– Slow progress due to technical challenges; – Reduce funding for AI research.
Al Nahda	– Development of expert systems and programmed logic; – The use of artificial intelligence in commercial applications.
Machine Learning	– Development of advanced machine learning technologies; – Application of artificial intelligence in areas such as finance. And Medicine
Rapid Evolution 2000	– Development of artificial neural networks; – The use of AI in areas such as voice and image recognition.
Deep Learning Approach2010 2010	– Development of deep learning and advanced neural networks; – The use of artificial intelligence in self-driving cars and voice search.
Advanced artificial intelligence 2020	– Development of advanced AI technologies such as enhanced learning; – The use of AI in areas such as health and education.

Source: Prepared by researchers based on(John, Marvin, Nathaniel, Herbert, & Simon, 2021)

3. Areas of Artificial Intelligence

AI comprises many fields each focused in distinct facets of intelligent systems. Some key areas include (Russell & Norvig, 2020):

3.1. Machine Learning (ML): Is preoccupied with methods that facilitate automating a system and enabling it to progress through data without requiring programming.

3.2. Natural Language Processing (NLP): Pertains to computer processing of human language, for example, tools required to translate languages, to determine the perception of texts, etc.

.3.3.Computer Vision: This type of, involves making machines capable of understanding visual data in the world including objects recognition or face detection among others.
3.4. Robotics: Covers the merger between artificial intelligence and engineering to build prototypes that can work either fully or partly on their own.
3.5. Expert Systems: Deploys knowledge-based point to mimic the power of decision making possessed by the human authorities within certain subject areas.
3.6. Reinforcement Learning: Takes an approach of teaching models to make a sequence of choices on a particular procedure to deliver a preferred 845behavior.

Technical Challenges

- The Challenge of Data Collection in Developing Countries

Data collection represents significant difficulties for researchers. Maintaining data integrity is one of the most important aspects of maintaining research result reliability. However, the social and economic situation of research subjects, their education levels, and their ability to express themselves vary significantly, especially in developing countries, making challenges multiply and limiting data collection to government institutions in these countries (Aiyub et al., 2020). The data becomes influenced by political and ideological orientations, in addition to lack of awareness regarding the importance of data collection. All of this impedes the path of digital transformation due to the fragility of the foundation upon which the entire digital transformation process rests.

- The Challenge of the Digital Divide

The distribution and application of digital technologies in public domains is unequal and contradictory. As a result, a situation arises in which some communities enjoy access to and can widely utilize the fruits of digitization while other communities are deprived of this opportunity. The inequality in accessible access to digital technologies and their possession creates what has been termed the digital divide. The digital divide has multiple dimensions, but three of its types are considered most important from a referential perspective:

- The divide between urban and rural areas.
- The divide between different types of social and economic groups.
- The global divide between developed and developing countries.

Inequality in educational attainment and income distribution in nearly every community plays a decisive role in forming and deepening the digital divide. According to statistical surveys, individuals with higher education have the ability to use digital technologies at a rateten times higher than individuals with secondary education. High-income individuals and families are likely to access the Internet and digital technologies twenty times more than low-income individuals.
The digital divide widens further on a global scale, as approximately half of the world's population, estimated at about 4 billion people, cannot access the Internet, and in most developing countries, only 20% have access to digital technologies (Travkina, 2022).

- The Challenge of Maintaining Privacy

Privacy issues have emerged as one of the most prominent contemporary challenges resulting from continuous technological acceleration. Personal data has become a valuable resource that is extracted and employed for multiple commercial and political purposes. This reality has exacerbated concerns related to security breaches, theft of personal information, and government surveillance practices, as well as raising other ethical issues related to data use on social media platforms, a matter that has provoked widespread criticism of those platforms and their practices (Kirkit, 2019).
The process of collecting user data begins at the moment the user browses a website through certain elements contained in the web page, such as the Internet Protocol address or what is known in short as the IP address. Through tracking the protocol address, access is gained to users' personal data and identification of cookies on the device performing the internet browsing. Cookies are small text files sent by network communications belonging to websites we visit and allow the website to identify our data and device data (Kirkit, 2019).

- The Challenge of Cybercrime

Cybercrime encompasses a wide range of illegal acts committed over the Internet or other digital devices, including fraud, identity theft, hacking, malware distribution, and child sexual exploitation. Girls are often the primary targets of these various forms of cybercrime (Suparto et al., 2024). For this reason, there is international consensus on the necessity of unifying laws and intensifying efforts to combat global cybercrime. However, national implementations often vary, which is attributable to differences in legal frameworks, technological capabilities and resources, and available technological infrastructure for monitoring and prosecution, as well as the level of priority each country allocates to cybercrime within its legal and security agenda (Allahrakha, 2024).

III. Theoretical Literature:

Porter argues that competitiveness is linked to a country's ability to achieve high productivity, enabling the creation of high added value, which directly impacts export performance (Porter, M. E., 1990). Krugman and Obstfeld define it as the

economy's ability to produce internationally tradable products at a lower relative cost or higher quality compared to competing countries (Krugman & Obstfeld, 2009). The United Nations Conference on Trade and Development (UNCTAD) indicates that export competitiveness is a country's ability to sustainably increase its exports and improve its market share in international trade (UNCTAD, 2018). Export competitiveness can be defined as the ability of a country, economic sector, or production facility to produce and export products that can penetrate foreign markets and maintain their position therein by achieving suitable levels of price, quality, productivity, and innovation compared to international competitors, thus ensuring sustainable economic returns. Export competitiveness has several determinants, including economic and productive ones. Technology and innovation, quality and specifications determinants, marketing and logistics determinants, institutional and political determinants, as the economic and productive determinants are the basis on which export competitiveness is based, as the cost of production directly affects the price power of agricultural exports. Lower costs of production inputs, particularly labor and raw materials, contribute to enhancing a country's comparative advantage. Increased productivity, resulting from improved resource efficiency, is a crucial factor in reducing average costs and increasing competitiveness in international markets. Furthermore, exchange rate stability influences price competitiveness; a depreciation of the local currency makes exports more attractive in terms of price, provided this does not negatively impact the cost of imported inputs (Krugman & Obstfeld, 2009). Technological advancements and innovation play a pivotal role in enhancing export competitiveness by improving product quality and reducing production costs. Investment in research, development, and innovation is a key factor enabling countries to transition from price-based competition to value-added competition. Innovation also contributes to export diversification and increases resilience to fluctuations in global demand (Porter, M. E., 1990). Moreover, quality is a fundamental requirement for accessing international markets, especially for agricultural products, as importing countries impose stringent standards related to technical specifications and safety. Food safety, health, and phytosanitary standards are among the most important requirements. Restrictions impact agricultural exports (FAO & WHO, 2020), as non-compliance leads to the rejection of agricultural shipments in international markets. Adherence to these standards enhances consumer confidence, improves a country's export reputation, and boosts the competitiveness of exported agricultural products (ISO, 2018). Marketing and logistics factors also play a significant role, as the efficiency of marketing and logistics services directly affects export competitiveness. High transportation costs and inadequate infrastructure erode price advantages. Packaging, delivery speed, and the availability of information about foreign markets are crucial for enhancing competitiveness in international markets (World Bank, 2018). Furthermore, government policies enhance export competitiveness by providing a favorable legislative and regulatory environment, simplifying customs procedures, and offering incentives and support to exporters. Regional and international trade agreements also contribute to improved access to international markets (UNCTAD, 2018).

IV. Standard Study:

Study Population: This study examines the agricultural sector in a group of developing countries between 1992 and 2018. We selected 20 developing countries: Algeria, Egypt, Saudi Arabia, Morocco, Tunisia, Jordan, the United Arab Emirates, Oman, Lebanon, Kuwait, Bahrain, Ivory Coast, Ghana, Kenya, Ethiopia, Nigeria, South Africa, Cameroon, Tanzania, and Mozambique. Our selection of these developing countries was based on a number of considerations, as follows:

• Agricultural Production: Most of the selected countries are developing countries that are among the largest producers of agricultural products, according to 2018 statistics from the Food and Agriculture Organization of the United Nations (FAO).

• Agricultural Exports: The sample countries are characterized as the top developing exporters of agricultural products, according to 2018 statistics from the Food and Agriculture Organization of the United Nations (FAO).

• Geographical Characteristics: Most of the selected countries share a similar geographical character, meaning they possess similar natural resources for agriculture.

Study Variables: The study variables were selected based on economic theory and previous studies, as shown in the following table:

Table 2:Study Variables and Data Sources

Dependent variable

Source	Definition	The symbol	variable
https://mec.worldbank.org/	Changes in a region's exports are related to changes in global exports. If global exports rise and the region's exports rise by a similar amount, there is no change in its export competitiveness. However, if the region's exports rise more than global exports, the region becomes more competitive.	MEC	***Export Competitiveness***

Independent variables			
Source	Definition	The symbol	variables
http://www.fao.org	The logarithm of agricultural production refers to the total agricultural output, both plant and animal, whether this output is used for direct consumption or processed into various food products.	LAP	*Agricultural Production*
https://data.albankaldawli.org/indicator/AG.LND.AGRI.K2	Agricultural land refers to the proportion of land that is arable and planted with permanent crops or covered by permanent farms. According to the Food and Agriculture Organization (FAO), arable land includes land planted with temporary crops (dual-crop areas are counted once), temporary meadows for harvesting or grazing, flower and vegetable gardens, and land undergoing a resting cycle.	LAL	*Agricultural lands*
https://data.albankaldawli.org/indicator/SL.AGR.EMPL.ZS	It refers to people of working age who engage in agricultural activity in exchange for wages or profit.	WAG	*Workers in agriculture*
https://data.albankaldawli.org/indicator/NV.AGR.TOTL.CD	The logarithm of value added for agriculture is the net output of the agricultural sector after summing all outputs and subtracting intermediate inputs. It is calculated without making any deductions for depreciation of manufactured assets or for the depletion or degradation of natural resources. The origin of value added is determined according to the International Standard Industrial Classification, Revision 3.	LAVA	*Added value in agriculture*
www.unido.org	The Industrial Competitiveness Index (ICI) is published annually by the United Nations Industrial Development Organization (UNIDO). This index aims to measure and determine a country's ability to produce and develop competitively priced manufactured goods, their high added value and advanced technology, and their capacity to market their products and increase their presence in domestic and international markets. This is based on eight economic and trade sub-indicators related to industry, value added, national income, and exports. These sub-indicators are grouped into three levels.	CPI	*Industrial Competitiveness Index*
www.unido.org		EQ	*Export quality*
https://www.globalinnovationindex.org/	It is a composite index consisting of more than 81 individual variables. The overall Innovation Index is calculated by determining the Innovation Efficiency Ratio, which represents the simple average of the Innovation Outputs and Innovation Inputs sub-indices. The Innovation Inputs sub-index is constructed based on five sub-indices: institutions, human capital and scientific research, infrastructure,	GII	*Global Innovation Index*

	market sophistication, and business sophistication. The Innovation Outputs sub-index comprises knowledge and technology outputs, as well as creative outputs.		
https://data.albankaldawli.org/indicator/PA.NUS.FCRF	The official exchange rate refers to the exchange rate set by national authorities or the rate determined in the legally permitted exchange market, and is expressed in units of the local currency against the US dollar.	Exch	*Exchange rate*
http://perspective.usHErbrooke.ca/bilan/stats/0/2016/fi/9/carte/HFI.COMMERCE/x.html	This index ranges from 0 to 100, where a score close to 100 indicates that trading is easy and free from significant legislative or regulatory restrictions, while a score close to 0 indicates low or nonexistent commercial freedom. The index was developed in 1973 by The Wall Street Journal in collaboration with the Heritage Foundation, whose mission is to develop and promote conservation policies based on free-market principles.	FTD	*Index of economic openness*
https://www.heritage.org/index/visualize	A sub-index of economic freedom that can be expressed is pricing, because taxes raise costs.	TB	taxburden
http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120	Also called the Herfindahl-Hirschmann Index, it is a measure of product concentration and is used to obtain values between 0 and 1. An index value closer to 1 indicates that a country's exports are highly concentrated on a small number of products. Conversely, values closer to 0 reflect exports that are more uniformly distributed across a range of products.	EC	*Export concentration index*
International Telecommunication Union, World Telecommunication/ICT Development Report and database	*It refers to the logarithm of the ratio of fixed telephone subscriptions to the total number of active fixed telephone lines.*	*LFT*	*Infrastructure: Information and Communication Technology Fixed Telephone SubscriptionsFixed telephone subscriptions*

Source: Prepared by the researcher.

Statistical Tools and Software Used in Data Processing

- Statistical Software: The Stata15 program was used to estimate stationary models and perform related tests.
- Statistical Tools and Methods: The econometric literature for panel data requires conducting cross-sectional effects tests before estimating models. The question is whether the estimated models are homogeneous with respect to the cross-section, or whether they exhibit fixed effects, as opposed to random effects.

Therefore, we will initially verify the presence or absence of fixed effects using Fisher's test. The null hypothesis assumes homogeneity in the estimated parameters with respect to the cross-section, while the alternative hypothesis states that the model contains variations in the fixed term at the cross-sectional level. These variations are referred to as fixed effects.

This result is only confirmed if the alternative hypothesis is accepted, which occurs when the calculated statistic exceeds the critical value at one of the three significance levels. The second step is to perform a comparison between fixed and random effects using the Hausman test. The null hypothesis assumes the random effects estimator is more effective than the fixed effects estimator, while the alternative hypothesis assumes the fixed effects are more effective. (Djouadi, 2021)

Next, we move to analyzing the robustness of the estimated model. Statistical robustness requires performing cross-sectional residual correlation tests using the Pesaran CD test and the Fridman test to ensure the absence of cross-sectional residual correlation. The null hypothesis states that there is no cross-sectional correlation.

Pesaran (2004) confirmed that the presence of cross-sectional residual correlation creates a bias problem. We then use the Wooldridge test to ensure the absence of autocorrelation of residuals at the time-sectional level. The null hypothesis of this test states that there is no autocorrelation of residuals. (Pesaran, 2004)

We will also use the Modified Wald test to ensure the homogeneity of error variances in fixed-effects models, and the Wald test to ensure the homogeneity of error variances in random-effects models. The null hypothesis of both tests is that error variances are homogeneous.

If one or all three of these problems—cross-sectional correlation, autocorrelation, and heterogeneity of variance—are present in the model, we address these defects using either the Generalized Least Possible Squads (FGLS) or Prais-Winsten (PCSE) methods. (Baltagi, 2005)

- Model Evaluation, Discussion, and Analysis of Results:

•Export Competitiveness Determinant Function: Export competitiveness is a function of: agricultural production, agricultural land, agricultural workers, value added in agriculture, industrial competitiveness, export quality, exchange rate, economic openness, tax burden, export concentration, and infrastructure: information and communication technology. The model is written in the following mathematical formula:

MEC = f(AP, AL, WAG, AVA, CPI, EQ, Exch, FTD, TB, EC, FT)

•Estimating and Testing the Validity and Robustness of the Export Competitiveness Model:

To conduct an economic analysis of the estimated model, its statistical validity and robustness must first be verified. The results in the table below show the validity of the fixed effects (FE) model compared to the pooled model. This means that the results of the fixed effects model are more valid and robust than those of the pooled model. Furthermore, the Hausman test demonstrated the effectiveness of the fixed effects model compared to the random effects (RE) model. Therefore, we will adopt the fixed effects model to complete the remaining robustness tests.

Table 3:Validity and robustness of the Export Competitiveness Determinants (MEC) model

Test	Wooldridge	Modified Wald	Pesaran CD	Hausman	Fisher
Statistics	17.44***	4582.53***	**2.045	***23.88	***14.08

Source: Prepared by the researcher using STATA15.1 outputs.

The PesaranCD test results show a correlation of residuals at the cross-sectional level at a significance level of 5%. The Wooldridge test also showed an autocorrelation of residuals at the time level. However, the Modified Wald test results indicate a heterogeneity problem in the error variances of the fixed-effects model. This necessitates addressing these problems by estimating the fixed-effects model using the Prais-Winsten (PCSE) method.

The following table shows the estimation of the Export Competitiveness Determinants (MEC) model:

Table 4:Estimation of the Export Competitiveness Determinants (MEC) Model

Variable	pooled	fixed	random	PCSEs
lap	-6.7323491	3.0302653	-3.0894853	-5.7703191
lal	-11.405535***	48.715837	-9.2414266	-.67982891
wag	.78966302**	1.8262919*	-.12704292	-.27228158
lava	5.8169409	7.349055**	7.2664319*	.81610493
eq	33.623639	131.17284***	101.85472**	28.123278*
cpi	19.414989	-1908.7331***	-1252.6801***	-51.772038
exch	-.03327945***	.02379748	-.01364702	-.04727967**
tb	-3.0841143***	-2.9079987***	-2.9399303***	-1.3891526***
ftd	3.4928222***	3.0390335***	3.2828652***	1.5371667***
ec	274.35735***	88.635529*	153.56936***	162.73602***
lft	14.123176**	-5.6614475	-3.0862399	-8.5534742*
_cons	-129.54957	-569.92319	118.73796	154.2315**

legend: * p<.1; ** p<.05; *** p<.01

Source: STATA15.1 Program Outputs

•Analysis and Interpretation of Results:

From the outputs of the Export Competitiveness Determinants Model Estimation, a number of conclusions can be drawn, as follows:

 Export quality is considered the most influential variable in the competitiveness of agricultural exports. A one-unit change in the independent variable contributes to a 28.12 increase in the competitiveness of agricultural exports. This result aligns with modern economic theory and policies, as product quality is a crucial requirement for export goods, especially agricultural products, in addition to price advantages. Adherence to quality standards and possession of various quality certifications, such as ISO 9000 (Quality Management), ISO 22000 (Food Safety Management), and ISO 14000 (Environmental Management), facilitates the entry of goods into foreign markets. Furthermore, the quality of goods in terms of health and safety standards—such as the number of regulated pesticides per product and the level of Allowing these pesticides for each importer would facilitate targeting markets in developed countries, increase exports, and reduce the rejection rates that agricultural goods and food products from developing countries often face. Furthermore, reducing losses and waste enhances price competitiveness, making domestic agricultural and food products more attractive for export and enabling them to capture market share in international markets.

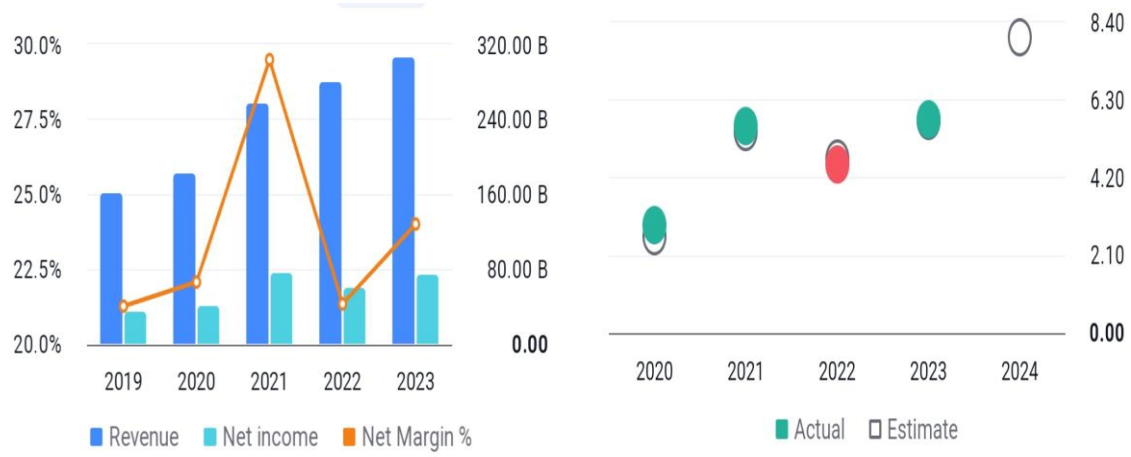
Conversely, currency devaluation has a negative impact on the competitiveness of agricultural goods and products. Economic theory dictates that currency devaluation can provide price advantages for domestic exports. The lower the currency value (the higher the exchange rate), the more competitive domestic goods become, leading to a decrease in the competitiveness of foreign goods compared to domestic products in both the domestic and international markets. This results in reduced imports. Conversely, currency devaluation (the higher the exchange rate) increases the competitiveness of export goods in foreign markets, leading to increased exports.

From an economic theory perspective, devaluing the local currency increases a country's competitiveness and boosts its exports due to lower export prices for the rest of the world. Conversely, this policy leads to higher import prices for domestic residents, which shifts demand towards domestically produced goods instead of imported ones, thus enhancing economies of scale. However, this is not always the case, as a higher exchange rate does not necessarily lead to the aforementioned outcome in every instance. Currency devaluation can have the opposite effect, reducing competitiveness, especially when there is a heavy reliance on imports of intermediate goods necessary for production, as well as foreign capital equipment and machinery. This is exacerbated when foreign technology is required, leading to higher agricultural production costs and reduced competitiveness.

The study's findings also confirm the negative impact of the tax burden on the competitiveness of agricultural goods and products, which aligns with economic theory. The tax burden increases the cost of the product, as producers pass the tax burden on to the end consumer, thus reducing the competitiveness of agricultural products intended for export. The tax burden may also be linked to the cost of services related to the export process, such as packaging, supply chain operations (shipping, transportation, and insurance), and the costs of conforming to various quality specifications.

The study's results indicate a positive impact of economic liberalization on increasing export competitiveness. In the case of developing countries, this is linked to the price advantages they can gain from a heavy reliance on imports of foreign intermediate goods necessary for the production process, foreign capital equipment and machinery, and imported technology. Furthermore, increased market access and improved infrastructure quality—a sub-indicator of economic openness—effectively enable the production and delivery of goods and services to customers. An improved investment climate, wider access to domestic and foreign financing, and institutional frameworks that ensure competitive markets free from burdensome regulations, along with governance underpinned by the rule of law and characterized by government integrity and effectiveness, all contribute to enhanced competitiveness when these factors are realized and developing countries improve their performance across the sub-indicators of the economic openness index.

Growth in revenues of Alphabet Inc. during the period between 2019 and 2023
Figure 1 : revenues during the period between 2019 and 2023



Source : Prepared by researcher based on(tradingview, 2024)

From the above figure, we see that Alphabet has still been able to maintain steady growth within the years 2019-2023.This through a number of expansion updates.By incorporating the use of artificial intelligence AI in its business operations, inclusive of, better Gemini chatbot software, and more refined search engine.Its parent company Alphabet also recorded revenue growth primarily due to a 35% increase in Google's artificial intelligence-based cloud business and higher growth in digital advertising.Alphabet's shares which shut 1.8 percent higher were up 4.4 percent in post closingtrade.rowth during the period between 2019 and 2023.This is due to a number of expansion updates.By resorting to the use of artificial intelligence AI in its business, including enhanced Gemini chatbot software and improvements to its precious search engine. Alphabet, Google's parent company, also won revenue boosted by a 35% rise in its AI-powered cloud computing business and a jump in digital advertising revenue. Shares of Alphabet, which closed 1.8 percent higher, rose 4.4 percent in post-closing trading. That is because the stock has been up around 22 percent this year, largely in tandem with other markets.Sales in Google's cloud business increase 35 percent to $11.35 billion in the third quarter from $8.39 billion a year earlier and above expectations of $10.86 billion.This is the highest quarterly growth rate since the three quarters to the current period and the above described capitalism in 2025 is still anticipated to be higher than the current year.
- Google has deepened and established a versatile strategic rivalry in artificial intelligence (AI) through innovation, emphatic research and pristine implementation across various fields.

1. Key Strategic Approaches:

1.1. Research and Development

Explorational funding through Google AI and Deep Mind Uninterrupted establishment of new generations of sophisticated machine learning algorithms Consistent introduction of new types of technologies including the transformer models(Brown, Benjamin, Ryder, Subbiah, & Kaplan, 2020)

1.2. Technological Integration

AI integration with Products AI development in Search, Cloud and Productivity tools Enabling Intelligent Platform through Google Assistant & Google Cloud(McAfee & Brynjolfsson, 2017)

1.3. Talent Acquisition and Collaboration

Recruiting the best talent in the field of AI Researching collaborations with Universities Furthering the adoption of Open Source tools in artificial intelligence.

1.4. Ethical AI Development

Applying accountable AI standards Prioritizing its adversative elements in AI technologies Creating AI solutions based on social purposes(Russell & Norvig, 2016)

1.5. Strategic Competitive Positioning

Direct competition with such market players as Microsoft and Open AI Utilizing vast datasets on an ongoing basis Ongoing development of generative AI and large language models

Analysis of results:

Digital transformation has become a comprehensive global phenomenon that revolutionizes various aspects of life, including the economy, society, and government. We have seen the most important positives and advantages of the digital transformation path, and finally the most important conclusions can be drawn as follows:

9.1 Improving process efficiency and increasing productivity:

•Automation of repetitive tasks: The use of artificial intelligence and robotics has automated many repetitive tasks in various sectors, which has contributed to improving the efficiency of operations and significantly increasing productivity.
•Improving communication and information exchange: Digital technology has facilitated communication and information exchange between various stakeholders, which has accelerated the decision-making process and improved coordination between various departments and divisions.
•Improving customer experience: Digital technology has enabled companies to provide better and more efficient services to their customers, by facilitating communication with them and providing them with support 24 hours a day, 7 days a week.

9.2 Promoting innovation and entrepreneurship:

•Creating new business opportunities: Digital transformation has provided new opportunities for businesses in various sectors, including e-commerce, the digital economy, and ICT.
•Encouraging innovation: Easy access to information and technology has encouraged innovation and the emergence of new ideas, innovative products and services.
•Supporting SMEs: Digital technology has helped SMEs grow and compete with larger companies by providing affordable tools and services.

9.3 Improving access to government services:

•Providing electronic government services: Digital governments have facilitated access to government services by providing them electronically, saving citizens time, effort and cost.
•Improving transparency and accountability: Digital technology has improved transparency and accountability in the public sector by facilitating access to government information.
•Enhancing civic participation: Digital technology has enabled citizens to participate in decision-making more effectively by providing platforms for communication and interaction with the government.

9.4 Promoting sustainable development:

•Improving education and health: Digital technology has improved the quality of education and health by providing better educational opportunities and broader health care services.
•Environmental protection: Digital technology has helped protect the environment by reducing dependence on natural resources and improving energy efficiency.
•Supporting comprehensive economic development: Digital transformation has contributed to supporting comprehensive economic development by creating new job opportunities and improving the standard of living.

However, it is important to note that digital transformation also faces some challenges such as:

•Digital Divide: There are still many people around the world who do not have access to the Internet or digital technology, creating a digital divide that hinders their full participation in society and the economy.
•Data security and privacy: Digital technology raises concerns about data security and privacy, as personal data becomes more vulnerable to theft or misuse.
•Impact on the labor market: Digital transformation may lead to the loss of some jobs, as many tasks previously performed by humans are automated.

Conclusion*:*

In this study, we attempted to focus on the most important factors affecting export competitiveness in twenty developing countries. To answer the research question, the impact of a set of variables was measured as independent variables representing the study's independent variables over twenty-seven days, using the STATA15 program. This program was used to estimate static models and their related tests. The study concluded with several results, most notably that there is a strong positive impact of export quality on increasing the export competitiveness of developing countries.

This reflects the adherence of these products to a set of required standards and specifications, technical specifications, and health measures, which are considered a necessary condition for the flow of these goods to international markets, especially the markets of developed countries. The study also concluded that economic openness positively affects the increase in export competitiveness of agricultural and food products. The result indicates the importance of eliminating quantitative and qualitative restrictions and customs and non-customs barriers in increasing trade flows, whether under the multilateral trade arrangements of the World Trade Organization or at a regional level within the context of economic blocs and bilateral trade agreements. Eliminating barriers and obstacles of all kinds facilitates the smooth flow of international trade according to competitive advantages of all kinds, avoiding the unfair advantages created by protectionism in many cases. Furthermore, the study found that currency devaluation has a negative impact on the competitiveness of agricultural exports. Currency devaluation can grant price advantages to domestic export goods. The lower the currency value (the higher the exchange rate), the more competitive price advantages domestic goods gain, leading to a decrease in the competitiveness of foreign goods compared to domestic products in both the domestic and international markets. This conclusion can be explained by the net effect of currency devaluation policies, as currency devaluation affects exports through several channels. The first channel is related to the price of agricultural products and food commodities at the cost of production factors (i.e., at the factory gate), resulting in price competitive advantages. The second factor is the cost of export-related services such as insurance, shipping, financial and banking services, and other logistical aspects. These costs increase when provided by foreign companies—a common occurrence in developing countries. The study also revealed that the tax burden negatively impacts export competitiveness. Taxes, whether direct or indirect, on production, profits, customs duties, or exports, raise the cost of domestic products and reduce the competitiveness of agricultural goods destined for export compared to foreign products in international markets.

Therefore, the following recommendations can be made:

1.Improve agricultural productivity by promoting the use of modern technologies, improved seeds, and efficient irrigation systems, thereby reducing costs and enhancing production quality.

2. Strengthen agricultural research and extension services, aligning their outputs with the needs of foreign markets, particularly regarding technical specifications and quality.

3. Adhere to international health and environmental standards (such as food safety and quality standards), facilitating access for agricultural products to global markets and boosting importers' confidence.

4. Develop agricultural value chains by supporting storage, packaging, and processing activities to increase added value and reduce post-harvest losses.

5. Improve infrastructure and logistics, particularly transportation, ports, and export markets, to reduce export costs and maintain product quality.

6.Diversify agricultural exports and shift from exporting raw materials to exporting processed agricultural products with higher added value.

7.Enhance agricultural sustainability by rationalizing the use of natural resources and addressing the effects of climate change, ensuring long-term competitiveness.

8.Simplify administrative and customs procedures and improve the business environment to enhance the ability of enterprises, especially small and medium-sized enterprises (SMEs), to access foreign markets.

9.Diversify the export base and shift towards high value-added products instead of relying on raw materials.

10.Adopt flexible and stable trade policies that ensure exchange rate stability and support the competitiveness of national products.

Ethical Considerations

This study is based exclusively on secondary data obtained from publicly available academic literature, international reports, and official statistical sources. It does not involve human participants, surveys, interviews, or experimental interventions. Consequently, ethical approval was not required. All sources used in the research have been properly cited in accordance with academic integrity and ethical research standards.

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Conflict of Interest

The author declares no conflict of interest regarding the publication of this paper.

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