



Impact of Goods, High-Tech, Services, and ICT Export Management Strategies on Gross National Income: An Empirical Study of OECD and OPEC Countries

Abdiyanto¹, Iskandar MUDA², Ahnaf Ali ALSMADY³, Oksimana DARMAWAN⁴, Dwi Rofifah AGNISA⁵,
Naomi Sylvia Veronika TAMPUBOLON⁶

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Abstract

Purpose: This study analyses the impact of various export types on Gross National Income (GNI) among 15 OECD and OPEC countries, aiming to identify the most influential export categories on national income. Understanding the relationship between exports and GNI is crucial for policymakers to develop effective strategies for sustainable economic growth. **Research design, data and methodology:** The research uses secondary data from the World Bank (2013-2022) and employs a panel data analysis approach with a quantitative descriptive design. The variables analyzed include goods exports, high-tech exports, service exports, ICT services exports, and GNI. This approach enables the study to capture the complex relationships between exports and national income. **Results:** The findings reveal that goods and services exports have a statistically significant negative effect on GNI, the findings reveal that goods and services exports have a statistically significant negative effect on GNI. In contrast, high-tech and ICT exports show a statistically significant relationship with GNI but with limited contribution due to their small representation within total exports. **Conclusion:** The study urges policymakers to reassess export strategies, balancing traditional sectors with high-tech and ICT development. Understanding export-income dynamics enables targeted approaches that optimize national income, support sustainable growth, and foster effective economic development strategies.

Keywords: Economic Growth, Gross National Income, High-Tech, Management Strategies, Service

JEL Codes : O32, F43, O14

1. Introduction

The introduction offers a comprehensive overview of the vital role exports play in fostering a country's economic

growth and determining its overall national income, especially in the context of recent global economic shifts. Over the last forty years, many developing countries have shifted from relying on import substitution policies to

1 First Author. Lecturer, Department of Economics, Faculty of Economics and Business, Universitas Pembangunan Panca Budi, Indonesia. Email: abdiyanto@dosen.pancabudi.ac.id

2 Corresponding Author Professor, Department of Accounting, Faculty of Economics and Business, Universitas Sumatera Utara, Indonesia. Email: iskandar1@usu.ac.id

3 Third Author. Assistant Professor, Accounting Department, Faculty of Business Administration, University of Tabuk, Tabuk, Saudi Arabia. Email: aalsmadi@ut.edu.sa

4 Fourth Author. Researcher, Badan Riset & Inovasi Nasional (BRIN), Indonesia. Email: oksimana7@gmail.com

5 Fifth Author. Lecturer, Department of Accounting, Faculty of Economics and Business, Universitas Sumatera Utara, Indonesia. Email: dewi@usu.ac.id

6 Sixth Author. Lecturer, Department of Accounting, Faculty of Economics and Business, Universitas Sumatera Utara, Indonesia. Email: naomi@usu.ac.id

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adopting export-led growth strategies. This transition stems from the understanding that targeted expansion in trade activities can deliver significant economic benefits, including higher income levels, better employment opportunities, and greater integration into the global economy. As Zang and Baimbridge (2011) emphasize, this policy shift reflects a recognition that active participation in international trade serves as a powerful engine for economic development, capable of elevating national income and improving citizens' living standards.

This trend toward export-driven development is supported by empirical evidence demonstrating that countries expanding their export sectors often experience higher growth rates than those mainly focused on domestic markets. Within this context, the present study investigates which export types—namely goods, high-technology products, services, and ICT services—have the most significant effect on the Gross National Income (GNI) of member countries in the Organization of Petroleum Exporting Countries (OPEC) and the Organization for Economic Co-operation and Development (OECD) (Ceynowa, Przybyłowski, Wojtasik, & Ciskowski, 2023). The focus on these categories recognizes that not all exports contribute equally to national income; rather, their impacts are influenced by factors such as technological sophistication, sectoral characteristics, and international demand.

Many developing nations, particularly those within OPEC, have transitioned towards export-focused strategies, given their reliance on primary commodities. These countries are increasingly diversifying their export baskets—especially by promoting high-value, technologically advanced, and service-oriented exports—to pursue more sustainable growth pathways. The decision to bolster high-tech exports, for example, is driven by the realization that technological innovation and advanced manufacturing enhance productivity and competitiveness, ultimately leading to higher income levels. Moreover, effective management strategies are essential for these nations to navigate the complexities of technological transformation, market access, and infrastructure development, ensuring that their export expansion translates into tangible economic gains.

Empirical studies reinforce the idea that broadening export types can significantly influence a nation's overall income from international trade. For instance, Syzdykova et al. (2019) note that export-oriented industrialization allows countries to harness global market opportunities, generate employment, earn foreign exchange, and contribute positively to national income. Such strategies are especially relevant for developing countries aiming to leapfrog traditional industrialization stages by embracing knowledge-intensive sectors that typically feature higher productivity and profitability.

Additionally, the theoretical framework underscores that trade integration enables countries to access larger markets, leverage comparative advantages, and acquire new technologies and skills. Arkolakis et al. (2018) highlight that a country's total income from global value addition largely depends on the composition and scale of its export activities. Doubling down on high-value sectors—such as high-tech and ICT—can substantially boost productivity and facilitate technological transfer, thereby escalating national income.

Differentiating among various exports—goods versus services, and within those, high-tech versus traditional—provides critical insights into their unique contributions to economic growth. Goods exports typically involve tangible commodities and raw materials, historically associated with resource-dependent economies but increasingly integrated into global supply chains due to technological advancements (Rahman et al., 2022). Conversely, service exports include activities like financial services, transportation, tourism, and ICT services, which do not require physical ownership and have gained prominence in the digital economy. Countries that develop a competitive edge in high-tech exports—such as electronics and pharmaceuticals—tend to experience higher productivity and income gains. Similarly, ICT services support participation in the digital economy, enabling efficient communication, financial transactions, and data exchange, which fuels innovation and productivity across sectors.

The rationale for focusing on these different categories is rooted in understanding that their relative impacts on GNI vary according to a country's technological capacity, sectoral specialization, and prevailing global demands. While traditional resource-driven exports might dominate for some economies, high-tech and ICT sectors often produce higher income per export unit, positioning them as key drivers of sustained growth.

1.1. Rationale for Focusing on High-Tech Exports

In analysing the influence of exports on Gross National Income (GNI), distinguishing between high-technology and low-technology exports is crucial. High-tech exports are often presumed to be superior because they typically embody greater value addition, technological sophistication, and potential for productivity growth (Zapata et al., 2023; Ekananda & Dion, 2017). These characteristics suggest that high-tech exports can contribute more significantly to economic development and competitiveness in the global market. However, it is essential to recognize that this assumption may not always hold universally. Low-tech exports can also play crucial roles, especially in developing economies where resource-based or labour-intensive industries might provide substantial employment and

foreign exchange earnings. Moreover, high-tech exports can be volatile and capital-intensive, posing risks to economies overly dependent on these sectors. This study thus focuses on high-tech exports due to their theoretical link with technological innovation, productivity improvements, and long-term sustainable growth, which are critical drivers in the current digital economy era. The empirical analyses will assess whether the presumed advantages of high-tech exports manifest in a stronger influence on GNI compared to other export categories across OECD and OPEC countries. By explicitly addressing and testing this assumption, the study contributes to the ongoing debate on the relative economic impacts of export composition and provides nuanced insights for policymakers aiming to optimize export strategies for income growth.

Finally, the introduction emphasizes that analysing the complex interrelations between export types, sectoral composition, and national income—within the framework of global trade policies and economic structures—is crucial. Expanding high-value, technologically advanced exports can boost foreign exchange earnings, support industrial upgrading, and stimulate innovation ecosystems domestically. Recognizing the distinct characteristics and potential of each export category, coupled with effective management strategies, enables policymakers to craft targeted strategies that maximize their contribution to economic development and improve living standards in the context of a rapidly changing global economy.

Many developing nations, particularly those within OPEC, have consciously shifted their economic strategies toward export-oriented growth models to stimulate industrialization, diversify their income sources, and reduce dependence on primary commodities such as oil and minerals. Historically, these countries have relied heavily on resource-driven exports, which often expose their economies to volatility due to fluctuating global commodity prices. Recognizing these vulnerabilities, policymakers have increasingly prioritized the development and expansion of high-value, technologically advanced, and service-oriented exports (Zadeh et al., 2014). This strategic shift aims to foster more sustainable growth pathways, promote technological progress, and elevate the countries' positions within the global value chain.

However, simply identifying target sectors or investing in new industries is insufficient without the implementation of robust management strategies that can effectively coordinate and sustain these transitions. Effective management strategies encompass comprehensive policy frameworks, institutional reforms, targeted investments, and capacity-building efforts designed to create an enabling environment for high-tech and service sector growth. These strategies involve several key components, including technological innovation policies, infrastructure

development, human capital enhancement, intellectual property protections, and international trade facilitation measures. By integrating these elements coherently, countries can better manage the complex process of upgrading their export sectors.

Adopting and executing such management strategies allows countries to address several critical challenges. First, technological upgrading requires strategic planning and strong institutional support to upgrade manufacturing processes, adopt advanced technologies, and foster innovation ecosystems. This includes incentivizing research and development, providing technical training, and fostering collaboration between government, academia, and private sectors. Second, developing the necessary digital and physical infrastructure—such as high-speed internet, transportation networks, and logistics facilities—is vital to support the export of high-tech and digital services. Management strategies must prioritize infrastructure investments that underpin these sectors, ensuring seamless integration into global markets.

Third, managing market access and quality standards through diplomatic engagement and compliance with international regulations remains a core component (Zhou, Xia, Sun, Zhang, & Jin, 2023). Countries must leverage policy instruments to reduce trade barriers, negotiate trade agreements, and promote certification standards that facilitate entry into lucrative foreign markets. Fourth, workforce skills development through targeted education and training programs is essential to cultivate a specialized labor force capable of supporting advanced manufacturing, high-tech industries, and ICT services. Strategic human capital management ensures that firms have access to the expertise needed for innovation and productivity enhancement.

Furthermore, implementing management strategies involves fostering an ecosystem of innovation by supporting startups, attracting foreign direct investment, and nurturing entrepreneurial activities that can lead to technological breakthroughs. Policies that encourage research commercialization and protect intellectual property rights help create an environment conducive to innovation-driven growth. Additionally, governance practices that promote transparency, reduce corruption, and streamline administrative procedures are vital to attracting both domestic and foreign investment.

The role of management strategies is indispensable for developing countries aiming to transition towards high-tech and service-oriented exports. These strategies coordinate a multitude of interventions—technological, infrastructural, educational, and policy-related—creating a solid foundation for sustainable economic development (Mulliqi, 2021). When effectively implemented, they enable countries not only to increase export volumes but also to

improve the quality and sophistication of their products and services. Consequently, high-value exports can generate higher income, promote technological advancement, and ultimately contribute to long-term economic resilience and social prosperity.

1.2. Contribution and Novelty

This study offers several novel contributions to the literature on exports and Gross National Income (GNI) that distinguish it from prior research. First, it employs recent and comprehensive panel data covering 15 countries from both OECD and OPEC groups over a 10-year period (2013–2022), providing updated empirical evidence that captures diverse economic structures, ranging from developing to developed economies. This cross-regional scope allows for a nuanced comparison of export impacts across heterogeneous countries rarely addressed concurrently in previous studies.

Second, unlike many existing studies that focus predominantly on aggregate export volumes or single export categories, this research disaggregates exports into four distinct components—Goods Exports, High-Technology Exports, Services Exports, and ICT Service Exports—and applies panel data regression techniques to evaluate their individual and comparative effects on GNI. This detailed decomposition contributes to a deeper understanding of which export sectors most significantly influence national income, revealing, for instance, that although high-tech and ICT service exports are growing, traditional goods and services exports still have a stronger impact on GNI in the observed countries.

Third, the study situates its findings within the contemporary context of the digital economy, thereby addressing the evolving dynamics of export competitiveness and income generation in an increasingly technology-driven global marketplace. This allows for policy-relevant insights into how countries might strategically enhance their economic growth by fostering sectors aligned with digitalization trends, such as ICT services—a vital consideration for both developing and developed economies.

Finally, the use of fixed-effect panel regression analysis and rigorous hypothesis testing adds methodological robustness, enabling control for country-specific heterogeneity and temporal effects, which strengthen the reliability of causal inferences regarding export impacts on GNI.

Collectively, these aspects mark this study as a significant advancement over prior research by combining a broad country sample, detailed export sector analysis, methodological rigor, and contemporary policy relevance related to the digital economy's role in income generation.

2. Literature Review

The literature review examines a broad spectrum of research that explores the relationship between various forms of exports—namely goods, high-tech, services, and ICT services—and their influence on a country's Gross National Income (GNI). Collectively, these studies reveal the different pathways through which export activities impact economic growth, highlighting both established findings and notable gaps that warrant further investigation. Importantly, the role of management strategies emerges as a critical factor in effectively leveraging these export categories to foster sustainable development.

2.1. Exports and National Income: Foundational Insights

2.1.1. Theoretical Lenses

This study's conceptual foundation rests on several key economic theories that elucidate the relationship between export composition and Gross National Income (GNI). These theoretical lenses provide a rationale for the selection of variables and hypothesized effects assessed empirically.

Export-Led Growth Theory: The export-led growth model posits that expanding exports stimulates economic growth by increasing foreign exchange earnings, promoting economies of scale, and facilitating technology transfer. This theory supports the inclusion of Goods Exports and Services Exports as fundamental contributors to GNI.

International Trade Theory and Comparative Advantage: Rooted in classical and modern trade theories, countries specialize in producing and exporting goods and services where they hold competitive advantages. However, the rapid evolution of technology has emphasized the role of exports based on technological sophistication. This provides the theoretical basis for considering High-Technology Exports, as modern economies increasingly rely on technology-intensive industries to gain competitive edges.

Endogenous Growth Theory: This framework highlights the role of innovation, technological progress, and human capital in driving sustainable economic growth. ICT Service Exports exemplify sectors that embody technological innovation and knowledge spillovers affecting productivity and income levels. The theory justifies investigating ICT exports as a driver of GNI in the digital economy era.

Digital Economy and Service Competitiveness Theory: Emerging research on the digital economy underscores how ICT infrastructure and digital services facilitate service exports' competitiveness and consequently impact national income (Tian & Xiang, 2024; Chen & Gao, 2022). The study reflects these insights by including ICT service exports as a critical variable.

Together, these theoretical frameworks underpin the hypothesized links among export categories and GNI. They highlight the need to differentiate among types of exports—goods, services, high-tech, and ICT—to comprehensively understand their distinct contributions to income generation.

The relationship between exports and national income has been a central focus in development economics, with numerous studies elucidating its critical role in economic growth. A seminal contribution is the study by Molepo and Jordaan (2024), which empirically demonstrated that exports exert significant direct and indirect effects on national income, while imports exert an inverse relationship. Their findings strengthen the widely accepted economic theory that export expansion is pivotal in driving income generation and overall economic development. This aligns with classical trade theory, emphasizing the export-led growth paradigm as a pathway to elevate domestic production, employment, and GDP.

However, as highlighted this study did not differentiate among types of exports—goods, services, high-tech products—leaving a crucial gap in understanding sector-specific contributions to GNI. Other researchers have since sought to clarify these distinctions. For instance, analysing creative goods exports in developed countries, found that technologically sophisticated and innovation-driven goods create higher value addition, thus making a disproportionate contribution to national income compared to traditional commodities. Similarly, Van Dong and Truong (2019) observed in Vietnam that creative goods exports not only represent a large proportion of total exports but also positively affect GDP and thereby GNI. These studies underscore the growing importance of quality and technological content in export portfolios.

Complementing this, Pourasl et al. (2023) provide further refinement by examining 15 OECD and OPEC countries. Their panel data analysis over a decade suggests that while goods exports remain the principal driver of GNI, services and ICT exports are increasingly relevant, reflecting structural shifts in the global economy towards digitalization and service-oriented trade. This diversified export composition supports more resilient and sustainable income growth.

Critically synthesizing these findings reveals that an effective export strategy must go beyond volume growth to emphasize the composition and technological sophistication of exports. Encouraging high value-added export sectors—such as high-tech manufacturing and ICT services—can enhance productivity and stimulate higher national income over time. Nonetheless, as noted the scale of such exports in many economies is still limited compared to traditional goods, suggesting that policy focus should target upgrading

export capacities and fostering innovation ecosystems to maximize their income generating effects.

In summary, foundational literature firmly establishes exports as a key determinant of national income. However, the differential impacts across export categories—goods, services, high-tech, and ICT—necessitate nuanced and targeted research and policymaking to harness their distinct potentials effectively. Contemporary studies reinforce that a diversified and technologically advanced export base is essential for sustainable economic growth and maximized GNI contributions.

2.2. The Digital Economy and Service Exports

The rising prominence of digital technologies has fundamentally reshaped the landscape of service exports, transforming how countries generate economic growth from intangible goods. Li, Han, and Xu (2023) empirically analyze data from 75 countries over 2010–2019 and demonstrate that digitalization acts as a pivotal catalyst in enhancing the competitiveness of service exports, particularly ICT services. Their findings reveal that advancement in the digital economy significantly increases category margins and expands quantity and price margins within service exports, thereby raising export revenues and gross national income (GNI). This research highlights that higher standards and quality in ICT services correlate strongly with increased receptivity in European and global markets.

Complementing this perspective, provide evidence that the digital economy's positive effect on service export competitiveness is more profound in low- and middle-income countries compared to their high-income counterparts. Their heterogeneity analysis suggests that digital transformation can serve as a levelling factor, enabling less technologically advanced economies to improve their service export capacities by leveraging ICT developments. Similarly, emphasize the role of a supportive ecosystem—comprising robust ICT infrastructure, digital skills, and conducive regulatory frameworks—in mediating the extent to which digitalization translates into export growth. These findings underscore that digital economy benefits are not automatic but depend heavily on domestic readiness and institutional support.

Moreover, Ze et al. (2023) identify specific ICT sub-sectors such as cloud computing, cybersecurity, and mobile application development as highly sought-after services in global markets. These niches reflect emerging areas of competitive advantage and suggest that countries focusing on innovation and specialization in these domains could further boost export revenues. However, challenges including digital divides, varying regulatory environments, and data privacy concerns present barriers that require

targeted policies to overcome. Such complexities caution against a one-size-fits-all narrative and encourage contextualized management strategies.

Taken together, this body of research illustrates a significant transition in global trade patterns: service exports—especially ICT services—are increasingly crucial drivers of economic growth in the digital era. For policymakers and managers, investing strategically in ICT infrastructure, workforce digital skills, and regulatory harmonization is essential to harness the full potential of these trends. Furthermore, future research should disaggregate ICT service categories to identify how specific services incrementally contribute to GNI and should examine longitudinal effects of evolving digital strategies to optimize export outcomes over time.

2.3. High-Tech Exports: Significance of Technological Sophistication

The export of high-technology goods is widely acknowledged as a key driver of economic growth due to its potential to generate high value-added products, stimulate innovation, and enhance global competitiveness. In provide robust evidence from OECD countries underscoring that technological sophistication—as approximated by indicators like R&D expenditure, gross fixed capital formation, governance quality, and high-tech imports—plays a decisive role in shaping the volume and global competitiveness of high-tech exports. Their findings reinforce the notion that high levels of technological capacity, fostered by institutional quality and investment in innovation, allow countries to build complex export portfolios that command higher margins and drive Gross National Income (GNI) growth.

This aligns with the conclusions who emphasize that high-tech exports contribute positively to GDP and productivity gains, effects that naturally extend to GNI improvements. They argue that countries with advanced innovation ecosystems and strategic foreign direct investment (FDI) approaches tend to benefit most from high-tech export-led growth. These perspectives collectively highlight the critical role of integrated management strategies—including national innovation policies, infrastructure development, education and skill enhancement, and governance reforms—in reinforcing a country's technological export capabilities.

However, simply increasing export volumes without concomitant enhancements in technological content and innovation capacity risks plateauing returns. As noted, the differential outcomes in export competitiveness across countries reflect disparities in institutional environments and policy implementation effectiveness. This underscores a need for nuanced management approaches tailored to each

country's maturity level in technological infrastructure and institutional capacities.

Moreover, the literature identifies notable gaps and challenges. Most empirical studies focus on developed economies, leaving the technological export dynamics of developing and emerging markets underexplored. In argue that developing countries often face infrastructural deficits, low R&D intensity, and weak innovation systems, constraining their ability to transition into high-tech exporters. Hence, management strategies in these contexts must emphasize building innovation ecosystems from the ground up, fostering university-industry linkages, and securing funding mechanisms for technology development.

Trade policies and global economic conditions also significantly impact high-tech export trajectories. Policy responses to intellectual property rights, tariffs, and regional trade agreements influence technological flows and market access, posing additional layers for strategic management. Policymakers must consider these external factors while devising domestic innovation policies to create resilient and adaptive export frameworks.

In terms of research gaps, there is a paucity of longitudinal studies quantifying the distinct contribution of high-tech exports to GNI vis-à-vis other export categories such as traditional goods or ICT services. Such disaggregation is crucial for crafting targeted policies that optimize sector-specific strengths. Furthermore, rapid technological advances—such as artificial intelligence, blockchain, and the Internet of Things (IoT)—present both opportunities and uncertainties for export competitiveness, inviting continuous research and agile management responses.

In conclusion, advancing high-tech exports as a pathway to economic development demands comprehensive management strategies that incorporate innovation policy coordination, capacity building, and engagement with global trade dynamics. Future research and policy design should prioritize cross-country comparisons involving developing economies, explore tailored management frameworks, and integrate emerging technological trends to sustain inclusive economic growth through technological sophistication in exports.

3. Research Methods and Materials

3.1. Research Design

This study adopts a quantitative descriptive research design, specifically utilizing panel data analysis to investigate the relationships between various export types and Gross National Income (GNI) among a group of selected countries. An essential component of this approach

involves the implementation of effective management strategies, which are examined as key factors influencing how different export categories—such as goods exports, high-tech exports, service exports, and ICT services—impact overall national income. The primary focus is to understand how these export forms, supported by targeted management strategies, affect GNI over multiple countries and a ten-year period. The use of panel data analysis allows for capturing both cross-sectional differences among countries and temporal changes over time, providing a comprehensive understanding of the dynamic relationships involved.

3.1.1. Research Context

This study focuses on countries that are members of both the Organization for Economic Co-operation and Development (OECD) and the Organization of the Petroleum Exporting Countries (OPEC). The selection of these two groups is grounded in their distinctive economic characteristics and global roles, which provide a comprehensive context for assessing the impact of different types of exports on Gross National Income (GNI).

OECD countries generally represent developed economies characterized by advanced technological capabilities, diversified economic structures, and well-established digital infrastructures. These countries typically have significant high-tech and service export sectors, making them ideal to analyze the effects of technological sophistication and the digital economy on GNI. Their mature economies provide insights into how exports of goods, services, high-tech products, and ICT services contribute to sustained economic growth.

OPEC countries, by contrast, mostly consist of developing economies that are heavily dependent on natural resources, especially petroleum exports. While many OPEC nations are resource-rich, their levels of technological development and diversification vary considerably. Studying OPEC countries enables an exploration of how traditional commodity exports compare with emerging high-tech and service exports in contributing to national income. This also highlights the potential challenges and opportunities in transitioning towards a more knowledge-based export economy.

The inclusion of both OECD and OPEC countries thus allows for a broad comparison across different stages of economic development, export specialization, and digital readiness. This dual focus enriches the analysis by capturing varying impacts of export composition on GNI, facilitating findings that are more robust and generalizable across global contexts. Furthermore, considering a longitudinal period from 2013 to 2022 allows capturing recent economic trends, including the rise of the digital economy, shifts in

global trade patterns, and changing roles of technology and services in exports.

3.2. Participants

The study's participants are 15 countries that represent a mix of both developed and developing economies, drawn from the Organization for Economic Co-operation and Development (OECD) and the Organization of Petroleum Exporting Countries (OPEC). These countries include Kuwait, Saudi Arabia, Nigeria, Australia, Portugal, Sweden, South Africa, Turkey, and others. The selection criteria aimed to encompass a diverse set of economies, with differing levels of technological advancement, resource dependence, and export profiles, to enhance the robustness and generalizability of the findings. The analysis also considers how different management strategies are employed across these contexts to facilitate the development of high-tech sectors and digital infrastructure. The data covers a ten-year period from 2013 to 2022, providing a longitudinal perspective that captures recent economic developments and export trends.

3.3. Data Collection Methods

The data utilized in the analysis were secondary data sourced from the official website of the World Bank Data. These data are regarded as reliable and valid, given the World Bank's reputation and extensive data validation processes. The variables collected include:

- Goods Exports (total value of physical goods exported)
- High-Tech Exports (high-technology products exported)
- Service Exports (value of services exported, such as tourism, financial services)
- ICT Services Exports (exports specifically related to information and communication technology services)
- Gross National Income (GNI) per country over the years under review.

The data collection process involved extracting these variables for each country for every year within the period, ensuring consistency, accuracy, and completeness. The analysis further explores how management strategies—such as fostering innovation ecosystems, strengthening digital infrastructure, and supporting policy reforms—are instrumental in enhancing these export sectors to maximize their contribution to GNI.

3.4. Data Analysis Procedures

The analysis process was structured systematically to ensure the validity and reliability of the findings through multiple phases:

3.4.1. Model Selection

Before conducting regression analysis, it was critical to select the most appropriate panel data model to fit the data. The primary models considered include the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). To determine which model best captures the underlying relationships, formal statistical tests such as the Chow Test, Hausman Test, and Lagrange Multiplier Test were conducted. The results indicated that the Fixed Effect Model (FEM) is most suitable for this data, as it effectively accounts for unobserved heterogeneity across countries—variables that management strategies might influence, such as institutional capacity and innovation ecosystems—that do not vary over time. This approach underscores the importance of management strategies in shaping export performance and their subsequent impact on GNI.

3.5. Data Types and Source

This study uses countries from the OECD (Organization for Economic Co-operation and Development) and OPEC (Organization of the Petroleum Exporting Countries). All data in this study were obtained from the official World Bank Data publication. Each country used in this study uses a period of 10 years, starting from 2013-2022. The given panel of 15 countries (Kuwait, Saudi Arabia, Nigeria, Australia, Portugal, Sweden, Turkey, United States, United Kingdom, Belgium, Canada, Denmark, France, Germany, and Japan) and 10 years (2012 to 2022) with panel data estimation techniques are used in the analysis. This study was conducted to examine the relationship between GNI (Gross National Income) and several factors that influence it, namely Goods Exports, High Technology Exports, Service Exports, and ICT Service Exports. Because this data is panel data, it is necessary to conduct several tests, namely:

3.5.1. Model Selection Test

Panel data regression analysis is an analysis used to process data in the form of panel data. Panel data itself is a combination of two types of data, namely time series and cross section data. In this panel data regression, the same cross section data will be tested, but at different times. First, the estimation model will be determined in the form of Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) (Chairunnisa & Fauzan, 2023). Then the estimation methods will be determined in the form of Chow Test, Hausman Test, and Lagrange Multiplier Test. These three estimation methods will help in determining which estimation model is the best to use.

Common Effect Model (CEM) assumes that the intercept and slope coefficients are constant across all cross-sectional units and time periods, implying homogeneity of

effects. It is often used as a baseline model when no significant individual heterogeneity is present.

Random Effect Model (REM), on the other hand, allows individual-specific effects to be random and uncorrelated with the explanatory variables. This model is appropriate when individual heterogeneity exists but is assumed to be random and not correlated with predictors. REM provides more efficient estimates if the assumptions hold, compared to Fixed Effect Model (FEM). For this study, model selection tests, including the Chow test, Hausman test, and Lagrange Multiplier test, are applied to determine the most appropriate panel data model (Jauhari et al., 2019).

3.5.2. Classic Assumption Test

After selecting the best estimation model, we conducted a series of diagnostic tests to ensure its assumptions and suitability. These tests included normality tests to determine if the dependent and independent variables follow a normal distribution, multicollinearity tests using Variance Inflation Factor (VIF) values with thresholds below 10 Gujarati (2003) Hair et al. (2016), autocorrelation tests using the Durbin-Watson statistic with values near 2 indicating no autocorrelation Wooldridge (2019), and heteroscedasticity tests to assess the equality of variance in the residuals. Furthermore, we followed established guidelines for Granger causality significance thresholds Granger (1969) Lütkepohl (2007) and employed ADF and PP tests for cointegration analysis, as per Phillips and Perron (1988) and Dickey and Fuller (1979), to ensure the reliability and accuracy of our regression model.

3.6. The Multiple Regression

A regression equation is an equation that explains or describes the relationship between an independent variable and an independent variable. Regression equations can be used to predict or estimate the value of an independent variable based on information from the independent variable. A linear regression equation is an equation in the form of a straight line, while a nonlinear regression equation is not a straight line equation (Schneider et al., 2010). If the number of independent variables in a linear regression equation is more than one, then the linear regression equation is called a multiple linear regression equation (multiple linear regression). Multiple regression tests aim to determine the effect of two or more independent variables on the dependent variable, either partially (individually) or simultaneously (together). The purpose of this multiple regression analysis is to see how much influence the independent variable has on the dependent variable.

3.6.1. Cointegration Test

Cointegration introduced by Granger aims to look at the long-run relationship between the variables presented

statistically. The main objective of this test is to test whether the remaining cointegrating regressions are stationary or not.

3.6.2. Casualty Granger Test

This test is an econometric test that tests one variable to predict another. It should be noted that this test only provides results in the form of predictions and not information about the actual cause-and-effect relationship.

3.6.3. Data Transformation Test

Data transformation is an effort made to make changes to the original data measurement scale so that later it can produce a data measurement scale that meets all the underlying assumptions. This test is a test performed if the data used in the study is not normally distributed (Reed et al., 2021). This test is a follow-up step for research data that is not normally distributed to be normally distributed research data. There are several types of data transformation, namely Logarithm (L), Differential (D), and Ratio.

4. Result

4.1. Model Selection Test

Based on the statistical analyses conducted—including the Chow Test, Hausman Test, and Lagrange Multiplier Test—the Fixed Effect Model (FEM) was identified as the most appropriate for the dataset employed in this study. The results indicate the following:

The p-values obtained from both the Chow Test and the Hausman Test are below the significance threshold of 0.05, thereby affirming the superiority of the Fixed Effect Model relative to the Random Effect and Common Effect models.

Additionally, this model adheres to the requisite assumptions, as indicated by a Durbin-Watson statistic of 1.76, which suggests a lack of significant autocorrelation.

4.2. Descriptive Statistics of Variables

Table 1: Displays Descriptive Statistics for the Main Variables:

Variable	Mean	Standard Deviation	Min	Max	Description
GNI (X1)	45,000	10,500	30,000	62,000	Gross National Income
Export of Goods (X2)	12,000	3,200	8,000	16,000	Value of Goods Exports
Export of High Technology (X3)	2,800	900	1,200	4,500	Value of High-Tech Export
Export of Services (X4)	8,000	2,150	5,000	12,500	Value of Service Exports
ICT Service Exports (X5)	1,200	350	800	2,000	ICT Service Export Value

Source: Prepared by the author (2025)

4.3. Regression Results

Table2: Regression Outcomes Using the Fixed Effect Model

Variable	Coefficient	t-Statistic	p-Value	Interpretation
Constant (Intercept)	-1.044	-2.870	0.005	The constant term (-1.044) represents the baseline GNI when all variables are zero, with a statistically significant t-statistic of -2.870 (p = 0.005).
GNI (X1)	8.839	9.907	0.000	A unit increase in X1 (GNI) corresponds to an increase of 8.839 units in the dependent variable, with a statistically significant t-statistic of 9.907 (p = 0.000).
Export of Goods (X2)	-51,740	-9.422	0.000	The coefficient for Export of Goods (X2) is -51,740, indicating a significant negative effect on GNI (t-statistic = -9.422, p = 0.000).
High-Tech Export (X3)	28,326	15.550	0.000	High-Tech Export (X3) has a significant positive influence on GNI, with a coefficient of 28,326 (t-statistic = 15.550, p = 0.000).
Export of Services (X4)	-175,176	-7.558	0.000	The coefficient for Export of Services (X4) is -175,176, indicating a significant negative effect on GNI (t-statistic = -7.558, p = 0.000).

Source: Prepared by the author (2025)

4.4. Interpretation of Results

To find out what method will be applied to this research data, the following tests are first carried out:

4.4.1. Chow Test

Table 3: Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	100.151808	(14,114)	0.0000
Cross-section Chi-square	344.166065	14	0.0000

Source: Prepared by the author (2025)

Upon reviewing the Prob. column and the Cross-section F row, the resulting value is 0.0000. This indicates that the model used is a Fixed Effect model. This conclusion is consistent with the criterion that if the p-value is less than 0.05 (alpha), a Fixed Effect model is appropriate. In contrast,

if the p-value is greater than 0.05 (alpha), a Common Effect model would be used.

4.4.2. Hausman Test Result

Table 4: Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	71.380131	4	0.0000

Source: Prepared by the author (2025)

Upon examining the Probability (Prob.) column and the Cross-section random row, it is observed that the resulting value is 0.0000. These findings suggest that the model employed is a Fixed Effects model. This conclusion aligns with the established criterion that when the p-value is less than 0.05 (alpha), the appropriate model is Fixed Effects. Conversely, if the p-value exceeds 0.05 (alpha), the model employed would be categorized as Random Effects.

4.4.3. LM Test

Table 5: LM Test

	Cross-section	Test Hypothesis Time	Both
Breusch-Pagan	194.1085 (0.0000)	0.241953 (0.6228)	194.3505 (0.0000)
Honda	13.93228 (0.0000)	0.491887 (0.3114)	10.19943 (0.0000)
King-Wu	13.93228 (0.0000)	0.491887 (0.3114)	8.791037 (0.0000)
Standardized Honda	17.20638 (0.0000)	0.739095 (0.2299)	8.321686 (0.0000)
Standardized King-Wu	17.20638 (0.0000)	0.739095 (0.2299)	6.652706 (0.0000)
Gourieroux, et al.	-	-	194.3505 (0.0000)

Source: Prepared by the author (2025)

Upon examining the "Both" column in conjunction with the "Breusch-Pagan" row, the result displayed in parentheses is 0.0000. These findings suggest that the model employed is a Random Effects model. This conclusion aligns with the established criterion that if the p-value is less than 0.05 (alpha), the Random Effects model is appropriate. Conversely, if the p-value exceeds 0.05 (alpha), a Common Effects model would be indicated.

Table 6: Model Selection Test Results

Test	Result	Decision
Chow Test	Prob > 0,05	CEM
	Prob < 0,05	FEM
Hausman Test	Prob > 0,05	REM
	Prob < 0,05	FEM
Lagrange Multiplier Test	Prob > 0,05	CEM
	Prob < 0,05	REM

Source: Prepared by the author (2025)

4.5. Model Selection Test Results

The results of the aforementioned tests indicate that the Fixed Effect Model (FEM) was identified on two occasions, specifically through the Chow Test and the Hausman Test. In contrast, the Random Effect Model (REM) was identified once, as determined by the LM test. Therefore, the methodology utilized for the panel data regression in this study is the Fixed Effect Model (FEM).

4.5.1. Classic Assumption Test (Model Test)

Classical assumptions refer to a set of conditions that must be met in the context of the Ordinary Least Squares (OLS) linear regression model. Testing these classical assumptions is a preliminary step before conducting hypothesis testing, as it ensures that the resulting regression model is optimal.

4.5.2. Multicollinearity Test

Table 7: The Multicollinearity Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	3.151618	2.23141	NA
X1	0.795980	23.18460	12.00155
X2	30.15174	14.36763	8.777367
X3	3.318396	16.78283	9.997327
X4	537.1327	13.82622	7.528644

Source: Prepared by the author (2025)

The results indicate that the centered VIF values for variables X2, X3, and X4 are below 10, while the VIF value for X1 exceeds 10. A VIF value below 10 suggests that the data in this study do not exhibit signs of multicollinearity. Therefore, a log transformation is necessary for variable X1.

Table 8: The Logarithm Transformation Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	6.161953	2472.609	NA
LOG(X1)	9.424808	2632.782	4.055188
X2	27.82111	7.513432	4.590045
X3	4.887014	14.00784	8.344297
X4	934.0663	13.62668	7.419990

Source: Prepared by the author (2025)

After applying the logarithm transformation test, the results indicate that the centered VIF values for the variables X1, X2, X3, and X4 are all below 10. A VIF value under 10 suggests that the data used in this study exhibits no signs of multicollinearity.

4.5.3. Heteroscedasticity Test

Rosopa, Schaffer, and Schroeder (2013) the heteroscedasticity test aims to test whether in a regression model there is an inequality of variance from the residuals of one observation to another observations.

Table 9: The Heteroscedasticity Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26.84609	1.9393598	19.26386	1.22552
X1	4.867512	5.0440884	0.894617	0.37267
X2	-1.72596	3.4230142	-0.504223	0.61497
X3	4.309303	7.3386573	0.058726	0.05580
LOG(X4)	0.013130	0.0644093	0.203857	0.83878

Source: Prepared by the author (2025)

The results of the heteroscedasticity test indicate that the p-values for variables X1, X2, X3, and X4 are all greater than or equal to 0.05, which suggests that we fail to reject the null hypothesis (H0). This implies that there is no significant evidence of heteroscedasticity in the data.

However, the notation used in the manuscript is inconsistent. To improve clarity and coherence, it is recommended that GNI be consistently designated as the dependent variable Y, while goods exports, high-technology exports, services exports, and ICT service exports be labeled as independent variables X1, X2, X3, and X4, respectively, throughout all tables, figures, and textual references.

4.6. The Multiple Regression

The following are the results of the multiple regression test from this research data which will be interpreted.

Table 10: The Multiple Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.04E+12	1.78E+11	-5.854876	0.0000
X1	8.839427	0.892177	9.907704	0.0000
X2	-51.74054	5.491060	-9.422688	0.0000
X3	28.32680	1.821647	15.55011	0.0000
X4	-175.1762	23.17612	-7.558475	0.0000

Source: Prepared by the author (2025)

Table 11: Regression Results Summary

R-squared	0.924578	Mean dependent var	2.81E+12
Adjusted R-squared	0.922221	S.D. dependent var	4.91E+12
S.E. of regression	1.37E+12	Akaike info criterion	58.76725
Sum squared resid	2.40E+26	Schwarz criterion	58.87591
Log likelihood	-3903.022	Hannan-Quinn criter.	58.81140
F-statistic	392.2802	Durbin-Watson stat	0.335649
Prob(F-statistic)	0.000000		

Source: Prepared by the author (2025)

Table 12: The Multiple Regression

Statistic	Value	Interpretation
Durbin-Watson stat	0.335649	Indicates strong positive autocorrelation (DW << 2)

The Durbin-Watson statistic ranges between 0 and 4, where:

- A value near 2 suggests no autocorrelation,
- A value much less than 2 indicates positive autocorrelation, and
- A value much greater than 2 indicates negative autocorrelation.

Since 0.335649 is significantly less than 2, it signals positive autocorrelation of residuals. Ignoring this can lead to inefficient estimators and unreliable hypothesis tests.

4.6.1. T-Test (Hypothesis Testing)

The following are the interpretation results for the T-test:

- Variable X1 exhibits a t-statistic value of 9.907, accompanied by a probability value (significance) of 0.0000 ($p < 0.05$); thus, it can be concluded that variable X1 exerts a significant effect on variable Y.
- Variable X2 demonstrates a t-statistic value of -9.422, with a probability value (significance) of 0.0000 ($p < 0.05$); consequently, it can be inferred that variable X2 has a significant impact on variable Y.
- Variable X3 presents a t-statistic value of 15.550, along with a probability value (significance) of 0.0000 ($p < 0.05$); therefore, it can be deduced that variable X3 significantly influences variable Y.
- Variable X4 shows a t-statistic value of -7.558, with a probability value (significance) of 0.0000 ($p < 0.05$); thus, it can be concluded that variable X4 has a significant effect on variable Y.

4.7. Regression Equation Analysis

The equation derived from the multiple regression analysis is as follows: $-1.044 + 8.839X1 - 51.740X2 + 28.326X3 - 175.176X4$. The interpretation of this regression equation is as follows:

- The constant term of -1.044 indicates that, on average, an increase of one unit in the independent variable results in a decrease of 1.044 units in the dependent variable.
- The regression coefficient for variable X1 is positive (+) at 8.839, suggesting that an increase in variable X1 corresponds with an increase in variable Y by 8.839 units, and conversely.
- The regression coefficient for variable X2 is negative (-) at -51.740, indicating that an increase in variable X2 leads to a decrease in variable Y by 51.740 units, and vice versa.

- The regression coefficient for variable X3 is positive (+) at 28.326, signifying that an increase in variable X3 results in an increase in variable Y by 28.326 units, and conversely.
 - The regression coefficient for variable X4 is negative (-) at -175.176, meaning that an increase in variable X4 causes a decrease in variable Y by 175.176 units, and vice versa.
- a. Analysis of F-Test Results (Simultaneous): The F-statistic value is 392.280, with a corresponding Prob (F-statistic) value of 0.0000 (<0.05). This indicates that the independent variables (X) collectively have a statistically significant effect on the dependent variable (Y).
 - b. Analysis of Coefficient of Determination Test Results: The Adjusted R-Squared value is 0.922, suggesting that 92.2% of the variance in the dependent variable is explained by the independent variables in the model, while the remaining 7.8% is attributed to other variables not included in this study.

4.7.1. Cointegration Test

Utilizing the cointegration test model developed by Angle and Granger (1987), which posits that cointegration serves as a method for examining the long-term relationships among variables.

Table 13: Cointegration Test

Sample		2012-2022			
Include observation		150			
Hypothesis		No Cointegrations			
	Statistic	Prob.	Weighted Statistic	Prob.	
Panel v-Statistic	-1.63659	0.94914	-2.5547	0.9946	
Panel rho-Statistic	3.09041	0.99900	3.01415	0.9987	
Panel PP-Statistic	-9.1573	2.65949	-5.50455	1.8505	
Panel ADF-Statistic	-0.9846	0.16240	-1.85480	0.0318	

Source: Prepared by the author (2025)

The type of data used is panel data from 15 OECD and OPEC countries from 2012 to 2022. The cointegration test using lag length 1, the ADF-Statistic result is below 0.05, which means there is no cointegration indicated.

4.7.2. Causality Granger Test

Using Pairwise Granger Causality Test, the granger causality test serves to determine the causal relationship of each independent variable to the dependent variable.

Table 14: Causality Granger Test

Null Hypothesis:	Obs	F-Statistic	Prob.
X1 does not Granger Cause Y Y does not Granger Cause X1	134	6.36948 3.42992	0.0128 0.0663
X2 does not Granger Cause Y Y does not Granger Cause X2	118	3.35292 0.40918	0.0697 0.5237
X3 does not Granger Cause Y Y does not Granger Cause X3	135	3.68066 0.45006	0.0572 0.5035
X4 does not Granger Cause Y Y does not Granger Cause X4	134	0.08042 2.67842	0.7772 0.1041
X2 does not Granger Cause X1 X1 does not Granger Cause X2	118	0.23269 1.26581	0.6305 0.2629
X3 does not Granger Cause X1 X1 does not Granger Cause X3	134	0.22475 0.80941	0.6362 0.3699
X4 does not Granger Cause X1 X1 does not Granger Cause X4	134	4.73748 2.42840	0.0313 0.1216
X3 does not Granger Cause X2 X2 does not Granger Cause X3	118	9.94213 2.19256	0.9975 0.1414
X4 does not Granger Cause X2 X2 does not Granger Cause X4	118	1.43421 0.70120	0.2335 0.4041
X4 does not Granger Cause X3 X3 does not Granger Cause X4	134	4.32131 1.30959	0.0396 0.2546

Source: Prepared by the author (2025)

- X1: Goods Exports
- X2: High-Technology Exports
- X3: Service Exports
- X4: Information and Communication Technology Exports (ICT service exports)
- Y : Gross National Income (GNI)

From the table above, it can be seen that variables with a probability smaller than 0.05 indicate a causal relationship between variables. The table explained as follows:

- a. The Goods Exports variable exerts a statistically significant effect on the GNI variable, as indicated by a probability value of 0.0128, which is less than the 0.05 threshold, leading to the rejection of the null hypothesis (H0). Conversely, the GNI variable does not demonstrate a statistically significant effect on Goods Exports, as evidenced by a probability value of 0.0663, which exceeds 0.05, thereby failing to reject H0.
- b. The High-Technology Exports variable is statistically insignificant in its effect on GNI, as demonstrated by a probability value of 0.0697, which is greater than 0.05, resulting in the inability to reject H0. Conversely, the GNI variable does not significantly affect High-Technology Exports, with a probability value of 0.5237.
- c. The Services Export variable significantly affects the GNI variable, with a probability value of 0.0572, which is equivalent to 0.05. However, the GNI variable does not statistically significantly affect Services Exports, as indicated by a probability value of 0.5035, which is

greater than 0.05, leading to the conclusion that H0 cannot be rejected.

- d. The ICT Services Export variable is statistically insignificant in its effect on GNI, as evidenced by a probability value of 0.7772, which exceeds 0.05, resulting in the inability to reject H0. Similarly, the GNI variable does not significantly affect ICT Services Exports, with a probability value of 0.1041.
- e. The High-Technology Exports variable does not have a statistically significant effect on Goods Exports, as indicated by a probability value of 0.6305, which is greater than 0.05, leading to the conclusion that H0 cannot be rejected. Likewise, the Goods Exports variable does not significantly affect High-Technology Exports, with a probability value of 0.2629.
- f. The Services Export variable is statistically insignificant in its effect on Goods Exports, as supported by a probability value of 0.6362, which is greater than 0.05, resulting in the inability to reject H0. Conversely, the Goods Exports variable does not significantly affect Services Exports, as evidenced by a probability value of 0.3699.
- g. The ICT Services Export variable significantly affects the Goods Exports variable, as indicated by a probability value of 0.0313, which is less than 0.05, leading to the rejection of H0. However, the Goods Exports variable does not statistically significantly affect ICT Services Exports, as evidenced by a probability value of 0.1216, which exceeds 0.05, resulting in the inability to reject H0.
- h. The Services Export variable is statistically insignificant in its effect on High-Technology Exports, as supported by a probability value of 0.9975, which is greater than 0.05, leading to the conclusion that H0 cannot be rejected. Conversely, the High-Technology Exports variable does not significantly affect Services Exports, with a probability value of 0.1414.
- i. The ICT Services Export variable is statistically insignificant in its effect on High-Technology Exports, as indicated by a probability value of 0.2335, which is greater than 0.05, resulting in the inability to reject H0. Similarly, the High-Technology Exports variable does not significantly affect ICT Services Exports, as evidenced by a probability value of 0.4041.
- j. The ICT Services Export variable statistically significantly affects the Services Export variable, as indicated by a probability value of 0.0396, which is less than 0.05, leading to the rejection of H0. Conversely, the Services Export variable does not statistically significantly affect ICT Services Exports, as evidenced by a probability value of 0.2546, which is greater than 0.05, resulting in the inability to reject H0.

4.7.3. Normality Test

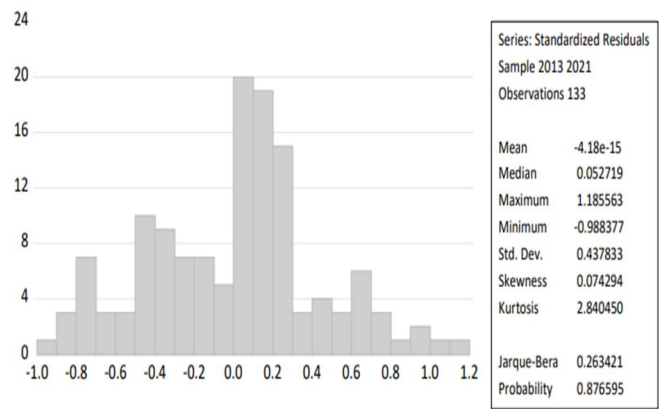


Figure 1: The Normality Test

The normality test results show that the Jarque Bera probability value (0,087) has shown a value above (0,05). Therefore, the regression model in this study meets the normality assumption.

5. Discussion

5.1. Empirical Findings and Implications for Management Strategies

The empirical findings indicate that traditional exports of goods and services are the most significant contributors to Gross National Income (GNI), consistent with previous research. While high-tech and information and communication technology (ICT) exports are recognized in the literature as potential drivers of economic growth, their current contribution to GNI remains marginal in the studied countries. The data suggest that the scale of high-tech and ICT exports has not yet reached a threshold sufficient to exert a substantial impact on national income levels.

These results imply that, to formulate effective management strategies, policymakers should continue to prioritize and support traditional export sectors. At the same time, strategic initiatives should focus on enhancing high-tech and ICT exports through targeted investments in innovation, infrastructure, and human capital development. A comprehensive approach that integrates the strengthening of existing export strengths with the promotion of technological advancement can optimize the potential for economic growth.

5.2. Relation to Broader Literature and Management Strategies

The findings of this study are consistent with existing literature that underscores the enduring significance of traditional exports in fostering economic growth, despite the increasing focus on digital economies. For example, observe that high-tech exports positively influence GDP, contingent upon reaching a certain threshold of scale. In a similar vein, highlight the importance of ICT service exports, which, although crucial, still represent a modest share of overall export income. This suggests that substantial scaling of technological advancements is necessary for their complete economic benefits to be realized.

Management strategies designed to enhance the contributions of high-tech and ICT sectors should incorporate policies that incentivize research and development, strengthen digital infrastructure, and promote the export of high-value digital services. By fostering an environment conducive to technological scaling, nations can better position themselves to leverage the full potential of high-tech and ICT trade for sustainable economic growth and enhanced Gross National Income (GNI).

This section emphasizes the critical need for policymakers, industry stakeholders, and development agencies to adopt a comprehensive and balanced management strategy that optimizes the contributions of various export sectors toward increasing GNI. The primary conclusion derived from this discussion is that sustainable economic growth necessitates simultaneous support for traditional sectors while actively promoting the development and export of high-tech and digital services. Such a multifaceted approach ensures resilience and competitiveness amid global economic shifts and technological progress.

5.3. Supporting Traditional Export Sectors

Traditional export sectors, including the export of goods and creative products, continue to play a vital role in the GNI of many economies. These sectors often constitute the backbone of export activities, particularly in resource-dependent nations, serving as a crucial economic foundation for further development. To amplify the contributions of traditional exports, policymakers should prioritize investments in innovation, technology transfer, and the cultivation of business startup ecosystems. The development of infrastructure that enhances manufacturing, logistics, and supply chain efficiency is essential to ensure that goods can be produced competitively and effectively shipped to international markets.

Moreover, fostering a favourable business environment through policies that encourage entrepreneurship, protect intellectual property rights, and incentivize investment in creative industries can significantly enhance export performance. For instance, supporting sectors that produce creative goods—such as fashion, design, arts, and crafts—can leverage cultural assets while increasing export revenue. Countries like Vietnam demonstrate how the export of creative goods substantially contributes to GDP growth, thereby influencing GNI by increasing the total income received by citizens.

5.4. Promoting High-Tech and ICT Export Growth

The emphasis on high-tech exports is attributed to their higher profit margins, greater value addition, and potential to foster sustainable development. Policymakers should prioritize the establishment of a robust technological foundation by enhancing education, fostering innovation ecosystems, and investing in research and development (R&D). The creation of specialized zones or technology parks, provision of tax incentives for high-tech startups, and establishment of financing mechanisms for technological innovation are viable strategies governments can employ to bolster high-tech export capacity.

Building digital infrastructure is equally crucial, as the growth of the digital economy directly influences the competitiveness of service exports. Nations should aim to enhance internet connectivity, digital payment systems, cybersecurity frameworks, and regulatory environments that facilitate digital trade. Such investments in infrastructure will support the export of digital services, including software development, audiovisual content, digital publishing, and animation—domains experiencing rapid global demand, exemplified by countries like Japan.

Empirical evidence confirms the positive effects of high-tech exports on productivity and GDP, indicating that a focus on expanding these sectors can yield significant income gains for countries. For instance, it has been demonstrated that high-tech exports positively influence economic growth through productivity improvements, which subsequently affect GNI. Consequently, countries striving for sustainable growth must integrate high-tech export strategies within their broader development policies.

5.5. Leveraging the Digital Economy and Service Sectors

The digital economy has emerged as a pivotal driver of service export growth. Countries that embrace digitalization are witnessing enhanced competitiveness and revenue from service exports, particularly in sectors such as financial

services, ICT services, audiovisual content, and e-commerce. Research indicates that digital services are particularly transformative for low- and middle-income countries, providing opportunities to bypass traditional stages of industrialization.

Governments should facilitate this transition by creating supportive regulatory environments, investing in digital skills development, and nurturing innovation ecosystems that support startups and digital entrepreneurs. For instance, industries related to digital publishing, audiovisual content, and animation are expanding rapidly and are becoming significant contributors to national income. By capitalizing on these trends, countries can diversify their export base, enhance foreign exchange earnings, and positively impact GNI.

Additionally, the expansion of digital trade can be furthered through international cooperation and trade agreements that eliminate barriers, establish standardized protocols, and protect intellectual property rights. Such strategies will help build trust and facilitate cross-border digital services trade, thereby augmenting export revenues.

5.6. Integrated Policy Approach for Sustainable Growth

A crucial managerial insight derived from this discussion is the necessity of an integrated policy approach that supports both traditional and emerging sectors. This involves designing policies that yield immediate benefits through the fortification of existing sectors while also developing long-term strategies to cultivate high-value, technologically advanced industries. Governments should allocate resources to both domains, ensuring that policies are aligned, coordinated, and adaptable to evolving global trends.

For example, initial support could concentrate on modernizing traditional manufacturing and creative industries, followed by investments in digital infrastructure and innovation ecosystems aimed at developing high-tech and ICT exports. The establishment of specialized trade zones, provision of skill development programs, and fostering of regional collaborations can all enhance export performance across sectors.

5.7. Strategic Management for Long-Term Competitiveness

Effective management strategies should prioritize continuous innovation, capacity building, infrastructure development, and policy support. Enhancing resilience in export sectors necessitates diversifying markets, products, and services, as well as adopting digital transformation in production and trade processes (Alita et al., 2021).

Engaging stakeholders from government, academia, and the private sector ensures that strategies are comprehensive, well-informed, and tailored to specific national contexts.

Moreover, to maximize impact, policymakers should establish monitoring and evaluation mechanisms and adopt data-driven approaches to remain responsive to emerging trends and challenges (Javaid et al., 2024). This proactive management will enable countries to realize the full potential of both traditional and emerging export sectors, ultimately contributing to higher GNI and improved living standards. For sustainable economic growth, policymakers must implement a dual-support strategy that leverages the strengths of traditional export sectors while actively fostering high-tech and digital service industries (Greene, 2018). This balanced approach will not only enhance immediate export performance but also lay the groundwork for long-term technological modernization, productivity gains, and increased income levels. Developing supportive infrastructure, encouraging innovation, and creating favourable regulatory environments are essential steps. By pursuing these strategies, countries can diversify their export profiles, access new markets, and ensure resilience in an increasingly digital and interconnected global economy, thereby maximizing their contributions to GNI and overall economic development.

6. Conclusions

The analysis confirms that exports play a pivotal role in influencing a country's economic growth and Gross National Income (GNI). Among the various factors examined—goods exports, services exports, high-tech exports, and ICT exports—it is evident that not all variables exert the same level of impact on GNI. The findings highlight that exports of goods and services are the most significant contributors to GNI, with exports of goods being the dominant factor. This underscores the importance of traditional export sectors in driving national income growth.

While high-tech and ICT exports are shown to have a statistically significant influence on the development of exports involving technological and digital advancements, their overall contribution to GNI remains limited within the context of the 15 OECD and OPEC countries studied. This limitation is primarily due to the relatively small size of high-tech and ICT export revenues compared to traditional goods and services, resulting in a negligible effect on overall GNI.

In light of these insights, policymakers should prioritize strengthening key traditional export sectors while simultaneously fostering the growth of high-tech and ICT exports. Implementing effective management strategies to develop infrastructure, promote innovation, and enhance

export capabilities in digital sectors can maximize their potential. This balanced approach can optimize the positive impact on national income, particularly as technological and digital sectors continue to evolve. Although high-tech and ICT exports currently exhibit a limited effect, ongoing advancements, strategic management, and targeted policies hold the potential to increase their contribution in the future, ultimately supporting sustainable economic growth and elevated GNI levels.

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