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Impact of Interrelationships among the Economic Sectors on Achieving Sustainable Development in the Kingdom of Saudi Arabia

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ABSTRACT:
This study is aligned with the vision of the Kingdom of Saudi Arabia 2030, which seeks to achieve sustainable economic development. This study aims to estimate the size of the interrelationships among the economic sectors in the Kingdom of Saudi Arabia from the period 1970 to 1920. The descriptive-analytical and econometric approaches were used to display the concepts and literature review relevant to the study as well as to analyze the interrelationships between the sectors of the national economy, which are represented in: the added value of (the manufacturing sector, the non-manufacturing industries sector, the service sector, and the agricultural sector) using Vector Auto-Regression model (VAR) and Impulse Response Functions. The results showed the weakness and limitations of the interrelationships among the economic sectors in the Kingdom of Saudi Arabia, in addition to the absence of leading sectors with a strong impact on the rest of the other economic sectors and are influenced by them as well. Accordingly, the study recommends the need to continue and intensify the diversification efforts made by the government to get out of the scope of a rentier economy, and to strengthen the interrelationships among the various economic sectors by applying appropriate reform models that are integrated with economic policies in a way that achieves the requirements of sustainable economic development.

Keywords: Economic interdependence, economic development, economic sectors, economic diversification, Added Value

1. Introduction

Economic development is a paramount challenge facing all countries in their efforts to advance their economic sectors and improve the living standards of their citizens. Economic development is inherently influenced by the goals of sectoral policies, necessitating coordination between all economic sector strategies, as each sector's policy is an integral part of the state's overall policies. The interrelationships between economic sectors are undoubtedly essential for achieving economic development and building a more advanced and sustainable economy. The strength of economic interconnectivity is considered an indicator of income source diversification and the reduction of economic dependency. Moreover, it is an effective tool in raising growth rates, evaluating suitable

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development policies, and analyzing the structural framework of the economy (Al-Hassoun, 2014: 2).

The Kingdom of Saudi Arabia has shown a keen interest in achieving high levels of economic diversification and reducing dependence on oil revenues. This has been accomplished through the implementation of numerous policies aimed at supporting its economy. These policies include the development of service and production sectors with strong links to primary and final industries based on oil and gas. They also involve expanding the production and processing of mining raw materials locally, increasing industrial sector productivity, enhancing national industries, and improving financial, tourism, information technology, and communication services. Despite achieving high economic growth in various economic sectors as a result of economic diversification efforts, reducing reliance on oil and increasing the diversification of the economic base remains one of Saudi Arabia's most important strategic goals. This calls for a focus on strong links and interconnections between various economic sectors to contribute to changing economic performance and promoting economic sustainability.

2. Theoretical Background

The significant fluctuations in global oil prices over many years have indicated that oil-exporting countries face clear income volatility, which can also affect their social welfare. To mitigate the risks associated with dependence on oil revenues, the Kingdom of Saudi Arabia is shifting its economic sectoral composition to achieve a sustainable and diversified economy as part of its ambitious Vision 2030. Hence, the importance of interrelationships between economic sectors becomes evident, granting various sectors of the national economy the ability to contribute more significantly to reducing oil dependence. It also enables them to solidify their role in achieving sustainable economic development. These interrelationships are of utmost importance for diversifying the production base and addressing any economic imbalances stemming from the absence of cross-sectoral nourishment. Additionally, they focus on leading sectors that stimulate the economic benefit and drive the growth process in the Saudi economy as a whole. Therefore, the study problem is encapsulated in the following questions:

Q1: What is the extent of interrelationships between different economic sectors in the Kingdom of Saudi Arabia and the degree of mutual dependence among them?

Q2: What are the key leading sectors that maximize economic benefits and drive the growth process in the Saudi economy as a whole?

3. Study Objectives

The main objective of the study was to assess the magnitude of interrelationships between economic sectors in the Kingdom of Saudi Arabia during the period 1970-2020. Additionally, the study aimed to achieve the following sub-objectives:

- Identify the leading sectors in the Saudi economy and reveal the extent of influence and impact of each sector on other economic sectors.
- Recognize the role of Saudi Arabia's Vision 2030 programs in enhancing mutual relationships between various sectors of the national economy.

4. Importance of the Study

Given that economic diversification has been a primary focus in the transformation process of the Saudi Arabian economy, making it less reliant on oil revenues and more self-reliant, determining the extent of interrelationships between economic sectors holds significant importance for program planners and economic decision-makers. Studying and identifying the degree of interconnectedness between different economic sectors provides a clear understanding of the growth mechanisms of these sectors and the flow of goods and services among them. This contributes to their appropriate utilization, production allocation, and value-added generation, as well as reducing the need for imports. Therefore, the significance of the study can be summarized as follows:

- Revealing the economic interconnectivity in the Kingdom of Saudi Arabia and demonstrating the degree of mutual dependence among various economic sectors.
- Identifying the leading sectors in the Saudi economy as sectors capable of initiating a series of activities across other sectors, thus directing resources towards them to maximize economic benefits and maintain the flow between economic units.
- The importance of this study is highlighted in light of the scarcity of applied empirical studies that utilize the Vector Auto Regression (VAR) model in analyzing economic interconnectivity in the Kingdom of Saudi Arabia.

5. Literature Review

The significance of the interrelationships between economic sectors and their role in promoting sustainable economic development has driven many researchers to conduct numerous studies and research to uncover the extent of mutual relationships between economic sectors in different countries. Some studies have focused on linking the level of these relationships to economic growth.

A study by Matar and Al-Kubaisi (2021) aimed to measure the extent of intersectoral relationships in the Iraqi economy by relying on input-output tables for the year 2010. The results of the study revealed a weak economic interconnection in Iraq, indicating that the economic structure of the country tends to be fragmented and reliant on external imports. The results also showed that the electricity, gas, and water sectors had the highest interconnectivity with other sectors, suggesting the potential for this sector to support economic development.

A study by Rabiean and Banafaa (2019) examined the impact of the agriculture, services, and industry sectors on the Gross Domestic Product (GDP) using time series data for the period 1970-2016. The results indicated that non-manufacturing industries had the greatest impact on GDP compared to other economic sectors. A 1% increase in the contribution of non-manufacturing industries led to a 0.59% increase in GDP, while the contribution of manufacturing industries was 0.22%, and the contribution of the services sector was 0.20%. This suggests a need to enhance economic diversification and reconsider the role of other economic sectors. The study also found that the contribution of the agriculture sector did not have a significant impact.

Regarding the impact of economic diversification on achieving balanced economic development, a study by Abdel-Hamid (2018) concluded that there is a positive relationship between the industry and services sectors and the level of economic growth. The study also highlighted the role of a positive diversification policy in achieving balanced economic development by increasing the value-added in the industry and services sectors. This leads to a higher relative contribution of these sectors to GDP, resulting in increased economic diversification and intersectoral connectivity, ultimately leading to economic growth.

A study conducted by Sharif (2018) examined the size of intersectoral relationships and the key sectors supporting economic development in Algeria. The study found weak intersectoral relationships, indicating structural fragmentation in the national economy and its reliance on external sources, as well as the absence of leading sectors. This analysis was conducted using a Vector Autoregression (VAR) model on time series data spanning from 1970 to 2015 for various economic sectors, including services, manufacturing industries, extractive industries, agriculture, and construction and public works.

In the same context, Yasmin and Bekhet (2017) conducted a study in Malaysia that focused on the role of economic sectors and their ability to promote economic growth. The study also identified the key leading sectors in Malaysia using input-output tables for the period from 2000 to 2015. The results showed that the industrial sector exhibited backward linkages and a high capacity to promote growth, while the energy and agriculture sectors had forward linkages.

Additionally, Yetiz and Ozden (2017) conducted a study in Turkey that examined causal relationships between Gross Domestic Product (GDP) and economic sectors (industry, services, and agriculture) during the period from 1968 to 2015. The study utilized a Vector Autoregression (VAR) model. The results revealed a long-term equilibrium relationship between the variables and a unidirectional causal relationship from the agriculture sector to GDP, industry, and services. This means that agriculture influences the growth of other sectors but is not significantly influenced by them. The study also highlighted a decrease in the contribution of agriculture to GDP, from 33.5% in 1968 to 8.9% in 2015, indicating a shift in the importance of this sector in favor of other sectors due to government efforts to support the industrial sector in Turkey and a developmental path that enhances economic diversification

Also, Haidar and Yousef (2017) conducted a study that focused on estimating the size of intersectoral relationships in the Syrian economy using input-output tables. The study found a statistically significant causal relationship between leading sectors (wholesale and retail trade, textiles, electricity, water, construction, and community and personal services) and other sectors. It also found that the Syrian economy exhibited weak intersectoral relationships, reflecting a decrease in production multipliers in the economy and, consequently, a weakness in the potential for economic growth. Furthermore, the expected results of promoting exports to increase national income were reduced due to these weak interconnections.

The study by Al-Raee and Al-Harazin (2017) also investigated intersectoral relationships in the Palestinian economy using a Vector Autoregression (VAR) methodology. The results emphasized the fragility of interconnections between economic sectors (agriculture, industry, construction, and services), indicating a limited impact on the overall size of

investment. The study suggested the absence of a leading sector in the Palestinian economy. Al-Madhoun's study (2016) also reached a similar result in its study of the extent to which the interconnections between economic sectors affect the total volume of Palestinian investment, as it showed the weak influence of the main economic sectors on each other, which indicates the absence of a leading sector in the Palestinian economy, and the impact of these interconnections Very limited on the total investment size

Alhowaish and AlShihri (2015) researched the causal relationship between Saudi economic growth and the growth of economic sectors (oil sector, agriculture, services, and industry) during the period from 1970 to 2012. The results indicated a long-term relationship between the study variables and a bidirectional causal relationship between sectors (agriculture, services, oil) and economic growth in the short term. It also highlighted that the income growth in the agriculture sector was significantly dependent on the growth of the industrial sector, while the Saudi economy relied on income generated by the industry and services sectors. The study emphasized the low level of economic diversification and the pivotal role of the oil sector in driving other economic sectors.

Additionally, Al-Hassoun (2014) demonstrated that the Saudi agricultural sector is not influenced by the industrial sector, but it contributes to the growth of the industrial sector, implying that the growth of the industrial sector depends on agricultural growth. In Siboleka et al.'s study (2014) on the reciprocal relationship between the agricultural and industrial sectors in Namibia, no relationship was found between the two sectors, indicating a lack of links between them.

In India, Tiwari's study (2010) focused on the relationship between economic sectors (industry, agriculture, and services) and Gross Domestic Product (GDP). Granger causality analysis and impulse response function were used. The results indicated a significant relationship between the services sector and both the industrial sector and GDP. Additionally, the agricultural sector was found to be linked to the services sector. The results also showed that the industrial sector was the largest contributor to India's GDP, followed by agriculture, and then the services sector.

On the other hand, the study by Trawneh (2008) aimed to estimate the size of the interrelationships between economic sectors in Jordan using Vector Autoregression (VAR) methodology. The study considered several sectors (agriculture, extractive industry, manufacturing industry, construction, and services) to assess the feasibility of planned development policies in Jordan. The study concluded that the implementation of an unbalanced development strategy does not suit the Jordanian economy and does not yield the expected results in terms of growth rates. This is due to the weak intersectoral effects and their inability to generate demand and create a more expansive marketing base.

Ghanem et al. (2023) examined the influence of the Green Middle East Initiative on sustainable development in the region of Saudia Arabia. The data extracted was tracked from 2000 till 2020. The study employed econometric analysis to estimate the study variables. The study yielded several findings that contribute to the sustainability of the economy. The most important is the replacement of diesel of crude oil from the batteries for electrical consumption. The economic growth increased by 0.8 percent due to the unstable economic growth. Also 10% increase in petroleum product consumption consequently resulted in a 7.97% rise in carbon dioxide emissions. The rise in petroleum consumption also resulted in 0.71 percent of the human development index. The project

of Green Middle East initiative will provide 1528.49 million m3 of untapped and treated sewage water to plant 10 billion trees. These factors are predicted to lead to economic stability (Ghanem et al., 2023). Triki et al. (2023) estimate the development of digitization to determine the capacity of the Ha'il region to achieve sustainable development goals. The study adopted two stages of the methodology. In the first stage, the research was based on artificial intelligence by employing techniques related to machine learning. The second stage of the methodology includes the auto-regressive model and impulse response functions. The five objectives related to economic, social, and environmental aspects have been achieved through digitalization as indicated in the study results (Triki et al., 2023). Guang-Wen et al. (2023) examined the suitable development goals in the United States to be achieved by the end of 2030. BRICS nations have been adopted as case studies to examine financial development, economic growth, renewable energy use, and environmental pollution by the objectives of SDG8, SDG13, SDG10, and SDG7. The study estimates the interrelationships among these variables. The study employed econometric analysis to estimate the annual data from 1990 to 2020. The finding revealed a robust long-run relationship among the study variables (Guang-Wen et al., 2023).

Regarding the relationship between the degree of intersectoral linkages and economic growth, O'Callaghan & and Yue's study (2004) examined intersectoral linkages and their evolution in the Chinese economy through input-output analysis for the period 1987-1997. The study found that the degree of interdependence between economic sectors increases in parallel with economic growth rates, indicating a positive relationship between the degree of mutual dependence among sectors and growth rates in China. The results also pointed to leading sectors in the Chinese economy, including basic metal industries, construction materials, textiles, agriculture, and chemical industries.

Cai & Leung (2004) examined the impact of the agricultural sector on the growth of other economic sectors in Hawaii. They found a strong relationship between the agricultural sector and the services sector. The study concluded that promoting agricultural development in Hawaii significantly affects the other sectors of the economy.

Ansari's study (1992), indicated its analysis to reveal the relationship between the industrial sector and the service sector in Canada and found that the growth of the industrial sector leads to the growth of the service sector. The industry is considered a fundamental source of income growth. The study concluded that focusing on manufacturing as a tool to increase economic growth rates is a sound policy in the Canadian economy.

6. Hypotheses

To answer the main question of the study about the interrelationships between economic sectors (Manufacturing industries, non-manufacturing industries, agriculture, services) in the Kingdom of Saudi Arabia. Therefore, the study hypotheses are formulated as follows:

Hypothesis 1: There are statistically significant relationships between economic sectors in the Kingdom of Saudi Arabia. This hypothesis branches into several sub-hypotheses, including:

- There is a statistically significant relationship between the Manufacturing industries and other sectors (Services Sector, Agricultural Sector, and Non-Manufacturing industries).
- There is a statistically significant relationship between the Non-Manufacturing Industries Sector and other sectors (Manufacturing Industries Sector, Agricultural Sector, and Services Sector).
- There is a statistically significant relationship between the Agricultural Sector and other sectors (Manufacturing Industries Sector, Non-Manufacturing Industries Sector, and Services Sector).
- There is a statistically significant relationship between the Services Sector and other sectors (Manufacturing industries Sector, Non-Manufacturing industries Sector, and Agricultural Sector).

Hypothesis 2: There are statistically significant leading economic sectors capable of developing other sectors according to the programs of Saudi Arabia's Vision 2030.

7. The economic sectors in The Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia is moving towards achieving a high level of interconnection to ensure self-sufficiency in services and goods, reduce imports of consumer goods from abroad, and increase non-oil exports. This requires significant and fundamental changes in the sectoral composition and tangible increases in the contribution of non-oil sectors to the Gross Domestic Product (GDP), enabling promising core sectors, expanding investments, introducing new technologies, and improving the quality of services (Ministry of Economy and Planning, 2010).

The economic reality of Saudi Arabia can be explained sectorally based on Figure (1), which shows the contribution of major economic sectors to the GDP at constant prices (2010=100) in 1970 and 2020. It is observed that the contribution of the services sector to the real GDP has increased to approximately 44.62% in 2020, compared to 18.49% in 1970. This confirms the government's view of the services sector as a fundamental pillar in the post-oil economy. Also, the manufacturing industry considered one of the most important economic sectors for its effective role in economic development, has achieved an increase of 11.43% in 2020, compared to approximately 5.2% in 1970. Meanwhile, the contribution of the agricultural sector was about 2.38% in 2020, compared to 1.33% in 1970, indicating that the agricultural sector contributes the least to the real GDP, despite its historical significance and its role in providing raw materials for many manufacturing industries and ensuring food security by supplying food products to the population. As the growth of these sectors increases, there is a continuous decrease in the contribution of the mining and quarrying sector (including crude oil and natural gas), with its contribution declining from 73.2% in 1970 to 37.46% in 2020. This reflects the success of government reform policies aimed at reducing dependence on oil.

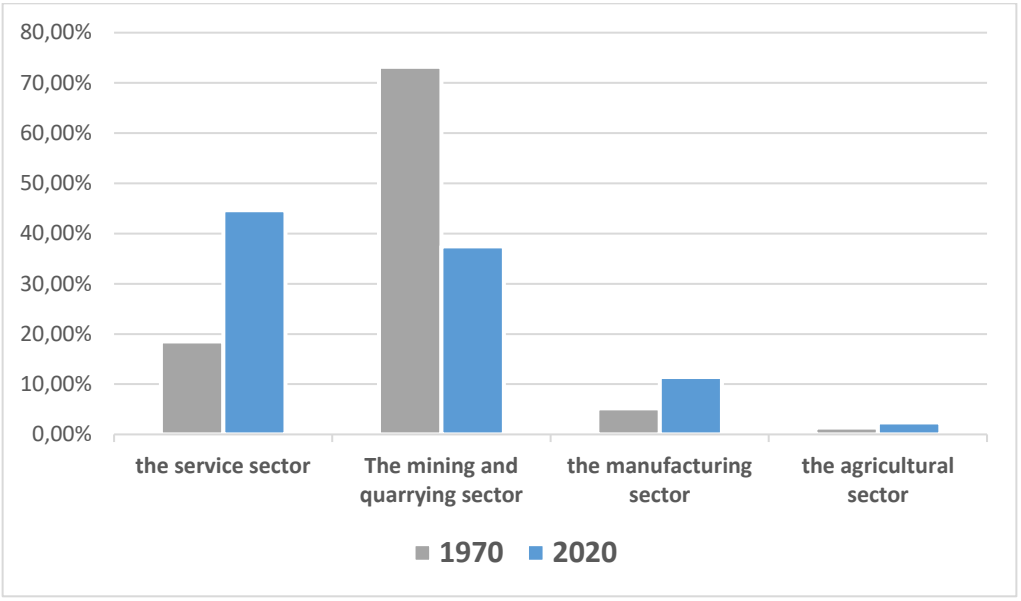

Figure 1: Contribution of Economic Sectors to Real Gross Domestic Product Source: Compiled by the researcher based on data from the General Authority for Statistics for the years 1970 and 2020.

It's worth mentioning that the interrelationships between economic sectors are among the prominent methods used in determining the leading sector in the economy, which is the focus of this study in selecting the leading sectors in the Saudi economy based on their interrelationships.

8. Interrelationships Between Economic Sectors and the Kingdom's Vision 2030

The concept of intersectoral relationships between economic sectors implies that the outputs of a specific economic sector are inputs for other economic sectors. The growth in the agricultural sector depends significantly on the industrial sector. The relationship between the two sectors is evident through the agriculture sector's need for fertilizers, animal feed, pesticides, packaging materials, energy sources, and other necessities produced in the manufacturing sector. Additionally, the agricultural sector indirectly depends on the extractive industries due to the demand for phosphates and potash needed for fertilizer production, demonstrating the mutual relationship between manufacturing and extractive industries. The growth in the industrial sector depends on the availability of agricultural raw materials for manufacturing and the increasing purchases of industrial goods by the agricultural sector, as the manufacturing sector requires agricultural products as inputs in food industries. The construction sector is also linked to the industrial sector through the need for essential materials like iron and cement. Furthermore, the services sector plays a vital role in providing all the essential services required by all sectors, including finance, transportation, wholesale and retail trade, and insurance services. Therefore, progress in a specific economic sector is necessary to

achieve progress and growth in other economic sectors (Trawneh, previous reference: 162).

Saudi Arabia has achieved numerous accomplishments in this direction by implementing a package of supportive and incentive programs to achieve the targets of Vision 2030. The agricultural sector has become a primary source of raw materials and production inputs for approximately 1000 specialized factories in the food and beverage industry, representing over 14% of the Kingdom's factories. It has also achieved high self-sufficiency ratios in several food products. For example, the self-sufficiency ratio for dates reached 116%, making Saudi Arabia one of the world's largest data exporters. Date exports reached about 200,000 tons in 2020, compared to approximately 108,000 tons in 2015, with a target of 400,000 tons in 2030. Moreover, the number of date factories has reached 157, which allows for increased investment opportunities in the manufacturing sector for medical, cosmetic, and food products, organic fertilizer production, and biofuel production using palm waste, as well as carbon production from date pits. The services sector provides financing loans and credit facilities and supports the establishment of logistic services projects through the Agricultural Development Fund (Ministry of Environment, Water, and Agriculture, 2020).

As part of the development steps undertaken by the Kingdom to enhance opportunities for interconnection between raw material production and local industries, the mining sector has succeeded in increasing its outputs and developing methods and techniques for processing raw materials, thus supporting the expansion of the manufacturing sector. Industries such as sand and gravel, cement, and bricks are among the largest promising industries that use primary mining materials and provide for the local market's requirements while exporting the surplus. A program was implemented targeting the local production of various construction materials as an alternative to imports. Additionally, several essential services were provided, including connecting mines to manufacturing sites and export outlets. Statistical, field, and marketing studies were conducted regarding the quantities of mineral resources and investment opportunities offered by the sector.

Moreover, the real estate sector has been a driver for the growth of over 120 economic activities. The development of the housing system and the creation of sustainable housing solutions according to the ambitious Vision 2030 have led to growth in the real estate, construction, and building sectors, creating over 39,000 direct job opportunities.

The energy sector also plays a significant role through its companies (Chemanol, Aramco, SABIC, Sadara, Sipchem), which provided the necessary support to the healthcare system during the COVID-19 pandemic by converting industrial ethanol into medical ethanol and supplying 11,500 tons of methanol to contribute to the production of medical sanitizers. Additionally, the localization of the medical supplies industry was achieved, producing over 10 million medical masks. (Vision of the Kingdom of Saudi Arabia, 2021).

9. Study Methodology

The study adopted a descriptive-analytical methodology, which presents the reality of economic sectors in the Kingdom of Saudi Arabia, their contribution to the real Gross Domestic Product (GDP), and the literature review related to the study. To estimate the size of interrelated relationships between economic sectors in the Kingdom of Saudi

Arabia during the period 1970-2020, the Vector Auto Regression (VAR) model and Impulse Response Functions were used. Time series data for the period 1970-2020 were derived from the open database of the World Bank for all study variables. Additionally, the Unit Root Test was conducted as it is the most effective tool to ensure that time series data are stationary at their levels or after differencing. The Augmented Dickey-Fuller (ADF) test and the test for detecting common integration among variables according to the Johansen methodology were also conducted, using the Max-Eigen Statistic and Trace Statistic.

The concept of the Vector Auto Regression model is that the same variable is both a dependent and an independent variable in the model. This means that all study variables were entered as independent variables and re-entered as dependent variables to measure the magnitude of the effects between each variable and the other variables. To ensure the statistical validity of the estimated model, several tests were relied upon, including the structural stability test (inverse roots of a characteristic polynomial), the Lagrange Multiplier test for Autocorrelation, and the Heteroskedasticity test for homoscedasticity.

10. Econometrics Model

10.1 Description of the Econometrics Model

To study the interrelationships between the economic sectors (the manufacturing industry sector, the non-manufacturing industry sector, the agricultural sector, and the services sector) in the Kingdom of Saudi Arabia, the vector autoregression (VAR) methodology was used after converting the economic variables to the logarithmic form. Accordingly, the study model can be described in a system consisting of the following mathematical equations:

$$lSER_t = \alpha_{10} + \sum_{i=1}^{l} \alpha_{11}\, lser_{t-i} + \sum_{i=1}^{l} \alpha_{12}\, lagr_{t-i} + \sum_{i=1}^{l} \alpha_{13}\, lmanuf_{t-i} + \sum_{i=1}^{l} \alpha_{14}\, lnon\_manuf_{t-i} + \varepsilon_{1t}$$

$$lAGR_t = \alpha_{20} + \sum_{i=1}^{l} \alpha_{21}\, lser_{t-i} + \sum_{i=1}^{l} \alpha_{22}\, lagr_{t-i} + \sum_{i=1}^{l} \alpha_{23}\, lmanuf_{t-i} + \sum_{i=1}^{l} \alpha_{24}\, lnon\_manuf_{t-i} + \varepsilon_{2t}$$

$$lMANUF_t = \alpha_{30} + \sum_{i=1}^{l} \alpha_{31}\, lser_{t-i} + \sum_{i=1}^{l} \alpha_{32}\, lagr_{t-i} + \sum_{i=1}^{l} \alpha_{33}\, lmanuf_{t-i} + \sum_{i=1}^{l} \alpha_{34}\, lnon\_manuf_{t-i} + \varepsilon_{3t}$$

$$lNON\_MANUF_t = \alpha_{40} + \sum_{i=1}^{l} \alpha_{41}\, lser_{t-i} + \sum_{i=1}^{l} \alpha_{42}\, lagr_{t-i} + \sum_{i=1}^{l} \alpha_{43}\, lmanuf_{t-i} + \sum_{i=1}^{l} \alpha_{44}\, lnon\_manuf_{t-i} + \varepsilon_{4t}$$

Whereas :
LSER: represents the natural logarithm of the value added of the services sector
LAGR: represents the natural logarithm of the value added to the agriculture sector
LMANUF: represents the natural logarithm of the value added to the manufacturing industry sector
LNON_MANUF: represents the natural logarithm of the value added of the non-manufacturing industry sector
($\alpha_{10} - \alpha_{40}$) : represents the fixed term vector in the mode
$(\alpha_{11\_}\alpha_{41})$: Vector of logarithm variable regression coefficients of the value added of the services sector
$(\alpha_{12} - \alpha_{42})$: Vector of logarithm variable regression coefficients of the value added of the agriculture sector
$(\alpha_{13} - \alpha_{43})$: Vector of logarithm variable regression coefficients of the value added of the manufacturing industry sector
$(\alpha_{14} - \alpha_{44})$: Vector of logarithm variable regression coefficients of the value added of the non-manufacturing industry sector
$(\varepsilon_{1t} - \varepsilon_{4t})$: random error vector for autoregressive vector model
(l) : represents the number of lag in the model
(t): represents the period

10.2 Estimation of the Econometrics model

To estimate the relationships between variables under study, it was necessary to conduct a test for the stability of time series data before estimating the model to avoid spurious estimates. This is because the stability of time series data is a fundamental condition for obtaining reliable results. Accordingly, the Augmented Dickey-Fuller (ADF) test was used to ensure the y nature and stability of the data. The results showed that the time series for the services and non-transformed industries sectors were stationary at the level, while the time series for the manufacturing and agricultural sectors became stationary at the first difference. These results show that services and non-transformed industries sectors share a long-run relationship with the GDP growth of Jordan; however, manufacturing and agricultural sectors share a short-term relationship with the GDP growth of Jordan.
Due to the non-similarity in the stability degree of the time series, it was not possible to perform the Johansen Cointegration test to detect long-term relationships between variables according to the Johansen method, which requires time series integration of the same order. Therefore, it is possible to rely on the Vector Auto Regression (VAR) method, which allows the use of stable time series when their integration orders differ. However, it

was necessary to determine the appropriate lag order for the model before estimating it. Therefore, several statistical indicators (LR, FBE, AIC, SC, HQ) were used, and all of them agreed that the optimal lag order for the model is three time periods, except for the SC criterion, which selected a lag of one period in the model.
In this context, the number indicated by most of the used indicators, which is three periods, was chosen, as shown in Table 1. Thus, the estimated model is as shown in Table 2.

Table 1: Determine the optimal lag degree for the Vector Autoregressive Model

Lag	LR	FPE	AIC	SC	HQ
0	NA	1.31E-05	0.109305	0.265239	0.168233
1	516.4392	1.56E-10	-11.23424	-10.45457*	-10.93960
2	32.08585	1.35E-10	-11.39029	-9.986888	-10.85994
3	55.68066*	5.57E-11*	-12.31450*	-10.28736	-11.54844*

Table 2: Estimation of the Vector Auto Regression Model

Variables		LMANUF	LNON_MANUF	LSER	LAGR
LMANUF(1)	Coef.	1.302032	0.374894	0.311571	0.566863
	P-value	0.0000	0.5152	0.0272	0.0141
LMANUF(2)	Coef.	-0.073183	-0.444701	-0.124431	-1.039291
	P-value	0.7887	0.5541	0.4958	0.0006
LMANUF(3)	Coef.	-0.143321	0.330117	0.024909	0.429472
	P-value	0.4106	0.4908	0.8305	0.0251
LNON_MANUF(1)	Coef.	-0.137358	0.757909	0.101557	-0.109314
	P-value	0.0249	0.0000	0.0133	0.1008
LNON_MANUF(2)	Coef.	0.212128	0.479079	-0.007340	-0.006525
	P-value	0.0384	0.0884	0.9140	0.9531
LNON_MANUF(3)	Coef.	-0.046547	-0.552905	-0.024802	-0.135594
	P-value	0.5570	0.0121	0.6397	0.1188
LSER (1)	Coef.	-0.605799	-1.196892	1.138014	-0.781993
	P-value	0.0302	0.1180	0.0000	0.0107
LSER (2)	Coef.	0.917670	2.138391	-0.485642	2.042956
	P-value	0.0236	0.0545	0.0721	0.0000
LSER (3)	Coef.	-0.435891	-1.123536	0.138123	-1.086036
	P-value	0.0383	0.0520	0.3232	0.0000
LAGR (1)	Coef.	0.066735	-0.379782	-0.050414	0.825428
	P-value	0.5179	0.1822	0.4652	0.0000
LAGR (2)	Coef.	-0.085924	0.317743	-0.068938	-0.308242
	P-value	0.4755	0.3379	0.3920	0.0202
LAGR (3)	Coef.	0.004661	0.002937	0.017778	0.399890
	P-value	0.9609	0.9910	0.7796	0.0002
C	Coef.	0.758345	8.387477	0.808620	5.352492
	P-value	0.4034	0.0010	0.1835	0.0000
R-squared		0.997356	0.868047	0.997970	0.995950
Adj. R-squared		0.996449	0.822806	0.997273	0.994562
Sum sq. resids		0.065468	0.495651	0.029268	0.078134
S.E. equation		0.043250	0.119002	0.028918	0.047248
F-statistic		1100.084	19.18719	1433.537	717.3161
Prob.(F-statistic)		0.0000	0.0000	0.0000	0.0000

Regarding the sector of non-manufacturing industries, the results of the F-test (F=1100) and the adjusted coefficient of determination, which reached 99%, indicate the statistical significance of the estimated model at a significance level of 0.05. Examining the significance of the coefficients reveals that the agricultural sector does not have statistical significance in terms of its impact on the value added to the non-manufacturing industries sector. However, the services sector shows statistically significant effects at the 5% level. Additionally, the non-manufacturing industries sector has statistically significant effects at the 5% level. This suggests that the manufacturing industries sector relies on the value added of the services sector and the non-manufacturing industries. Furthermore, the manufacturing industry sector is self-reliant in explaining its performance.

As for the non-manufacturing industries sector, the results indicate that other economic sectors do not have a significant impact on its value added at the 5% significance level. All calculated significance levels for the other sectors are above 0.05, suggesting that the value added in non-manufacturing industries does not depend on the value added of other sectors. However, the self-reliance of the non-manufacturing industries sector is evident as the source of significance in the model parameters, indicating that it is influenced by its past performance. The F-test value (F=19.18719) and the adjusted coefficient of determination (82%) also point to the statistical significance of the estimated model at a significance level of 0.05.

In the services sector, the results of the Vector Auto Regression model indicate that it is influenced by both the manufacturing and non-manufacturing industries sectors as there is statistical significance for both sectors at the 5% significance level, in addition to self-reliance in explaining its performance. However, the agricultural sector does not have statistical significance in terms of its impact on the value-added of the services sector. Overall, the estimated model is statistically significant at a 0.05 significance level, as indicated by the F-test value (F=1433.537) and the adjusted coefficient of determination (99%).

Finally, for the agricultural sector, the results show statistical significance of the estimated model at a significance level of 0.05, with an F-test value (F=717.3161) and an adjusted coefficient of determination of 99%. The significance of the model parameters indicates that there are statistically significant effects at the 5% level for the services and manufacturing industries sectors. This suggests that the agricultural sector depends on the value added by the services and manufacturing industries sectors, in addition to being self-reliant in explaining its performance. It is also evident that the non-manufacturing industries sector does not have statistical significance in terms of its impact on the value added to the agricultural sector.

10.3 Tests of the Econometrics Model Top of Form

10.3.1 Structural Stability Test (Test for Model Stability)

Figure (2) illustrates that the estimated model is stable, as all the roots lie inside the unit circle. This is further confirmed by the fact that all inverse roots have values less than one, as shown in Table 3. This implies that the model is structurally stable and meets the stability condition.

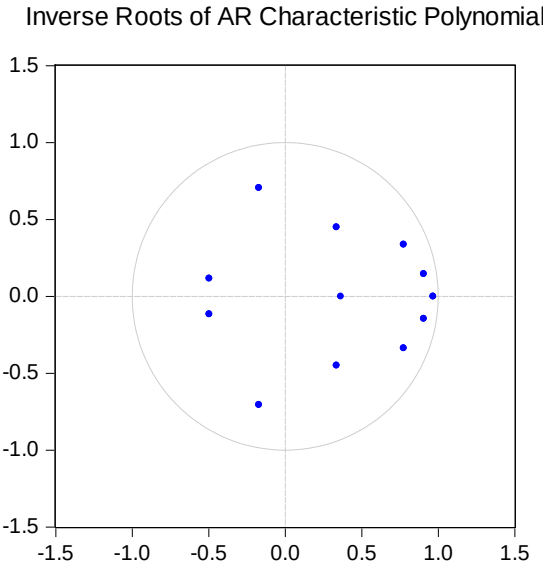

Figure 2: Structural Stability Test

Table 3: Structural Stability Test

Root	Modulus
0.967451	0.967451
0.905143 - 0.145853i	0.916819
0.905143 + 0.145853i	0.916819
0.773670 - 0.336433i	0.843654
0.773670 + 0.336433i	0.843654
-0.171543 - 0.705790i	0.726338
-0.171543 + 0.705790i	0.726338
0.335117 - 0.449093i	0.560346
0.335117 + 0.449093i	0.560346
-0.496191 - 0.116268i	0.509631
-0.496191 + 0.116268i	0.509631
0.363541	0.363541

10.3.2 Heteroskedasticity Test (Test for Variance Homogeneity)

From the results in Table 4, it is evident that there is no issue of heteroskedasticity, as the p-value equals 0.2732, which is greater than 0.05. This suggests the possibility of accepting the hypothesis of constant error variance in the estimated model, indicating that the random error variance in the model is stable.

Table 4: Result of the Heteroscedasticity Test

Chi-sq	df	Prob
477.8521	460	0.2732

10.3.3 LM (Test for Autocorrelation)

From Table 5, it is evident that the p-value is greater than 5% at lag 3, which means there is no significant autocorrelation. This indicates the acceptance of the null hypothesis, which states that there is no serial autocorrelation in the regression equation residuals. Moreover, this reaffirms the choice of lag 3 based on most of the previous statistical indicators.

Table 5: Results of the LM Autocorrelation Test

Lags	LM-Stat	Prop
1	33.94368	0.0055
2	39.27624	0.0010
3	25.94931	0.0547

10.4 Impulse Response Functions Analysis

Impulse response functions show the effect of a shock of one standard deviation to one of the variables on the current and future values of the model variables (Al-Hoshan, 2002: 26). Figure (3) below shows the immediate response functions for the various variables of the model, where the horizontal axis represents the time after the shock occurred (years), while the vertical axis measures the amount of the variable's response (%).

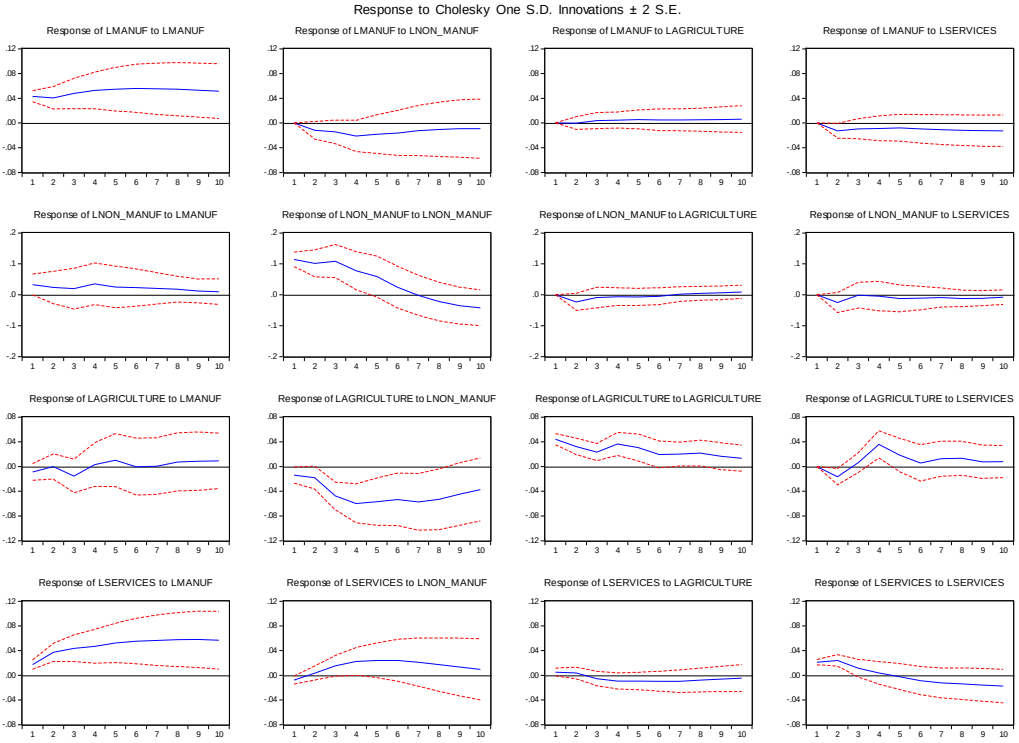

Figure 3: Impulse response functions of the autoregressive vector model for the sectors of the economy.

The results of the Impulse Response Function (IRF) for the manufacturing sector, as shown in Table 6, indicate that the response of the manufacturing sector to sudden changes in other economic sectors, with a one-standard-deviation shock, was very weak, not exceeding 2.5% either positively or negatively. It is observed that the maximum reaction in the manufacturing sector due to changes in other sectors was 2.1%, primarily influenced by the non-manufacturing industries sector, followed by the services sector at 1.2%.

Table 6: Response of the Manufacturing Sector to Shocks in Itself and Other Economic Sectors (periods)
Manufacturing Sector

Period	Manufacturing Industries Sector	Non-Manufacturing Industries Sector	Agriculture Sector	Services Sector
1	0.043250	0.000000	0.000000	0.000000
2	0.040661	-0.011939	-0.000186	-0.012787
3	0.047783	-0.014429	0.003819	-0.009462
4	0.052654	-0.021093	0.004717	-0.008777
5	0.054673	-0.018098	0.005603	-0.007895
6	0.056114	-0.016150	0.004960	-0.009535
7	0.055219	-0.012348	0.004999	-0.010822
8	0.054633	-0.010371	0.005179	-0.011871
9	0.053109	-0.009117	0.005666	-0.012450
10	0.051496	-0.009332	0.006277	-0.012597

From the results of the Impulse Response Function for the non-manufacturing industries sector, as shown in Table(7), we find that the response of the non-manufacturing industries sector to sudden changes in other economic sectors, with a one-standard-deviation shock, was also very weak, not exceeding 4% either positively or negatively. It is observed that the maximum reaction in the non-manufacturing industries sector due to changes in other sectors was 3.5%, primarily influenced by the manufacturing sector, followed by the services sector at 2.5%.

Table 7: Response of the Non-Manufacturing Industries Sector to Shocks in Itself and Other Economic Sectors

period	Manufacturing Industries Sector	Non-Manufacturing Industries Sector	Agriculture Sector	Services Sector
1	0.032828	0.114384	0.000000	0.000000
2	0.023594	0.101296	-0.023015	-0.025264
3	0.019680	0.108702	-0.009090	-0.001286
4	0.035303	0.077760	-0.006283	-0.004504
5	0.025028	0.058942	-0.007222	-0.012119
6	0.023044	0.024170	-0.004910	-0.010672
7	0.020545	-0.001934	0.001791	-0.008947
8	0.017970	-0.022111	0.004311	-0.011933
9	0.012288	-0.035367	0.006248	-0.011423
10	0.009922	-0.042348	0.009252	-0.007655

The results of the impulse response function for the services sector are shown in Table 8, we find that the response of the services sector to sudden changes of one standard deviation in other economic sectors was very weak, not exceeding 6%, whether positively or negatively. It is worth noting that the maximum reaction in the services sector due to changes in other sectors reached 5.8%, mainly due to the manufacturing sector, followed by the non-manufacturing sector with a rate of 2.4%.

Table 8: Services Sector Response to Shocks in the Same Sector and Other Economic Sectors

period	Manufacturing Industries Sector	Non-Manufacturing Industries Sector	Agriculture Sector	Services Sector
1	0.017421	-0.007767	0.005183	0.021108
2	0.037079	0.003482	0.003667	0.024021
3	0.043785	0.015331	-0.005429	0.011368
4	0.046760	0.022527	-0.009411	0.003708
5	0.052306	0.024162	-0.009449	-0.002203
6	0.055330	0.024153	-0.009794	-0.008791
7	0.056655	0.021200	-0.009632	-0.012445
8	0.057879	0.017168	-0.007848	-0.013817
9	0.058220	0.013328	-0.006086	-0.015800
10	0.056771	0.009404	-0.004612	-0.017581

From the results of the impulse response function for the agriculture sector shown in Table 9, we find that the response of the agriculture sector to sudden changes of one standard deviation in other economic sectors, as in the other sectors, had very weak effects.

Table 9: Agriculture Sector Response to Shocks in the Same Sector and Other Economic Sectors

Period	Manufacturing Sector	Non-Manufacturing Sector	Agriculture Sector	Services Sector
1	-0.008821	-0.013971	0.044265	0.000000
2	2.37E-05	-0.017962	0.032484	-0.016506
3	-0.015360	-0.047698	0.023301	0.006227
4	0.003024	-0.059687	0.036531	0.035719
5	0.010319	-0.056857	0.030740	0.018493
6	-0.000327	-0.053355	0.019466	0.005809
7	0.000699	-0.057349	0.020227	0.012611
8	0.007405	-0.053029	0.021675	0.013255
9	0.008614	-0.044605	0.016589	0.007536
10	0.009091	-0.037199	0.013310	0.007994

In Table 10 the F-ratio in the chow test suggests that there are no break points in the data for this reason we conclude that there is no significance in using two smaller regressions as compared to the original regression test.

Table 10: Model stability: Chow test (breakpoint 1995)

Chow Test Indicators	Values
F-statistic	0.527559
Log likelihood ratio	2.451113
Wald Statistic	2.110237
Prob. F(4,42)	0.7161
Prob. Chi-Square (4)	0.6534
Prob. Chi-Square (4)	0.7155

In Table 11 we observe the Robustness of the model. The VAR model is a case-sensitive model for this reason the robustness of the values has been tested. The R-square value is within the acceptance range which is 0.706. Moreover, the Akaike info criterion and Schwarz criterion give a robust value of 100.3155 and 114.8591 respectively with a significant probability (0.000000<0.05). Non-robust statistics evaluate the mean of the dependent variable to be 14.15095 which shows no impact of any robust value on the dependent variable in Table 11.

Table 11: Reliability of the VAR model (Robustness check)

Robustness check indicators	Values
R-squared	0.706275
Rw-squared	0.999678
Akaike info criterion	100.3155
Deviance	0.006325 Scale
Rn-squared statistic	125842.3
Adjusted R-squared	0.680166
Adjust Rw-squared	0.999678
Schwarz criterion	114.8591

scale	0.008147
Prob (Rn-squared stat.)	0.000000
Non-robust Statistics	Values
Mean dependent var	14.15095
S.E. of regression	0.042865
S.D. dependent var	0.384368
Sum squared resid	0.082684

11. Discussion

This study aimed to uncover the extent of interrelationships between economic sectors in the Kingdom of Saudi Arabia during the period 1970-2020. The study measured the interrelationships between the following sectors: Manufacturing industry Sector, Non-Manufacturing Industry Sector, Services Sector, and Agriculture Sector using the Vector Autoregressive (VAR) method and the statistical software E-Views.

Based on the theoretical foundation, the study emphasized the importance of interrelationships between economic sectors in enhancing economic growth rates, achieving economic development, and correcting structural imbalances in the economic system as a whole. It also showed that there is a close connection between economic diversification and the strength of the inter-relationships between the economic sectors that make up the national economy on the one hand and sustainable economic growth on the other hand. In this, the study agrees with the study of O'Callaghan & Yue (2004) and the study of Abdul Hamid (2018).

The study concluded that the mutual impacts between economic sectors in Saudi Arabia are limited and weak, indicating a low level of economic diversification. Therefore, the challenges of the rentier economy require significant efforts to enable the Saudi economic environment to reduce its dependence on oil, as highlighted by the study conducted by Alhowaish & AlShihri (2015), which emphasized the reliance of the manufacturing and service sectors on the oil sector. Additionally, Rabiaan and Banafaa (2019) noted that non-manufacturing industries continue to be the primary supporter of the Saudi economy. Hence, the success of economic diversification through strengthening the interconnections between economic sectors depends on the success of comprehensive reform policies pursued by the government.

The results of the estimated model indicated weak interrelationships among the studied variables as the impact of a sudden change in one of the sectors did not exceed one standard deviation and accounted for only 6% of the changes in the value added to the rest of the economic sectors. The weak connection between the manufacturing industry sector and other sectors was evident, as a one standard deviation change in the manufacturing sector explained no more than 5.8% of the changes in any of the other economic sectors. The other economic sectors did not explain more than 2.1% of the changes in the value added to the manufacturing sector. Even the impact on the agriculture sector was very weak, as a one standard deviation change in the agriculture sector explained no more than 0.62% of the changes in the manufacturing sector. The reason for the weak interrelationships between the agriculture and manufacturing sectors, which did not

exceed 2% in total, may be attributed to the Kingdom's heavy reliance on importing approximately 93% of its raw materials to meet its food needs.
The study also revealed a weak connection between the services sector and other economic sectors. A one standard deviation change in the services sector explained no more than 3.5% of the changes in any of the other economic sectors. Despite the services sector's contribution of 44.6% to the Saudi GDP, its effects are limited. The reason for the weak interrelationships between the services sector and other economic sectors is that a significant portion of the services sector's production is directed towards satisfying the final demand of individuals as the services sector encompasses various activities such as healthcare, education, hotels, financial services, and others. So, the portion directed toward other economic sectors is relatively limited.
Similarly, there was a weak connection between the non-manufacturing sector and the rest of the economic sectors. A one standard deviation changes in the non-manufacturing sector explained no more than 5.9% of the changes in any of the other economic sectors, and the other economic sectors explained no more than 4% of the changes in the value added to the non-manufacturing sector. The agricultural sector also exhibited weak connections, as a one standard deviation change in the agricultural sector explained no more than 0.97% of the changes in any of the other economic sectors, and the other economic sectors explained no more than 6% of the changes in the value added to the agricultural sector.

12. Conclusion

The study concludes that the weakness of mutual influences between sectors of the national economy reflects the weakness of the level of economic diversification in the Kingdom of Saudi Arabia, which confirms that diversifying the production base is long-term. process. Finally, the results found that there are no leading sectors that have a strong influence on the rest of the other economic sectors and are similarly affected by those sectors. The study recommends to enhancing the interrelationship between Saudi economic sectors by formulating developmental strategies that facilitate and deepen these relationships. Moreover, it is suggested to conduct more research on interrelationships between economic sectors, with a focus on comparing sectors to identify leading sectors that can enhance overall economic growth. The study has some limitations the study briefly mentions the impact of external shocks on the economy, particularly in relation to oil prices. Thus, the study recommends the future researchers to discussion over the potential external shocks and their implications on economic interrelationships.

13. Recommendations

Based on the findings, the study's recommendations are as follows:
Enhancing the interrelationship between Saudi economic sectors should be established for robust intersectoral relationships capable of generating economic value across various production sectors. Strengthening interconnections between economic sectors contributes to achieving economic self-reliance and creating diversified employment opportunities in line with sustainable economic development requirements. Focus on National Product

Development by enhancing national production and leveraging modern technological achievements to support the growth of production sectors, thereby stimulating the sustainability of economic development. Sustainable development leads to eco-friendly economic progress in the state. Economic development based on sustainable practices flourishes in each law, judiciary, and every segment of society. To achieve sustainable development goals related to poverty eradication, climate change mitigation, food security, income equality, and access to clean energy the results of the current study are highly beneficial. Further, it will lead to achieving the desirable status of net zero and green economy and will be highly beneficial in achieving the diversification of economy under the Vision 2030. Moreover, explores international successful experiences and best practices in building a diverse and sustainable economy.

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