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Key Sectors Driving Saudi Vision 2030 Diversification

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Abstract

Saudi Arabia's Vision 2030 is quite an important strategy to decrease the dependency on oil and build a more robust and more sustainable economy. This paper uses input-output analysis to map out the strength of some sectoral interactions and multiplier effects in order to figure out the economic value of key sectors. While employing backwards and forward linkages, the research explains the role that manufacturing, agriculture, tourism, technology, and renewable energy sectors have in growth, employment, and competitiveness. About the results, the manufacturing industry is identified as a crucial sector due to its high degree of interconnection with the rest of the economy, thereby enhancing diversification efforts. The agriculture sector, however, does exhibit strong backward linkages as it is a key supplier of many sectors, and tourism and entertainment sectors serve to strengthen forward linkages by encouraging such ancillary sectors as hotels and transport industries. The dominion of technology in society is highlighted as a driver of change that encourages economic growth and assists the Kingdom in its shift to the Industry era. In addition, renewable energy is compatible with sustainability objectives in the world as it creates significant positive impacts on the economy through investments targeting solar and wind energy. The paper emphasizes precision concerning policies aimed at promoting linkages between industries to engender balanced growth. By focusing on high-impact industries, Saudi Arabia will be able to fully meet the long-term goals embedded in Vision 2030. The evidence generated from the research brings us useful recommendations for Malaysia, in particular for policymakers and stakeholders dealing with resource allocation in striving for a sustainable, multifunctional economy.

Keywords: Key Sectors, Backlinkcoefficients, Saudi Arabian Economy, Economic Diversification, Vision 2030.

Introduction

Saudi Arabia has invested in diversifying the economy away from oil dependency towards a more diversified economy in the last few years. The Kingdom wants to see this economic transformation as part of a long-term strategy, Saudi Vision 2030, aimed at boosting new economic sectors and increasing the nation's competitiveness in the global economy as well (Arabia, 2016) There is also significant interest within the Kingdom's comprehensive economic restructuring in determining and nurturing sectors with potential for increasing economic performance (Algamdi, Brika, Musa, & Chergui, 2021; Beyers & A, 1976; Hewings, 1982; McGilvray & policy, 1977; Rao & Harmston, 1979).

The input-output table is a useful tool for this analysis because it shows how the different industries in the economy are connected and how products move between them. It shows how the inputs and outputs of one industry are used by the outputs of another (Hirschman, 1958;

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McGilvray & policy, 1977; Veselovsky, Gnezdova, Romanova, Kirova, & Idilov, 2015). Using input-output transactions, one can effectively look at, detail and quantify the relationships and the influence of each sector and their interrelationships, as well as their ability to propel the economy in the setting of the changing economy of Saudi Arabia. By using input-output transactions, it is possible to clearly see, describe, and measure how each sector affects the economy and how they work together, as well as how they can move the economy forward in Saudi Arabia's changing economy (W. Leontief, 1986).

The concept of input-output analysis, created by Wassily Leontief, allows policymakers and researchers to visualize the entire process of an economic cycle as networks of products and industries that are associated with one another (W. Leontief, 1986). Researchers can find new investment opportunities, figure out how different industries affect the growth of the economy, and see what roles different industries can play in implementing the strategy of diversification by using the input-output table.

This method has become more important in Saudi Arabia because the country is putting more effort into industries other than oil, such as technology, entertainment, tourism, and renewable energy (Callen, Cherif, Hasanov, Hegazy, & Khandelwal, 2014; Hvidt, 2013; Saxena & Science, 2017).

Finding high-potential sectors, figuring out their backward and forward linkages, and measuring their multiplier effects (Banerjee et al., 2016; Norbu, Tateno, & Bolesta, 2021) is possible with this analysis, which helps policymakers come up with ways to boost the economy and create jobs.

Traditionally, the oil sector has been the main contributor to the GDP of Saudi Arabia, a factor that has made the economy overly dependent on it. But as observed and shown by globalization, there has been a paradigm shift to this scenario due to changes in oil prices and the opportunities and threats that globalization presents in terms of resilience in a country's economic structure (Abid & Alotaibi, 2020). An input-output table can illustrate the benefits that certain industries have, particularly digital industries, which increase the demand for construction, services, and equipment in a number of other industries. To give an example, the forecast on renewable energy, such as wind and solar, has multiple effects, including but not limited to an increase in energy equipment production and even operational and maintenance services (Sweeney, Bessa, Browell, & Pinson, 2020). Thus, this logic illustrates the need to build a more diverse economy where different levels and forms of industry are emphasizing and equally supporting each other.

The tourism industry may be viewed as one more developed I think it does have the capacity to add substantial worth to the economy of Saudi Arabia. Considering Vision 2030, the Kingdom has been focusing much on improving their tourism potential in the form of cultural tourism, eco-tourism, and entertainment facilities. From an input-output point of view, tourism can also boost related industries like transportation, hospitality, and retail (Raifu, Afolabi, & Salihu, 2024). This creates a multiplier effect that spreads throughout the economy. In the same manner, the area of entertainment has also been regarded as having growth potential, with new constructions in cinemas, theme parks, and sporting events creating a pull in the construction, media, and service industries. These sectors, along with relevant policy measures, help demonstrate how the input-output model can help understand the potential economic impact and help focus investments strategically (Arabia, 2016).

Another field worth looking into is the technology industry. It is the industry that received the

most funding from the government with the goal of having Saudi Arabia at the forefront of digitalization and innovative solutions.

When new industries emerge that are technology-based, secondary industries such as telecommunications, education, and finance do not remain unaffected. Input-output analysis has shown that the technology sector and how it affects national competitiveness are two areas that help other industries become more productive. Furthermore, the shift to Industry 4.0 around the globe implies the Kingdom's priorities in the economy will focus on artificial intelligence, robotics, and data-driven services, which is very helpful for expanding economic structure and increasing employment (Raifu et al., 2024). Furthermore, it is obvious that renewable energy is also very promising since it is in line with the sustainability goals of the world, and it also helps the kingdom reduce its dependency on oil revenues, thus increasing the chances of healthy economic stability in the future.

As such, the input-output analysis seeks to quantify the degree to which the different sectors are integrated so that resources may be utilized efficiently. For example, the expanding education sector directly contributes to the Kingdom's economy because it prepares citizens with appropriate skills necessary for the new economy. It is ensured through training programs in renewable energy, technology, and tourism activities that these sectors will be able to thrive and thereby participate in the economy's growth. Azad (2023) says that the forward and backward links shown in the input-output sections can also draw attention to sectors that not only bring in money but also strengthen the national economy by creating high-level jobs, raising productivity, and encouraging self-sustaining growth.

Finally, the input-output table can be effectively used in determining and developing target sectors within the economy of Saudi Arabia, particularly in this specific case, where the focus is on the Saudi Arabian tourism sector. The country can move forward with its diversification plans that are in line with Vision 2030 goals if it knows how the tourism, entertainment, technology, and renewable energy sectors all affect each other and how they affect the economy. Such a framework is instrumental not only in the designing of policies but also in showing how Saudi Arabia can position herself in the world economy after transitioning out of the usual petro-based economy. With this conjunctive perception of sector connectivity, Saudi Arabia can lay the foundations for a diverse and sustainable economy in the years to come (Arabia, 2016).

This paper explores the different sectoral contributions to the overall economic structure of Saudi Arabia under Vision 2030 by using input-output analysis in a new way. The methodological approach relies on backward and forward linkages, crucial metrics derived from the renowned works of Hirschman (1958) and Rasmussen (1956). These indicators let you look at the economy across many sectors in great detail. This lets you find the key areas that are causing growth poles and structural transformation. In contrast to earlier research that focused on broad sectors, this study uses advanced input-output modeling to look into the connections between sectors in a more quantitative way within the Saudi Vision 2030 framework. The new approach of analyzing additional indicators focuses on backward and forward linkages. A different perspective on how to assess a sector's impact on another and its spatial sensitivity to other sectors and the economy. Such a focused approach makes for an important advancement in the literature, enabling policymakers to clearly allocate resources based on empirical evidence.

The indicators of backward and forward linkages are useful for economies such as Saudi Arabia, which are in the process of shifting from being resource-based to more diversified economies. To put it another way, backward linkages measure how dependent a sector is on inputs that come

from other sectors and industries. This could help the country's economy grow in a vertical direction. Forward linkages test a sector's ability to make goods that will be used by other sectors or island economies. They do this by focusing on the growth that could happen at each level after the initial one. With the help of these indicators, the analysis pinpoints the key economic sectors that support the Vision 2030 ethos, such as manufacturing and tourism, technology, and renewable energy.

Wassily Leontief's input-output model perceives the economy as one big system with industries interconnected and dependent upon each other to survive. Backward and forward linkages are able to provide estimates of direct and indirect hatchings between sectors, making them important aspects of comprehending the economy. For instance, the enormous forward linkages in maturing indicate the sector's heavy dependence on goods from a variety of industries, stimulating demand throughout the supply chain. Likewise, high forward linkages in tourism more robustly affect the hospitality, retail, and transport industries.

This paper fills the gap in existing literature in the following ways:

- a) This paper provides quantitative analysis to assess the interrelationships between sectors of an economy undergoing transformation, particularly Saudi Arabia.
- b) Recognizing key industries that have strong effects and can serve as good direction for the policy-making process.
- c) Demonstrating the effective use of input-output analysis to steer strategies for economic diversification.
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Economists in other shifting economies can use the results as a methodological framework to assess and select industries and sectors within the economy based on specific inter-industry relations and capacity.

Table 1 and Appendix 1 (Table 5) provides a clear numerical representation of the oil sector's dominance in the economy while also including general trends that may highlight diversification efforts:

Category	Key Insights (2020–2024)
Vision 2030 Goals	Focus on reducing oil dependence and fostering growth in non-oil sectors like tourism, technology, real estate, and renewable energy.
Non-Oil Sector Growth	Non-oil GDP grew by 4.33% in 2020, driven by private sector activity. The non-oil economy is projected to maintain steady growth through 2024.
Oil Sector Decline	Oil sector output dropped by 6.43% in 2020. This decline highlights the importance of diversification in maintaining economic resilience.

Tourism Industry	Tourism's GDP contribution aims to increase from 3% to 10% by 2030 . Major projects like the Red Sea Project to contribute \$5.86 billion annually post-completion.
Real Estate Expansion	Government targets increasing homeownership to 70% by 2030 , supported by initiatives like Sakani, delivering 19,500 residential units .
Entertainment Growth	Entertainment sector to generate \$20 billion by 2030, creating 30,000 direct jobs and 100,000 indirect jobs .
Renewable Energy	Commitment to sustainability with investments in solar and wind projects, achieving 100% carbon neutrality and reducing oil dependency.
Public Investment Fund	Strategic investments in six key sectors, including NEOM (\$500 billion) and international investments accounting for 15% of assets by 2024 .
Fiscal Reforms	Introduction of VAT and restrained spending to balance the budget by 2023 , amid low oil prices.
Private Sector Role	Shift towards a market-based economy, enhancing private sector participation and SME development to generate jobs and stimulate growth.

Table1: Key Insights into Saudi Arabia's Economic Diversification (2020–2024)

This table highlights Saudi Arabia's progress and strategic focus on non-oil sector development under Vision 2030, with key data and targets between 2020 and 2024.

Literature Review

All countries plan to diversify their economies to reduce financial shocks (Guendouz, Ouassaf, & Journal, 2020; Hilmi, Farahmand, & Belaid, 2020; Samargandi, A. Alghfais, & AlHuthail, 2022). For many years, economists have used the input-output (IO) analysis method to look at the relationships between different economic sectors and to find out how different sectors affect the overall growth of the economy. The method was incepted by Wassily Wassily Leontief came up with the idea and his I-O tables have helped policymakers figure out how changes in one sector affect other sectors. They also made it clear how sectors in economies are connected (W. Leontief, 1986). This practice gained traction in Arabia due to the transition of the country towards a diversified economy in the Vision 2030 strategy. This practice gained traction in Saudi Arabia due to the country's transition to a diversified economy in the Vision 2030 strategy. Both researchers and policymakers have adopted input-output models to evaluate the potential of emerging sectors like tourism, renewable energy, technology, and entertainment to reduce oil dependency and thereby enhance economic strength (Arabia, 2016). IO analysis can help find

forward and backward linkages, sector multipliers, and capture multiplier effects. It can also help find the best way to allocate resources so that they help the economy reach its long-term goals (Brika, Adli, & Chergui, 2021; Norbu et al., 2021).

One sector that has received considerable attention in the literature is renewable energy. Considering the global trends towards sustainability as well as the need to curb climate change, renewable energy is regarded as a key area in economic diversification for Saudi Arabia and regions within it.

According to Rahman et al. (2021), utilizing renewable sources of energy prevents emissions of greenhouse gases, and at the same time, it develops local economies by creating job opportunities and establishing demand for complementary industries such as manufacturing, construction, and services. Employment analysis has been very helpful in thinking about these benefits, which include investments in wind and solar energy. Projects like these have a multiplier effect that makes people more likely to offer specialized engineering and equipment-making services in the future. Smith's study also says that using solar and wind power is a way to diversify that has strong backward links to the technology and manufacturing sectors. This is important for achieving the sustainability vision set out in Vision 2030 (Moshashai, Leber, & Savage, 2020).

Sightseeing has emerged as another sector that has high potential under Vision 2030. Samargandi et al. (2022) established the point that tourism can generate manifold economic returns through employment creation, foreign capital inflow, or through local expenditures on lodging, transportation, and cultural services. The authors stress that the I-O analysis of the tourism sector is particularly important, as it has substantial forward linkages to the retail, hospitality, and transportation industries. Such a linkage effect shows that a country's investment in tourism will create development and general expansion of other sectors of the economy, which contribute to the growth of the economy and the region. In addition, I-O analysis contributes to an accurate assessment of different economic impacts of mega-events or large-scale projects such as NEOM and Al-Ula, which are aimed at making Saudi Arabia one of the top tourist destinations.

According to literature, the technology sector is also considered the area that shows the most promise for diversification, particularly in respect of the Fourth Industrial Revolution.

Alqublan (2021) talks about how technology affects the economy in this way: the progress made in artificial intelligence, robotics, and digital networks will make many industries more productive, including finance, telecommunications, healthcare, and many more. With the help of I-O analysis, it was possible to answer how investments in technology result in positive spillovers, for example, increased productivity in other industries and a greater variety in skill requirements in the workforce. The research of Khateeb emphasizes the existence of strong backward linkages in the technology sector; in other words, the investments in digital transformation and innovation activities do not only benefit the technology industry per se but also have multiplier effects on the economy at large.

Vision 2030 earmarks the entertainment sector as having economic benefits. The forward linkages of this sector are emphasized by input-output analysis. These include the tourist and retail linkages, which show that entertainment leads to consumption and encourages economic activities. Grand and Wolff (2022) observe that the growth of this sector also advances KSA's foreign policy objectives as it boosts the country's attractiveness and its prominence

internationally. According to their research, even new investments in the entertainment industry had big positive effects, like creating jobs, encouraging social interaction, or attracting investments from other countries. These effects are all cost-effective and in line with the KSA's long-term goals.

Additionally, the educational sphere is in demand because it is increasingly becoming the backbone of the new economic sectors that are emerging in Saudi Arabia. As Azad (2023) puts it, education and training are some of the prerequisites to establishing the workforce necessary for the development of the technological, renewable energy, and tourism sectors. The author uses input-output analysis to show that education creates strong backward links by investing in areas like technology and services to meet demand. The educational sector does not only directly impact the economy through employment creation opportunities but also indirectly by preparing the human capital to be able to operate in a multipolar economic environment.

In addition, the evidence suggests that the input-output analysis method can be used correctly for evaluation and can also help the Saudi Arabian economy become more diverse in certain areas. Each of these sectors—renewable energy, tourism and hospitality, technology, entertainment, and education—has its own linkages and multiplier effects, which enhance the robustness and competitiveness of the Kingdom's economy. We can guide decisions on resource allocation and achieve optimal returns by understanding how these sectors relate to each other. The input-output model sheds light on Vision 2030 with regards to the resource allocation for the strategic sectors instead of catering to those that will foster growth but have little implications for the Kingdom's stature globally (Arabia, 2016).

DATA

Consequently, key sectors with significant economic impacts typically show broadly distributed, above-average forward and backward linkages across the economy. Rueda-Cantuche, Neuwahl, and Delgado (2009) suggest a suitable approach in analyzing these results when using the main sectoral analysis (Table 3). The industries in the upper left corner of Table 3 have strong backward and forward spillovers across the economy. As we move down the table, the sectors' backward linkage effects become less strong, and the sectors at the very bottom have almost no overall backward linkage effects on other economic areas. Now if we go across to the right of the table, we see forward linkage impacts becoming progressively scarce until we reach the sectors with the least to no forward linkage impacts.

These categories help separate the sectors based on how they affect things through links and diffusion, as well as whether they have below- or above-average levels of connectivity. Tellingly, high-linkage sectors do exist but only have a weak impact in highly export-oriented economies, and, for example, in Saudi Arabia, a number of these linkages may be to external rather than local businesses. Though these linkages are apparently many in number, these sectors will have only a limited impact on the domestic economy when compared to other economies that are less export-reliant.

The data are included in the median consumption matrix and GDP column for 19 key sectors in Saudi Arabia in 2021, which we obtained from the general authority for statistics.

Availability Statement

Publicly available datasets were analyzed in this study. This data can be found at : <https://www.stats.gov.sa/en/1158> (13/02/2024)

Variable	Description (Unit : Million Saudi Riyals)
Sectors	The economic activity or industry being analyzed (e.g., agriculture, manufacturing, etc.).
Total Intermediate Consumption	The total value of goods and services consumed as inputs in the production process within the sector.
Households Final Consumption Expenditures	The value of goods and services purchased by households for personal use.
Government Final Consumption Expenditures	The value of goods and services consumed by the government for public services.
Final Consumption Expenditures	The sum of household and government expenditures on goods and services.
Total Export	The value of goods and services sold by the sector to other countries.
Final Demand	The total demand for goods and services produced by the sector, including domestic consumption and exports.
Total Imports	The value of goods and services brought into the country to support the sector's production and consumption.
Total Output	The total value of goods and services produced by the sector, including intermediate and final outputs.

Table 2. Study Variables

Source : Input-Output Databas

Table 2 shows a complete way to figure out how different parts of the economy affect the whole by listing important numbers like total output, final demand, and intermediate consumption. Total intermediate consumption shows how dependent the sector is on other sectors within the same industry. This makes the sector the one that could help the upstream industries grow. Exogenous demand, such as household and government consumption, is called final consumption expenditure: an indicator of economic health. Total sales to other countries and total consumption of inputs from other countries are used to determine how competitive the country's economy is and how much dependency exists on external sources. A high final demand as well as final output indicates the key role the sector plays in the economy. These variables are important because they help us understand how the economy is doing at the country level by giving us more details about the structure of the economy, how different parts of the economy are connected, and where there are chances for growth in each. This information is then used to make policies and decisions about investments.

Methodology

Based on the work of Rasmussen (Rasmussen, 1956) and Hirschmann (Hirschman, 1958), the key sectors are found by measuring the back and forward linkages. They focus on Leontief's inverse feedback.

Authors such as Augustinovics (1970); Laumas (1976); Lenzen and Dynamics (2003), have made significant contributions to this field. The standard Leontief inverse (W. W. Leontief, 1951) can specify backlinks using the table of inputs and outputs. While forward links can be

specified using the inverse of Hubbell (1965) or, alternatively, also using the Leontief inverse, there is some debate among practitioners about which approach should be used for forward linkages (Oosterhaven, 2012). We follow the approach of the famous Leontief (W. W. Leontief, 1951) I/O, which has the following mathematical form:

$$x = Ax + f \quad (\text{Vision 2030})$$

where x is the vector of gross output, f is the vector of final demand, $A = (a_{ij})$ is the matrix of direct inputs a_{ij} into the set of n production sectors, with properties:

$$\begin{aligned} a_{ij} &\geq 0, \quad i, j = 1, 2, \dots, n \\ \sum_{i=1}^n a_{ij} &> 0, \quad j = 1, 2, \dots, n \end{aligned} \quad (\text{Vision 2030})$$

The equivalent form of the Leontief model is:

$$x = (I - A)^{-1} f = Bf \quad (\text{Vision 2030})$$

Where: I is the identity (unit) matrix, and the matrix $B = (I - A)^{-1} = [b_{ij}]$ is the Leontief inverse matrix see, (Jensen, Hewings, & A, 1985; W. W. Leontief, 1951; Miller, Silverman, Hoover, & Blair, 1986).

In the Leontief inverse matrix, each sector directly and indirectly linked with all other sectors. For each sector i , these linkages divided into two different types: *backward linkages* describing the direct and indirect economic inputs of other sectors into sector i , and *forward linkages* describing the direct and indirect economic inputs of sector i into all other sectors. The backward linkages of sector i are associated with the column i and its forward linkages are associated with the row i of the Leontief inverse. The notion of backward and forward linkages and the corresponding concept of *key sectors* are associated with the work of both Rasmussen (1956) and Hirschman (1958). The major thrust of this economic concept has been towards identifying sectors whose linkages are such that they create an above-average impact on the rest of the economy.

Rasmussen (1956) proposed two types of indices :

1. Power of dispersion for the backward linkages:

$$BL_j = \frac{1}{n} \sum_{i=1}^n b_{ij} / \frac{1}{n^2} \sum_{i,j=1}^n b_{ij} = n B_{\bullet j} / V \quad (4)$$

where $B_{\bullet j} = \sum_{i=1}^n b_{ij}$ is the column multiplier of the sector j

2. Sensitivity of dispersion for forwarding linkages:

$$FL_i = \frac{1}{n} \sum_{j=1}^n b_{ij} / \frac{1}{n^2} \sum_{i,j=1}^n b_{ij} = n B_{i\bullet} / V \quad (5)$$

where V is the intensity (*the volume*) of the Leontief inverse B :

$V = \sum_{i,j} b_{ij}$ and $B_{i\bullet} = \sum_{j=1}^n b_{ij}$ is the row multiplier of the sector i . Moreover, all backward linkages and the sum of all forward linkages are equal to n , and the average linkage is equal to 1.

The usual interpretation is that the Hirschman-Rasmussen backward linkage index $BL_j > 1$ indicates that the corresponding column multiplier $B_{\bullet j}$ is larger than the average column multiplier.

Therefore, a unit change in final demand in sector j will create an above-average increase in the economy. Similarly, for the forward linkage index $FL_i > 1$, the corresponding row multiplier FL_i is larger than the average row multiplier. Thus, a unit change in all sectors' final demand (including sector i) would create an above-average increase in sector i .

Using these hierarchies of backward and forward linkages, we can divide sectors into four groups:

Sector i is considered a *key sector* if $BL_i > 1$ and $FL_i > 1$;

Sector i is considered as a *backward linkages oriented sector* if $BL_i > 1$ and $FL_i < 1$;

Sector i is defined as a *forward linkages oriented sector* if $BL_i < 1$ and $FL_i > 1$;

Sector i with both backward and forward linkages less than one, is considered a *weakly linkages oriented sector*.

A graphical illustration of the above concepts can be suggested, where each sector i is represented by the point I , with coordinates (BL_i, FL_i) .

Statistical Analysis

The study used relevant economic indicators data and in-depth statistical analysis to find out how different sectors contribute to economic diversification in line with Saudi Arabia's Vision 2030.

The study used input-output modeling to look at the connections between sectors, technical efficiency, multiplier effects, and forward and backward links. In Table 6 (Appendix 2), the descriptive statistics for intermediate consumption, final demand, and total output show the average and the range of values across the sectors. Linkage indices shown in Tables 7a and 7b (Appendix 3) also show how strong backward and forward links are and how important the manufacturing, tourism, and technology sectors are.

Additionally, the authors attempt to expand employment opportunities by estimating regional and sectoral multipliers. We found the most influential multipliers for the key sectors in Lithuania's economy in Tables 8a and 8b (Appendix 4). The research shows that manufacturing has the highest sobber multiplier and improves activities both upstream and downstream. Tourism and tunnels are next in line within the renewable energy economy. This kind of information supports investment policies that focus on industries with strong linkage and multiplication effects. These policies are in line with Vision 2030's goals for diversification. The results show how important each sector is on its own, but they don't show how these sectors are connected and work together to create value. This shows a gap in the study of sectoral linkages that needs to be filled.

Results

Table 3 gives a bigger picture of how Saudi Arabia's total productive activities are structured. It also gives each sector a weighted rating based on how important it is right now. Mining, beverage, food, and government services prove to be the most integral parts of Saudi Arabia's economic infrastructure. The GDP of these sectors is considerable, and their impact is high in terms of employment and earnings. For instance, agriculture and government services function as important providers of earnings and employment to firms around the Kingdom. There are resources that enable Linestaff to specialize in many employment opportunities, including farming. Additionally, the commercial agricultural sector, particularly the livestock industries, proves to be equally demanding, especially for rural dwellers.

Sectors	Backwards - linkage	Forward-linkage
S1-Agriculture, forestry and fishing	1.04	1.05
S2-Mining and quarrying	0.70	1.49
S3-Manufacturing	1.14	3.27
S4-Electricity, gas, steam and air conditioning supply	1.13	0.89
S5-Water supply; sewerage, waste management and remediation activities	1.24	0.59
S6-Construction	1.24	0.83
S7-Wholesale and retail trade; repair of motor vehicles and motorcycles	1.22	1.88
S8-Transportation and storage	1.08	1.03
S9-Accommodation and food service activities	1.15	0.69
S10-Information and communication	1.06	1.01
S11-Financial and insurance activities	0.67	0.79
S12-Real estate activities	0.68	0.75
S13-Professional, scientific and technical activities	1.08	0.71
S14-Administrative and support service activities	1.06	0.86
S15-Public administration and defense; compulsory social security	0.88	0.63
S16-Education	0.69	0.61
S17-Human health and social work activities	0.93	0.60

S18-Arts, entertainment and recreation	1.20	0.66
S19-Other service activities	0.82	0.67

Table 3. Hirschman/Rasmussen Backward and Forward Linkages for the Arabia Saudi Atsector 2021

The results show how important each sector is on its own, but they don't show how these sectors are connected and work together to create value. This shows a gap in the study of sectoral linkages that needs to be filled.

Various firms depend on revenue generation and employment, within which total work income is proportionately large from mining and agriculture; government services are also significant contributors. At the same time, commercial agriculture, especially livestock production and sale, becomes an important sector in employment within the Saudi economy. These findings serve to substantiate not only the peculiarity of the aforementioned sectors but also their interrelation and interdependence at the global economic level.

Backward and forward linkages for 19 economic sectors in Saudi Arabia are accounted for in Table 3; great differences can be noticed among the sectors. They are regarded as leading sectors—those whose both backward and forward linkage values exceed 1 because they dominate both the supply and demand sides of the economy. A sector is regarded as forward-oriented where the forward linkage coefficient is over 1, implying that the blue line in Figure 2 goes beyond the unit circle. Likewise, such a sector, which in picture 2 has a backward linkage value of over 1, is said to be backward-oriented; in this case, it is the brown line that moves out of the unit circle. Lastly, the fourth group includes sectors that aren't well connected—their forward and backward linkage coefficients are both less than 1. This means that these sectors don't do much to connect with other sectors to get economic activities going. These classifications assist greatly in providing a lesser abstraction of what every sector should contribute and its impact within the Saudi economy as a whole.

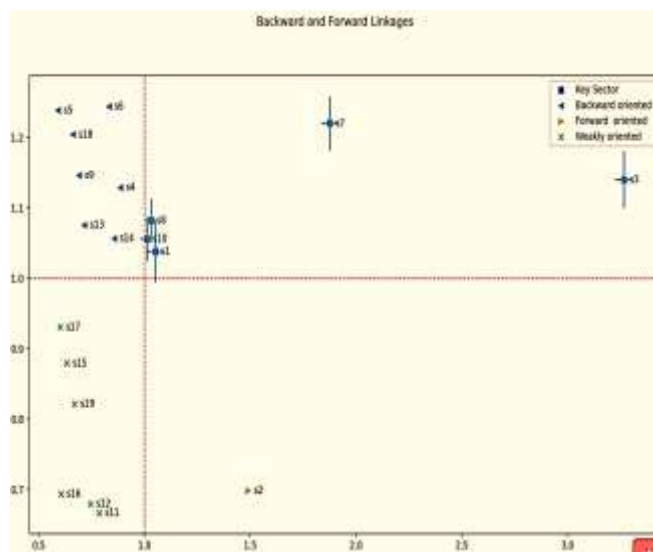


Fig. 1. Key sector for Saudi Arabia 2021

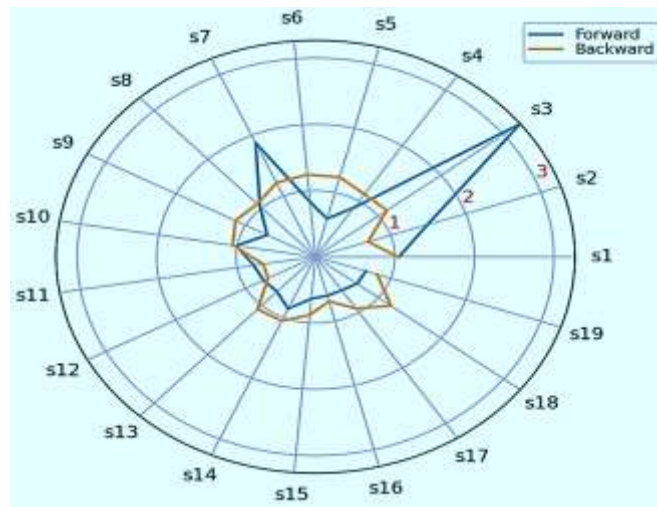


Fig. 2. Hirschman/Rasmussen Backward and Forward Linkages for the Arabiasaudi sector 2021

The results of the study can be better illustrated using the diffusion figure (Vision 2030), and we found that the leading sectors are represented by:

S1: Agriculture, forestry and fishing.

S3: Manufacturing.

S7 : Wholesale and retail trade; repair of motor vehicles and motorcycles

S8: Transportation and storage

S10 : Information and communication

Unweighted analysis, which demonstrates the influence of slight improvements in sectors on the economy as a whole, provides a more complicated view (Fig, 2).

If the two values of the forward linkages index for two different sectors are the same, then the sector with the lowest coefficient of variation gets priority. This means that the sector gives its outputs to a lot of different sectors in a fairly equal way to meet a one-unit increase in final demand. On the other hand, a sector with a high coefficient of variation only gives its outputs to a few sectors. Likewise, if the two values of the backward linkages index for two different sectors are equal, the priority for the sector that has the larger value of the coefficient of variation, which means that the sector buys its inputs from a large number of sectors, i.e. t, he total impact of the withdrawal is dispersed relatively evenly over a large number of sectors

Table 4 shows the forward and backward coefficients of variation for four key sectors in Saudi Arabia. The results of the table show that the best sector among the four key sectors is S3, followed by S1, then S7, and finally S10 and S8.

Sector	Backward coefficient of variation	Forward coefficient of variation
S1: Agriculture, forestry and fishing.	0.07966	0.08801

S3: Manufacturing.	0.08323	0.08037
S7 : Wholesale and retail trade; repair of motor vehicles and motorcycles	0.07815	0.07675
S8: Transportation and storage	0.05843	0.06034
S10 : Information and communication	0.06321	0.062866

Table 4. Forward And Backward Coefficient of Variation For 5 Key Sectors

The backward and forward linkages of the five key sectors in Saudi Arabia, as highlighted in Table 4, yield the respective links to the national economy. Out of the three sectoral indices of linkage, the manufacturing sector (S3) is rated the highest in both forward and backward linkages at 0.08037 and 0.08323 variances, respectively. This emphasizes the fact that the sector has a strategic vertical position in the economy on both the supply side and the demand side, which makes it one of the focal sectors of economic diversification. Agriculture, forestry, and fishing (S1) occupy the second position, and they have a wider reach as providers of inputs for other sectors, even if they may rank lower than manufacturing in terms of reach. Wholesale and retail trade (S7), transportation and storage (S8), and information and communication (S10) have low linkages, and this is evidence of their primary roles in facilitating other sectors of the economy.

The varying values in coefficients with regards to the different sectors of the economy help to appreciate the unique contributions made by these industries. The strong linkage coefficients obtained show that manufacturing has two functions: it is always in need of other inputs, while value added from other activities is provided and hence plays an integral part in the diversification strategy of the Kingdom of Saudi Arabia. As for transportation and storage (S8) as well as information and communication (S10), their scores are slightly lower, but their importance is high for integration and productivity across all sectors of the economy. With these conclusions in mind, smart investments in sectors with lots of connections can boost the economy and lead to faster growth. Pay special attention to the manufacturing of high technology and the services that go along with it.

Table 4 provides useful directions for decision-makers in focusing on the sectors that bear strong linkage effects. The first position of the manufacturing sector emphasizes the relevance of investment in industry innovation and capacity building toward its development. For agriculture (S1), such measures as providing more emphasis on value addition and improving the efficiency of the supply chain would enhance its linkages. Also, improving infrastructure and understanding how to use technology can help make the connections between sectors that aren't doing too well, like transportation and information better. This enables Saudi Arabia to adopt a comprehensive but selective approach to sectoral development as suggested by Vision 2030—a structural transformation of the economy toward one that is sustainable, diverse, and resilient.

Inter-Sectoral Linkages in Saudi Arabia's Economy:

The Hirschman/Rasmussen backward and forward linkages reveal substantial interdependence among Saudi Arabia's key economic sectors. These linkages describe the relations various industries have in terms of relations with other industries, be it backward linkages where an industry relies on other industries that provide goods or forward linkages where it supplies goods

to other industries.

According to the five key sectors that have been analyzed, the manufacturing industry (S3) has the highest calculated values, which are 0.08323 for backward linkage and 0.08037 for forward linkages. This makes it one of the pillars of Saudi Arabia's diversification strategy, as outlined in Vision 2030. The sector's backward linkage means that it buys raw materials from the mining sector (S2), and its forward linkage shows how important it is for transporting or selling finished goods to wholesale and retail trade (S7). The way the Kingdom's manufacturing industry works with other areas shows that investing in it leads to growth in other areas, which in turn boosts trade in goods and materials, solidifying its place in the Kingdom's economy.

Agriculture, forestry, and fishing (S1) are ranked second, but their backward (1.04) and... T... This only serves to indicate that the activity in question is essential as a supplier of primary goods and for meeting consumption purposes. Certainly, with the same preeminence that manufacturing holds over the economy, agriculture does not enjoy it, though the benefits to rural employment and food security are considerable. In addition, there remains scope for growth in the sector in areas such as supply chains and value-adding activities, which can enhance its degree of integration and sustainability.

With a linkage ratio of 1.49, mining and quarrying (S2) is primarily a forward-looking sector. Being a provider of raw materials for energy and manufacturing industries, this sector is crucial. The low backward linkages of 0.70 indicate, however, that there is little integration downstream. Such a gap provides opportunities both for investment in the upstream industry and up-to-date technology development in order to expand its economic volume.

Wholesale and retail trade (S7), a trade sector, has also grown with backward and forward linkages of 1.22 and 1.88, respectively. Such values depict its important function of linking the producers and consumers and the movement of goods. The contributions of the region are especially distinguished in the area of access to domestic and international markets, so it is classified as a facilitator of the economy.

The communication sector and the transport sector seem to have the same coefficient linkage values, which means they have a supporting role. The transport sector facilitates the provision of goods and services while the communication sector enhances technological advancements. Both sectors provide essential services that support productive activities in the economy and have room for expansion through the use of additional resources, improving infrastructure, and technological enhancements.

Coefficients of Variation and Measure of Economic Context:

In regards to the economic understanding of a region, the coefficients of variation in the main sectors have a deeper understanding. Sectors like transport (S8) and technology (S10) all show low forward linkage variation, implying that the contribution made is equally well spread out among the downstream industries. According to this, the high variation means that the economy has backward sectors like agriculture (S1) and manufacturing (S3) that need a wide range of inputs and have a lot of room for economic diversification.

From what we've seen so far, it's clear that transportation and technology have effects that are the same across many industries. Conversely, manufacturing and agriculture should thrive due to their extensive interconnected upstream activities. Such insights are relevant for planning support strategies, as they help identify the specific areas to target for investment and resource

Discussion

Manufacturing as a Driver for Economic Development:

Manufacturing will be the most important industry in Saudi Arabia because it supplies and consumes other sectors. The strong linkages of the sector emphasize both its roles in boosting growth and the diversification of the economy. There is scope for global competitiveness and economic strength through investment in advanced manufacturing and bespoke industry (Hirschman, 1958). For example, investing in sophisticated manufacturing technologies such as robotics and artificial intelligence might enable Saudi Arabia to assume the position of a leader in the industry.

Because the sectors depend on each other, policies can be made that encourage manufacturing value addition, like planning and separating upstream and downstream production flows for finished goods. These policies then support the forward linkage of 3.27, which drives activities in sector S7 for wholesale trade and in sector S8 for transportation.

The Vital Contribution of Agriculture:

Agriculture, along with forestry and fishing, accounts for one of the most important sectors for the economy of Saudi Arabia. Industry linkages demonstrate that the sector actively participates in both upstream and downstream support activities. This particular sector encourages job creation in rural areas, sustains food security, and facilitates value addition in the food processing and retail industries. More emphasis is required on undertaking modernization in farming and additional activities further up the value chain (Elbashir, 2024).

The adoption of new technologies like precision agriculture and sustainable water use can create synergies and increase the productivity and sustainability of the ecosystem. In addition, optimizing supply chains and stimulating global agro-processing industries will diversify the sector and further add to its economic value.

Mining's Strategic Importance to the Economy:

The resource-rich economy of Saudi Arabia also puts a lot of emphasis on mining and quarrying (S2) activities. These activities have a forward linkage of 1.49, which means they supply energy and manufacturing. Making investments to improve the infrastructure and applying technology innovations could address this deficiency (Callen et al., 2014).

The mining sector's forward linkage makes it a key contributor to industrial development. But for the mining value chain to reach its full potential, policymakers should focus on the top end by providing exploration and processing technologies that will make the chain stronger and more long-lasting.

Wholesale and Retail Trade as an Economic Enabler:

Wholesale and retail trade (S7) serves a critical purpose in linking production and consumption and has high backward (1.22) and forward (1.88) linkages. The ability of this sector to reach out to consumers from producers both locally and globally makes it an important sector of the economy. Improving market facilities such as logistics centers and e-commerce can also enhance its role in economic activity (Samargandi et al., 2022).

Transportation and Technology: Sectors that are deemed supportive with high scope:

Transport and storage (S8) and information and communication (S10) are key additional sectors that contribute to maintaining efficiency and depth of technology across industries. Their moderate linkage values indicate that they are enhancing productivity and fostering connections within the economy.

An improvement in logistic networks that provide transportation in the form of railways or logistic hubs will improve efficiencies in the supply chain. Likewise, the ongoing digital transformation in the information and communication sector will promote innovation and high productivity, thus contributing to economic resilience and competitiveness (Alqublan, 2021).

Policy Implications and Vision 2030:

The report of the present research is in line with the Saudi Vision 2030 business proposition and its goals, which, among many, focus on economic diversification and sustainability. There exists a greater possibility of Pineli (2022) growth-linking argument in the manufacturing and agriculture sectors. They also suggest that policymaking for these sectors ought to include investments, innovation systems, and value-added activities to ensure they do not miss out on the possible growth rate (Vision 2030, 2016).

Sectors like transportation and technology that are moderately linked and depend on other sectors for economic growth must receive investments that could improve their potential contributions. Improving infrastructure and supporting the industry age could lead to better connectivity and integration within the industries, resulting in a more comprehensive and changing economic system.

Challenges and Opportunities for Weaker Sectors:

While improvements are being witnessed, efforts to integrate some weak sectors, such as financial services and real estate, have not progressed as well as anticipated in the wider economic context. These types of sectors don't seem to be connecting with each other very much, which suggests that there are policy gaps and even a lack of new ideas for how to make these sectors more useful (Moshashai et al., 2020).

Investing in weak sectors can enhance their contributions, create spill prevention, and lead to a more diverse and robust economy. For instance, embedding financial services into the value chains of small and medium enterprises could ease their capital constraints, thus promoting entrepreneurship and economic growth.

Balanced Growth for Sustainable Development:

It is essential to emphasize that, apart from the leading and interconnected sectors, the results have significance in regard to balanced growth in the lower linkages' spending. Immediate investments in high-linkage industries have the potential for quick economic returns; on the other hand, the integration of weak sectors should be a long-term strategy. In this manner, we achieve economic and social sustainability and meet the goals of Vision 2030.

Conclusion

This paper primarily sought to determine the essential areas of the economy in Saudi Arabia, concentrating on those showing significant interaction as well as yielding an economic advantage on a larger scale. The results indicate that sectors with their products call for a variety of other sectors, such as transport or retail, to exert strong dominance over the economy. This is due to the role such sectors play in the provision of goods and services, and as such, they find

themselves serving numerous industries in the domestic market. Transportation and communication stand out as important policy support areas. This is in line with previous research that found how important economic connections are in Saudi Arabia's vast geography (Akgün, 2022). Such findings make clearer the need for policies that enhance these sectors in order to strengthen the regions' economic linkages.

To improve the fluency, replace with: The findings of the study extend to other sectors as well, including those engaged in a particular niche in manufacturing that is more export-oriented or caters to foreign tourists. This aligns with the objectives of Saudi Vision 2030, which considers cross-border trade and tourism as potential growth areas (Arabia, 2016). Our investigation is consistent with past research that has emphasized the need for a targeted focus on subindustries within the manufacturing sector to enhance productivity and growth as opposed to viewing the sector as a homogenous whole. For instance, increasing market share in high-value segments of chemicals and pharmaceuticals brings in more money than putting value into the whole production of chemicals and pharmaceuticals (Norbu et al., 2021). This perspective is different from the rather wide coverage of industrial processes as portrayed in some of the official reports, and this may imply a more sophisticated policy change that tends to focus on strategic areas of industry with a high impact on the economy.

In this perspective, it is worth highlighting some of the contradictions inherent in modern agriculture. While, in our analysis, agriculture has significant backward linkages and is a key sector, the latter enjoys, however, much lesser policy attention. Agriculture ties to the local economy explain its importance to food production and regional economic stimulation. Other studies suggest that the modernization of agricultural practices can help strengthen the economy by lessening the reliance on imported foods and providing jobs in the countryside (Elbashir, 2024). It is reasonably believed that a reassessment of modern agricultural policies might serve greater diversification aims by strengthening domestic supply chains and improving food systems.

This study brings to light that there is an ominous, always-recurring theme, namely that Saudi Arabia's economy has a single most important oil product, which is oil, and therefore oil depresses the impact of the rest of the sectors. Although many non-oil sectors have reasonably good links with the rest of the economy, their contribution can be disentangled in terms of volumetric dimensions relative to the oil industry. This validates previous findings that a dramatic intersectoral disconnect does not mean that oil is not going to be the key determinant for economic activity (Alqublan, 2021) .

However, this dependency creates difficulties for diversification. Such complexes of scale and scope in the oil sector are difficult to compete with for the smaller sectors. To increase diversification (which is a good thing), policies should be aware of this unfair competition. One way to do this could be to encourage links between new sectors as they form, along with efforts to boost value addition in sectors other than oil.

It is quite compelling to note that some of the identified key sectors are actually mid-sized subsets of the economy characterized by a proliferation of small to medium-sized enterprises. Some sectors are more stable than others because the structure of these sectors shows that the composition of these sectors would not change much if one company came or went. This implies that sectors with a high market concentration may not exhibit the same stability. On the other hand, the gradual expansion or downsizing of certain sectors may affect the equilibrium of an economy in a negative manner. However, this view of the part that small and medium-sized

businesses play in these areas shows the need for policies that encourage their growth and involvement in the economy as a whole, since they can make the economy more stable and create jobs at relatively low costs (Alshebami, 2024).

In addition, the study shows that it would be useful to develop high-impact sectors, as there is a demand for such inputs and the local suppliers are highly capable of meeting the demand. However, some sectors with multiplier effects may face limitations when complementing industries that remain weakly developed. For example, if the development of transportation and logistics services does not keep pace with the growth of manufacturing or the tourism sector, it may overload the existing infrastructure. This view fits with other evidence that shows activities aimed at different sectors need to be coordinated if the benefits of vertical growth are to be fully realized (Grand & Wolff, 2022). Therefore, to reduce potential constraints, it is important to have balanced growth within related industries.

Finally, using broad sectoral analysis helps us understand why policies need to be targeted at certain areas that have a big effect on the economy in a roundabout way. Even quite marginal areas in sectoral terms can have a substantial effect in the long run, provided they are well integrated into the rest of the economy. For a country like Saudi Arabia, which is primarily an energy-exporting economy, that would mean it is crucial to understand which of the non-oil sectors can provide substantial economic value for future sustainability. In this sense, appropriately oriented policies would allow oil dependence to be gradually reduced, thereby allowing a more balanced economy that will be in line with the aspirations of the Saudi Vision 2030 (Arabia, 2016).

Future Directions and Global Competitiveness:

To conclude, the research emphasizes the importance of restructuring the economy of Saudi Arabia by identifying and sustaining productive sectors in an operationally efficient and analytically sound manner. By focusing on the growth of strategic sectors with strong forward and backward links, policymakers will be able to come up with steps that not only meet the needs of these sectors but also help the economy grow as a whole. Input-output analysis supports this strategy, providing a clear path towards a balanced, sustainable, and resilient structure of the Kingdom's economy.

The case of Saudi Arabia provides timely insights for all resource-dependent economies in regard to the issue of economic diversification and sustainability. This study has demonstrated that we can harness inter-sectoral links for the diversification and integration of economies. Through the enhancement of connectivity and consolidation of key sectors, Saudi Arabia is able to emerge as a pioneer in economic innovation and sustainability.

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