SAUDI ARABIA

Country Competitiveness Profile

Vienna, 2019

المملكة العربية السعودية
وزارة الصناعة والثروة المعدنية

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COUNTRY COMPETITIVENESS PROFILE

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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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The competitiveness assessment of Saudi Arabia‘s manufacturing sector presented in this report is based primarily on the UNIDO Competitive Industrial Performance (CIP) Index. The report is a component of an ongoing technical cooperation project implemented jointly by UNIDO and the National Industrial Information Center (NIIC) at the Ministry of Energy, Industry and Mineral Resources (MEIM).

Valentin Todorov from the Statistics Division of UNIDO prepared the Report together with UNIDO consultants Suyu Liu and Ah Young Lee. Dina Dragoshinska created the graphical layout and cover design. We appreciate the contribution of Jung-In Yeon who, during her Internship period at UNIDO in 2016 developed the first prototype of the format of this report.

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CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

CIP	Competitive Industrial Performance
GCC	Gulf Cooperation Council
GDP	Gross domestic production
GMCI	Global manufacturing competitiveness index
IMF	International Monetary Fund
ImWMT	Export share in world manufacturing trade
ImWMVA	Value-added share in world manufacturing value-added
MHVAsh	Share of medium- and high-tech value-added in total value-added
MHXsh	Share of medium-and high tech manufactured exports in total manufactured exports
MODON	The Saudi Industrial Property Authority
MVA	Manufacturing value-added
MVApc	Manufacturing value-added per capita
MVAsh	Share of manufactured value-added in GDP (%)
MXpc	Manufactured exports per capita
MXsh	Share of manufactured exports in total exports
NIDLP	The Saudi National Industrial Development and Logistics Program
OPEC	The Organization of the Petroleum Exporting Countries
SMEs	Small and medium enterprises
UN	United Nations
UNIDO	United Nations Industrial Development Organization
VA	Value-added

EXECUTIVE SUMMARY

UNIDO celebrated the new role given to the manufacturing sector with the 2013 Lima Declaration's acknowledgement of inclusive and sustainable industrial development (ISID) as key to achieve the Sustainable Development Goals (SDGs). Promoting manufacturing competitiveness in a sustainably responsible approach is an essential part of achieving SDGs with ISID. Saudi Arabia has a strong and solid foundation of industrial development, especially in manufacturing. It has the largest manufacturing sector and highest manufacturing production activity among Gulf Cooperation Council countries. It is therefore a regional model which deserves further research of its manufacturing competitiveness in line with its national development strategy, the Vision 2030.

The report compares Saudi Arabia's manufacturing competitiveness with three comparator countries: Brazil, South Africa, and Turkey. Although not the largest economy in the four countries, Saudi Arabia has the highest manufacturing productivity as reflected by the high MVA per capita and technology intensity. Its manufacturing growth is also stable. However, there is still a distance from leading industrialized countries. These can be reflected by Saudi Arabia's positions in world competitiveness rankings.

In comparison with Brazil, South Africa, and Turkey, the diversity of manufacturing production and export in Saudi Arabia is relatively low. Manufacturing production and export in Saudi Arabia have strong reliance on a few economic activities and products. In particular, the dependence on oil sector remains relatively strong. This provides supportive evidence for the Kingdom to reduce its high reliance on oil sector and diversify its economy, particularly manufacturing, as set in Vision 2030.

Increasing a country's technological deepening and upgrading is at the heart of the structural change process needed for emerging and developing countries. Manufacturing in Saudi Arabia has a high intensity of technology comparing with the three comparator countries. This provides suitable spaces for promoting gender equality and youth employment in the Kingdom, as strongly emphasized in Vision 2030.

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01. INTRODUCTION

1.1 CONTEXT

The Kingdom of Saudi Arabia (hereafter shortened as 'Saudi Arabia' or 'the Kingdom') is located in the Middle East on the Arabic Peninsula. With the land area of about 2.15 million square kilometers, it shares borders with Jordan, Iraq, Kuwait, Qatar, Bahrain, United Arab Emirates, Oman, and Yemen from the north to the south.

As a G20 country and the largest economy in the Gulf Cooperation Council (GCC) region, Saudi Arabia's GDP in 2018 (converted into 2010 constant price) was near USD 698 million (UNIDO, 2019e). Saudi Arabia has an oil-based economy with strong government controls over major economic activities. It possesses about 16% of the world's proven petroleum reserves, ranks as the largest exporter of petroleum, and plays a leading role in OPEC. The petroleum sector accounts for roughly 87% of budget revenues, 42% of GDP, and 90% of export earnings.[1]

As the world's leading oil exporter, the Government of the Kingdom is in the midst of accelerating its national structural transformation efforts. In 2016, the government unveiled the Saudi Vision 2030, which acts as national development strategy and roadmap (The Kingdom of Saudi Arabia government, 2016). The Vision 2030 largely outlines the three main themes of creating: 1) a vibrant society; 2) a thriving economy; and 3) an ambitious nation by 2030. More specifically, the Vision 2030 emphasizes that Saudi Arabia will continue to increase and non-oil revenues and diversify its economy in the coming years

[1] **Data source |** US Central Intelligence Agency the World Factbook

by introducing new measures. The Vision 2030 shows that the government is fully committed and has strong determination to transform and accelerate economic development and diversification.

The delivery plan for the National Industrial Development and Logistics Program (NIDLP) was approved in 2017. The program is mandated to transform the Kingdom into a leading industrial powerhouse and a global logistics hub in promising growth sectors with focus on Industry 4.0. The NIDLP further aims to generate more job opportunities for Saudi citizens, improve the trade balances of the Kingdom, and maximize the local content.

In addition, the government has been intensively investing to build six new industrial cities with modern infrastructure to create a business-friendly environment. The Saudi Industrial Property Authority (MODON), established in 2001, is the responsible agency for overseeing the development of industrial cities with integrated infrastructure and services in Saudi Arabia. These cities are expected to act as industrial clusters and, at the same time, boost the productivity. MODON also works on attracting global companies to contribute to the realization of Vision 2030 in terms of diversifying the national economy and encouraging the Saudization of the industrial sector in the Kingdom, while competitively raising the quality standards and work force capabilities. MODON has also achieved a great improvement in local partnerships.

Industrialization in Saudi Arabia has witnessed a steady development, during which distinguished accomplishments were achieved. These are attributed to the importance of the industrial sector and the support it receives from the government owing to its role in achieving strategic and economic goals of the country. The efforts exerted by the government for the support of industrial development can be reflected by the establishment of the Saudi Industrial Development Fund

(SIDF), which is committed to provide high level of support and diversify the industrial development in the Kingdom by helping to shape industrial sectors, develop competitive enterprises and local small and medium enterprises (SMEs). The response and cooperation of the private sector with the governmental plans and efforts have an effective impact on the achievements of the industrial development.

This Saudi Arabia Country Competitiveness Report (hereafter 'the report') primarily aims at examining the role and influence of Saudi Arabia's manufacturing sector, with emphasis in identifying the country's position in terms of competitiveness and potentials. In particular, Saudi Arabia's manufacturing production performance, export performance, the level of technological upgrading and deepening and global ranking will be reviewed by using the most recent data from the UNIDO databases. A number of indices related to manufacturing, especially about market and production diversification, will also be introduced. The competitiveness of Saudi Arabia will also be assessed and analyzed in comparison with three other countries: Brazil, South Africa, and Turkey.

The remaining parts will be arranged as follows. The next sub-section of introduction will explain the reasons of selecting Brazil, South Africa, and Turkey as comparator countries. Section 2 will examine Saudi Arabia's competitiveness from three dimensions: capacity to produce, capacity to trade, and technological upgrading and deepening. Section 3 will adopt CIP index and a number of other indexes to analyze the competitiveness of Saudi Arabia and comparator countries. Section 4 will examine Saudi Arabia's competitiveness from the perspectives of production and export diversification. In Section 5, practical implications will be provided based on the findings and analyses in the previous sections. Section 6 concludes the report.

1.2 SELECTING THE COMPARATOR COUNTRIES

It is a popular practice to compare Saudi Arabia with its neighbor countries (particularly GCC countries) due to the geographic adjacency and similarity in socioeconomic structures. However, the report does not choose neighbor countries and other GCC countries as comparators. This is firstly because of Saudi Arabia is the largest country and economy in the GCC region, which brings the Kingdom with a leading status in that region.[2] Secondly, in terms of industrialization, Saudi Arabia is a role model in the region. This can be shown in the Table 1.1, for example, in 2010, MVA in Saudi Arabia equaled to almost the sum of the other 8 countries. Significant intra-regional disparities in economic development of GCC countries also reduce the suitability to compare Saudi Arabia's competitiveness with them.

Instead, Brazil, South Africa, and Turkey are selected as comparator countries of Saudi Arabia's competitiveness. This

TABLE 1.1 | GDP, MANUFACTURING VALUE ADDED (MVA) AND POPULATION IN SAUDI ARABIA AND ITS NEIGHBOR COUNTRIES, 2018 (AT CONSTANT 2010 PRICES)

Country	GDP (millions of USD)	MVA (millions of USD)	Population (millions)
Saudi Arabia	697,564	89,060	33.6
Bahrain	34,039	5,131	1.6
Iraq	210,728	1,789	39.3
Jordan	32,141	4,947	9.9
Kuwait	141,562	6,391	4.2
Oman	74,580	7,487	4.8
Qatar	175,338	16,172	2.7
UAE	392,918	33,442	9.5
Yemen	13,052	866	28.9

SOURCE | UNIDO MVA DATABASE (UNIDO, 2019E)
NOTE | ALL FIGURES IN THIS TABLE ARE REPORTED TO THE NEAREST INTEGRAL NUMBER, SAME AS IN ALL OTHER TABLES, UNLESS OTHERWISE SPECIFIED

2 The popular experience suggests that comparing the regional role model with other countries in the same region usually generates good experience and implications for relatively less developed countries, but has rather limited benefits to the role model.

is firstly because of these three countries have similar overall industrial performance as Saudi Arabia, which can be revealed in their close CIP rankings (as will be shown in Section 3, and also UNIDO, 2019a). The three countries are all 'Emerging Industrial Economies' according to UNIDO classification (UNIDO, 2019g). Secondly, Saudi Arabia and the other three countries are regional role models in economic development and industrialization. As can be referred from Table 1.1, Saudi Arabia has the highest GDP per capita and MVA per capita among its neighboring GCC countries. Comparing Saudi Arabia with other regional models would generate more insightful analysis and useful practical implications. Thirdly, Brazil and South Africa are both rapidly growing economies and 'BRICS' countries[3], and it is a widely-accepted practice to compare an emerging economy such as Saudi Arabia with BRICS countries, which are leading role models of emerging economies[4]. Fourthly, industrial development in these three countries highly relies on natural resource. For example, Saudi Arabia and Brazil are among the top 10 oil producers[5], and South Africa ranks 7th in the coal production list[6].

Some widely-selected regional and global role models (such as Germany, Republic of Korea, India, Japan, and United States of America) are not included as comparator countries due to Saudi Arabia's significant lag behind these countries and/or sharp disparities in country contexts[7]. Therefore, it is unlikely to generate useful implications for Saudi Arabia by comparing with these leading performers in manufacturing. In contrast, comparison with countries which have similar contexts such as same level of economic development and industrialization may generate more analytical insights and practical implications. However, it is necessary to notice that these industrialized countries may still serve as good examples and references in the analysis of findings.

3 BRICS stand for Brazil, Russian Federation, India, China, and South Africa. These countries are widely recognized as regional role models due to their top levels of economic development and industrialization in respective regions.

4 Nevertheless, Russian Federation, China, and India are exceptional due to their huge population size and land scale. Therefore, it is more suitable to compare Saudi Arabia with Brazil and South Africa in this context. In UNIDO publications, China is also often listed separately.

5 See US Energy Information Administration International Energy Statistics

6 See British Petroleum Statistical Review of World Energy

7 For example, as the role model of industrialization in East Asia, Japan is often selected as a comparator country. However, Japan's leading status in manufacturing competitiveness (CIP ranking 2nd in 2017), its tremendous GDP scale, and R&D level make it is incomparable with Saudi Arabia.

02. CAPACITY TO PRODUCE, TRADE AND STRUCTURAL CHANGE

Industrial competitiveness refers to '…the ability of a producer to sell its products in the market' (UNIDO, 2010, p235). Therefore, it is able to understand that there are two main determinants of competitiveness at national level: the capacity to produce (supply) and the capacity to trade (satisfy the demand). More specifically, high competitiveness requires a good capacity to produce the suitable amount, quality, and type of products within certain time-scales which meet the demands of both domestic and foreign markets. Also, high competitiveness requires strong capacity to trade in order to satisfy the demand of consumers in both domestic and foreign markets[8].

In addition, industrial competitiveness is strongly associated with the efficiency in resource allocation and the degree of value-added activities. Therefore, the report also investigates the technological upgrading and deepening of Saudi Arabia and the selected comparator countries, as an important component of structural change.

2.1 CAPACITY TO PRODUCE

Capacity to produce has two dimensions: scale (the absolute term) and productivity (the relative term). Scale means the ability to produce sufficient amounts and desired types and qualities of products within a suitable time scale. Productivity refers to the relationship between outputs and inputs of production[9].

8 From this description, it is not difficult to understand that these two determinants of competitiveness are relied on each other: without correct amount, quality, and type of products in a restricted time-scale, it is unable to trade properly; if trade capacity is low, the production cannot be delivered to satisfy the market (even the production amount, quality, and type are all suitable). However, due to the limited space, the mutual dependence of capacity to produce and capacity to trade will not be discussed in more detail.

9 Although it is generally perceived that scale and productivity should be consistent with each other, it is not necessarily the case in practice. An easily-noticed example is the former USSR, which produce large scale of industrial products so that its capacity to produce is considered as very high, but due to the tremendous consumption of inputs, it is widely labelled as low productivity.

The former is measured by a number of MVA related indicators, while the latter is measured by the value-added to output ratio in manufacturing sector[10], and also taking value-added per employee into consideration[11].

Table 2.1 shows the MVA of Saudi Arabia, Brazil, South Africa, and Turkey. The growth rates in different periods are also shown. According to Table 2.1, Saudi Arabia demonstrates a rapid and sustained increase in its MVA (measured by constant USD in 2010). For example, between 2010 and 2018, MVA of Saudi Arabia increased steadily without any negative annual growth. MVA of Turkey also increased significantly and stably. In contrast, the MVA growth in Brazil and South Africa are not stable, especially between 2014 and 2015,

TABLE 2.1 | MVA OF SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY BETWEEN 2005 AND 2018

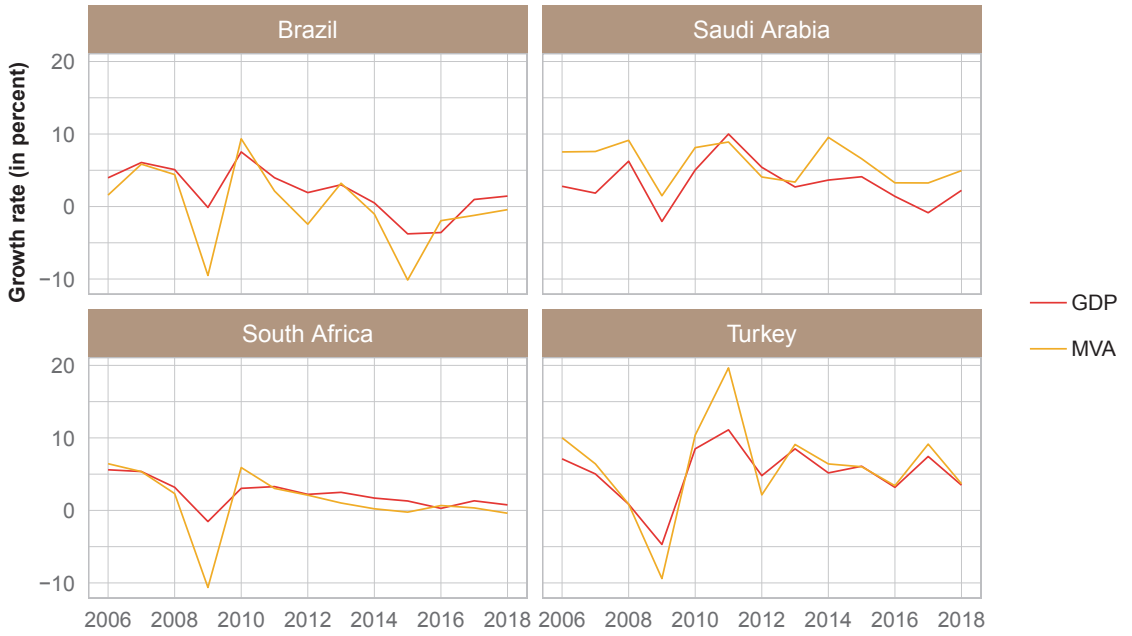
	Manufacturing Value added in million USD (constant 2010 prices)										MVA change (in per cent)			
Country	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2005-2010	2010-2015	2015-2018	2005-2018
Saudi Arabia	41,991	58,179	63,359	65,938	68,161	74,663	79,584	82,186	84,858	89,060	38.5	36.8	11.9	112.1
Brazil	253,000	281,000	287,000	280,000	289,000	286,000	257,000	252,000	248,932	247,863	11.1	-8.5	-3.6	-2
South Africa	45,116	48,994	50,481	51,539	52,064	52,178	52,051	52,401	52,580	52,376	8.6	6.2	0.6	16.1
Turkey	99,072	117,000	140,000	143,000	156,000	166,000	176,000	182,000	198,639	205,929	18.1	50.4	17	107.9
GCC	83,445	109,309	117,709	125,244	130,157	136,419	144,482	148,505	151,334	157,684	31	32.2	9.1	89
MENA	316,989	411,130	442,968	451,283	465,766	490,301	506,825	521,732	548,417	566,312	29.7	23.3	11.9	78.7
World	8,896,601	10,365,999	10,805,972	11,045,093	11,357,813	11,789,998	12,125,510	124,696,34	12,952,205	13,415,707	16.5	17	10.6	50.8

SOURCE | UNIDO MVA DATABASE (UNIDO, 2019E)

10 The similarity and difference between the two core concepts, manufacturing value added (MVA) and value added (VA), need to be clarified here. The data of are collected and calculated by following a national accounts approach based on the System of National Accounts. MVA is a variable that represents the total value added of the manufacturing sector in relation to the economy as a whole (GDP). The measure of VA is based on an industrial census approach that covers activities of an industrial nature. The data of VA are from establishment survey/census, including data of establishments that are officially registered in the business registry. Many countries perform the survey/census only on establishments of a given size or higher (e.g. number of employees), and informal economy is not included. VA plus intermediate consumption equals the output.
11 Productivity here refers only to labor productivity and resource productivity. Capital productivity is not included.

when both countries experienced negative annual growth in MVA. Saudi Arabia also demonstrates a much faster growth in MVA than these two comparator countries. For example, the increase in MVA between 2005 and 2010 in Saudi Arabia was 38.5% (annual average growth rate 7.7%), while the growth rates in Brazil and South Africa during the same period was 11.1 and 8.6 respectively (annual average growth rate 2.2% and 1.7%). Similarly, the overall growth rate of MVA in Saudi Arabia between 2005 and 2018 was higher than 112% (more than double), while the figures over the same period for Brazil and South Africa were merely -2% and 16.1%, respectively. However, Turkey's growth in its MVA is not falling very far away from Saudi Arabia. For example, the overall growth of MVA of Turkey between 2005 and 2018 was near 108%, only less than 5 percentage points behind Saudi Arabia. Saudi Arabia's MVA growth in comparison with the three comparator countries can be revealed in Figure 2.1.

FIG. 2.1 | MVA GROWTH IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY OVER YEARS



SOURCE | UNIDO MVA DATABASE (UNIDO, 2019E)

Table 2.1 and Figure 2.1 reveal Saudi Arabia's strong manufacturing production performance. It is particularly essential to notice that as the country with the world's second largest proven oil reserves, manufacturing development (and the whole economy) relies strongly on the oil sector. Nevertheless even during 2014 and 2015 when the oil price dropped sharply (as shown in Table 2.2 and Figure 2.2), Saudi Arabia still showed an increase of MVA with near 5,000 million USD (2010 constant), which equals to a 6.5% annual growth. In contrast, during the same year, Brazil's MVA dropped 29,000 million USD, which means an over 10 percent decrease. Although the speed of MVA growth in Saudi Arabia slowed down in recent years, it is largely due to the natural slowing-down accompanied with expansion[12].

Also, MVA growth in Saudi Arabia is generally faster than its GDP growth, with only exception in 2011 and 2012. This provides evidence of strong manufacturing production performance in Saudi Arabia. Turkey demonstrates a similar pattern of MVA growth in relation to its GDP. However, in South Africa and

TABLE 2.2 | BRENT CRUDE OIL PRICE IN THE LAST 10 YEARS

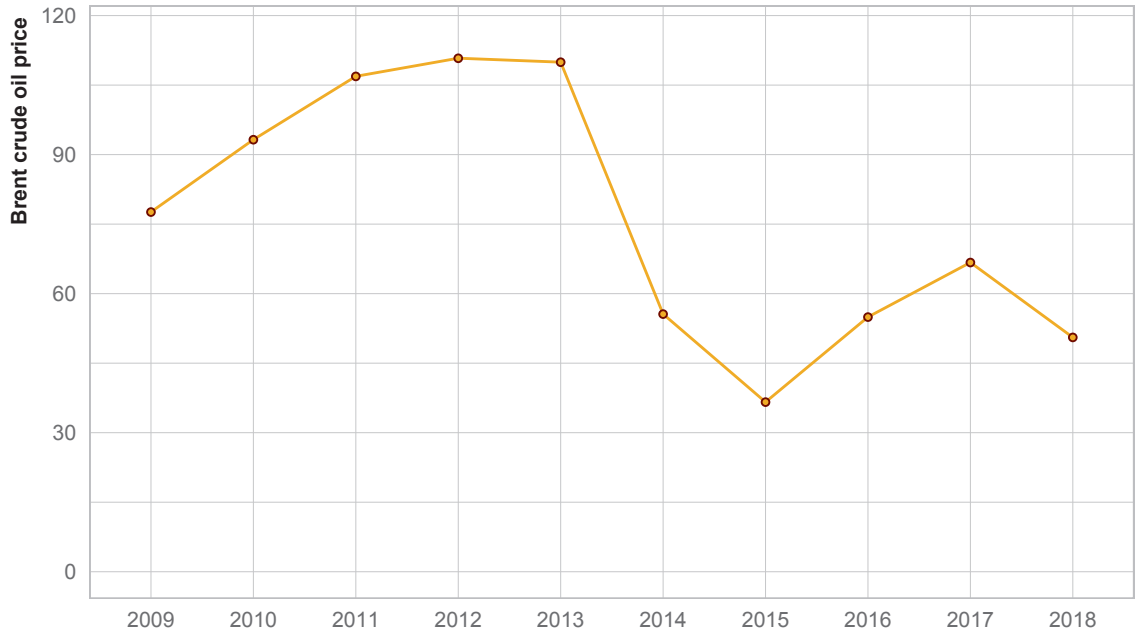
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Crude oil price	77.62	93.23	106.89	110.8	109.95	55.6	36.61	54.96	66.73	50.57

SOURCE | FEDERAL RESERVE BANK OF ST LOUIS, ECONOMIC DATABASE, AVAILABLE FROM HTTPS://FRED.STLOUISFED.ORG/SERIES/DCOILBRENTEU
NOTE I THE CRUDE OIL PRICE SHOWN IN THE TABLE IS THE PRICE OF THE LAST TRADING DAY OF THE YEAR, AND THE UNIT IS CURRENT USD/BARREL; FIGURE 2.2 IS BASED ON DATA IN TABLE 2.2

12 This is a natural phenomenon, accompanied with expansion, the growing speed is less obvious because the baseline is also increasing. Also, in economics, the growth is usually much more significant at the beginning stages than at the mature stages because they have stronger growth potential.

Turkey, MVA growth rate is lower than its GDP growth rate. Taking the size of economy into consideration, the report also compares the MVA shares in GDP in order to further analyze the competitiveness of Saudi Arabia and three comparator countries. According to Table 2.3, the shares of MVA in GDP in these four countries do not vary sharply, especially in recent years (e.g., 2014 onwards). However, the changes of MVA's contribution to GDP in Saudi Arabia are significantly different from Brazil and South Africa. For example, the contribution of MVA to GDP in Saudi Arabia in 2005 was around 9.1%, and this figure soared to 12.8% in 2018, which was a 40% increase. In contrast, MVA share in GDP in Brazil and South Africa both dropped significantly between 2005 and 2018 (by 24% and 13% respectively). In 2005, Saudi Arabia had the lowest contribution of MVA to GDP in these three countries. But in 2018, the MVA share in GDP in Saudi Arabia was higher than Brazil and South Africa. Contribution of MVA to GDP in Turkey has been stable, and higher than the other three countries. The annual variations of MVA's share in GDP can be observed in Figure 2.3.

FIG. 2.2 | VARIATION OF BRENT CRUDE OIL PRICE IN THE PAST 10 YEARS



Taking the size of economy into consideration, the report also compares the MVA shares in GDP in order to further analyze the competitiveness of Saudi Arabia and three comparator countries. According to Table 2.3, the shares of MVA in GDP in these four countries do not vary sharply, especially in recent years (e.g., 2014 onwards). However, the changes of MVA's contribution to GDP in Saudi Arabia are significantly different from Brazil and South Africa. For example, the contribution of MVA to GDP in Saudi Arabia in 2005 was around 9.1%, and this figure soared to 12.8% in 2018, which was a 40% increase. In contrast, MVA share in GDP in Brazil and South Africa both dropped significantly between 2005 and 2018 (by 24% and 13% respectively). In 2005, Saudi Arabia had the lowest contribution of MVA to GDP in these three countries. But in 2018, the MVA share in GDP in Saudi Arabia was higher than Brazil and South Africa. Contribution of MVA to GDP in Turkey has been stable, and higher than the other three countries. The annual variations of MVA's share in GDP can be observed in Figure 2.3.

TABLE 2.3 | CONTRIBUTION OF MVA TO GDP IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY OVER YEARS

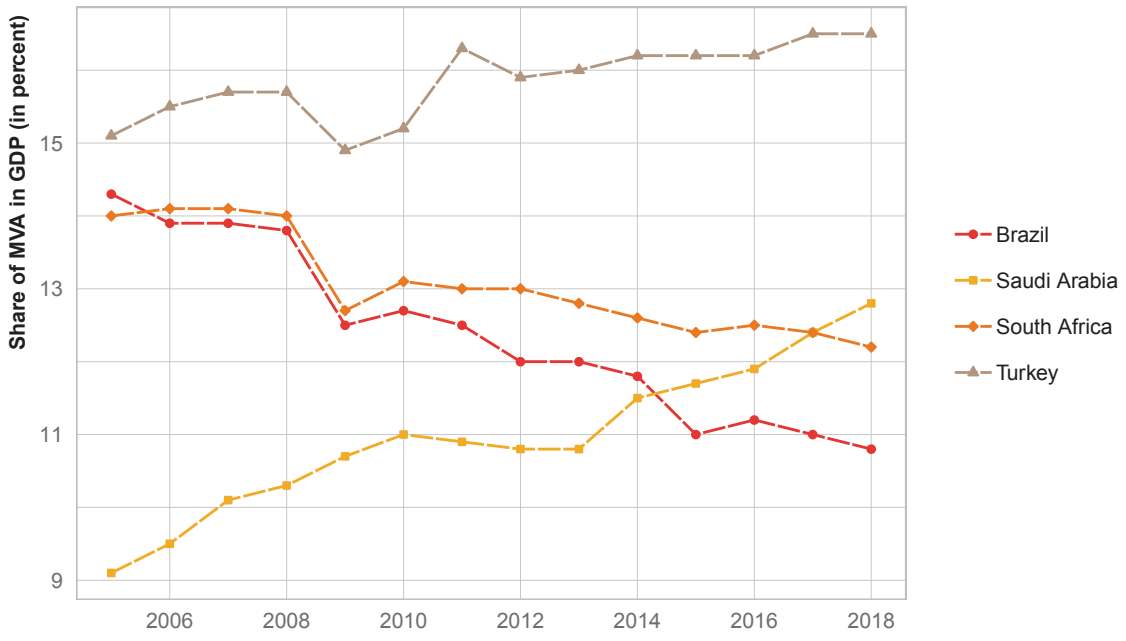
Country	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
Saudi Arabia	9.1%	11.0%	10.9%	10.8%	10.8%	11.5%	11.7%	11.9%	12.4%	12.8%
Brazil	14.3%	12.7%	12.5%	12.0%	12.0%	11.8%	11.0%	11.2%	11.0%	10.8%
South Africa	14.0%	13.1%	13.0%	13.0%	12.8%	12.6%	12.4%	12.5%	12.4%	12.2%
Turkey	15.1%	15.2%	16.3%	15.9%	16.0%	16.2%	16.2%	16.2%	16.5%	16.5%

SOURCE | UNIDO MVA DATABASE (UNIDO, 2019E)
NOTE | THE NUMBERS IN TABLE 2.3 ARE CALCULATED BY ORIGINAL VALUES BEFORE MEASUREMENT UNIT CHANGED INTO 'MILLIONS', WHICH IS A PRACTICE THROUGH-OUT THE REPORT UNLESS OTHERWISE SPECIFIED

Figure 2.3 shows manufacturing's growing contribution to Saudi Arabia's economy, which reflects its enhancing the capacity to produce. This is particularly the situation between 2016 and 2018, when the contribution of MVA to GDP increased rapidly from 11.9% to 12.8%, the largest biannual increase since 2010. Such an increase corresponds to the Kingdom's efforts in diversifying its economy and expanding investment, under its national development strategy Vision 2030 which was unveiled in 2016.

In an international perspective, a country's competitiveness is also reflected by its share in world manufacturing, which is measured by the value-added share in world MVA. Table 2.4 shows Saudi Arabia's value-added share in world MVA over the past decade, in comparison with the three comparator countries and the top five countries in the rankings (2018)[13]. Figure 2.4 reveals the changes of Value-added share in world MVA of the selected countries.

FIG. 2.3 | ANNUAL VARIATIONS OF MVA'S SHARE IN GDP IN SAUDI ARABIA, BRAZIL, AND SOUTH AFRICA



SOURCE | UNIDO MVA DATABASE (UNIDO, 2019E)

13 The sum of the five countries' value-added shares was near 60% of the world MVA.

From the Table 2.4 and Figure 2.4, it is possible to observe that Saudi Arabia's value-added share in world MVA has been increasing throughout the selected period, from 0.47% in 2005 to 0.66% in 2018 which is an increase of near 40 percent. Among these nine selected countries, Saudi Arabia is the only one which did not experience any decrease in the value-added share in world MVA. In contrast, Brazil and South Africa have experienced steady decrease of value-added share in world MVA.

However, even though the value-added share in world MVA of Saudi Arabia has increased steadily, it is still far from the leading performers on the list. For example, Republic of Korea,

TABLE 2.4 | VALUE-ADDED SHARE IN WORLD MVA, SAUDI ARABIA AND SELECTED COUNTRIES, 2005-2018, IN PER CENT

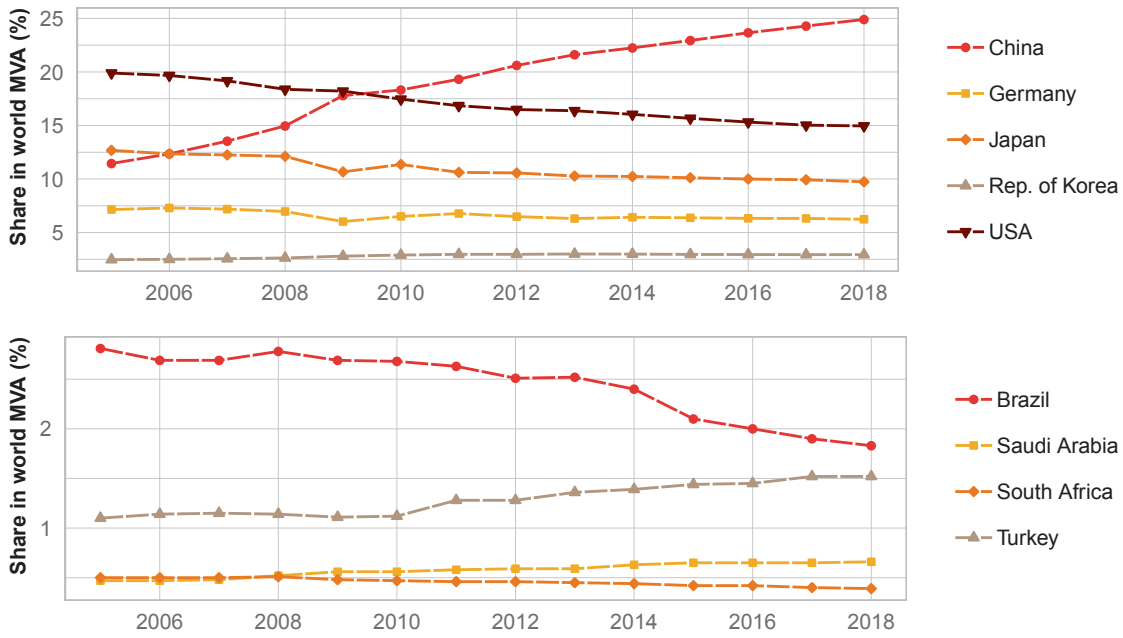
Country	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Saudi Arabia	0.47	0.52	0.56	0.56	0.58	0.59	0.59	0.63	0.65	0.65	0.65	0.66
USA	19.90	18.38	18.21	17.46	16.85	16.49	16.38	16.04	22.94	23.66	15.03	14.96
China	11.45	14.96	17.79	18.32	19.32	20.61	21.61	22.25	15.67	15.32	24.29	24.90
Germany	7.15	6.97	6.03	6.51	6.78	6.49	6.31	6.43	6.38	6.33	6.32	6.24
Japan	12.68	12.12	10.67	11.36	10.62	10.57	10.28	10.24	10.12	10.00	9.93	9.74
Korea (Rep.)	2.47	2.63	2.80	2.90	3.00	2.97	3.00	2.99	2.96	2.95	2.94	2.94
Brazil	2.81	2.78	2.69	2.68	2.63	2.51	2.52	2.40	2.10	2.00	1.90	1.83
South Africa	0.50	0.51	0.48	0.47	0.46	0.46	0.45	0.44	0.42	0.42	0.40	0.39
Turkey	1.10	1.14	1.11	1.12	1.28	1.28	1.36	1.39	1.44	1.45	1.52	1.52

SOURCE | ELABORATION BASED ON THE UNIDO MVA 2019 DATABASE (UNIDO, 2019E, 2019F)

which ranked 5th on the list (2018), had value-added share in world MVA 2.94, over 4 times of Saudi Arabia's value-added share in world MVA (0.66) in the same year. Such significant gaps may not be easily bridged.

MVA per capita is also a widely-observed indicator to measure a country's capacity to produce (e.g., Park et al, 1993). MVA per capita in Saudi Arabia, Brazil, and South Africa between 2005 and 2018 are shown in Table 2.5 and Figure 2.5.

FIG. 2.4 | VALUE-ADDED SHARE IN WORLD MVA, SAUDI ARABIA AND SELECTED COUNTRIES, 2005-2018



SOURCE | ELABORATION BASED ON THE UNIDO MVA 2019 DATABASE (UNIDO, 2019E)

Saudi Arabia has significantly higher MVA per capita than two comparator countries, Brazil and South Africa. MVA per capita in Saudi Arabia is also higher than Turkey, though the difference is not as sharp as comparing with other two countries. This suggests Saudi Arabia's strong manufacturing competitiveness in this aspect. Also the growth of MVA per capita in Saudi Arabia is stable and significant. In contrast, the changes of MVA per capita in Brazil and South Africa are not stable (which often observe negative values). This also suggests that high reliance on foreign investment (such as Brazil) may not necessarily increase manufacturing production performance (e.g., Bonelli, 1999). This deserves attention for Saudi Arabia's efforts to develop a thriving economy which is widely open for business. The target of FDI set in Vision 2030 (5.7% of GDP) is a suitable standard. This not only reduces the possible high reliance on foreign investment, but also provides

TABLE 2.5 | MVA PER CAPITA IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2005-2018 (IN CONSTANT 2010 USD)

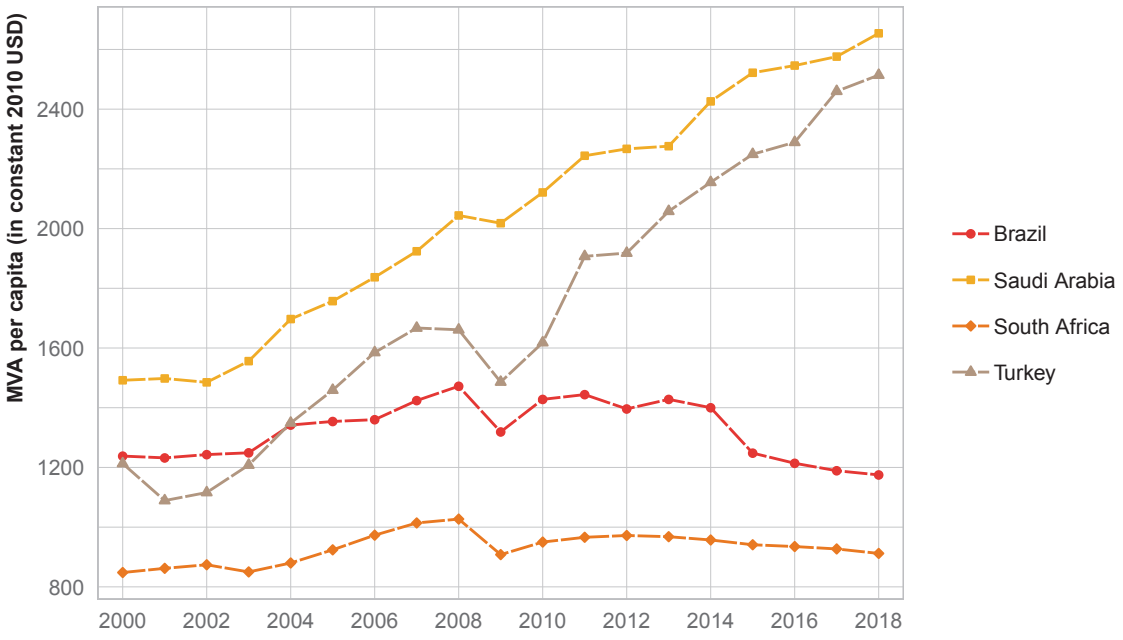
Country	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
Saudi Arabia	1,756.50	2,121.30	2,243.80	2,267.00	2,276.20	2,426.00	2,521.90	2,546.40	2,576.30	2,654.20
Brazil	1,353.50	1,427.90	1,444.50	1,396.10	1,427.80	1,400.50	1,247.80	1,213.60	1,189.40	1,175.40
South Africa	924.10	949.80	965.90	972.50	968.30	956.70	941.40	935.50	927.10	912.50
Turkey	1459.00	1617.70	1907.10	1917.70	2058.40	2155.00	2248.60	2289.00	2460.10	2513.90

SOURCE | ELABORATION BASED ON THE UNIDO MVA 2019 DATABASE (UNIDO, 2019E).

more spaces to increase local investment opportunities, which is an important component of maximizing local contents as aspired by NIDLP.

However, in consideration of the demographic factors (e.g., workforce participation, age structure, and nationality)[14], it would be also important to incorporate value-added (VA) in manufacturing (not MVA; the different between MVA and VA is introduced in footnote 10), manufacturing output, and employees in manufacturing sector to analyze a country's manufacturing performance. This is mainly from the perspective of productivity. Table 2.6a and Table 2.6b summarize the information on total VA in manufacturing, manufacturing output, and employees in manufacturing sector in Saudi Arabia and the three comparator countries between 2010 and 2017.

FIG. 2.5 | FLUCTUATIONS OF MVA PER CAPITA IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2005-2018



SOURCE | ELABORATION BASED ON THE UNIDO MVA 2019 DATABASE (UNIDO, 2019E).

14 This is especially important for Saudi Arabia, which is widely-known for its large foreign workforce. Since it is unknown whether the population figures in UNIDO MVA capture this information, the number of employees from INDSTAT 2 would be a more suitable proxy

In accordance with Table 2.1, Table 2.6 also shows that Brazil and Turkey have larger manufacturing sectors than Saudi Arabia. This is reflected in the total VA, output, and employees in manufacturing sectors of the two countries. For example, between 2010 and 2013, manufacturing sector in Brazil absorbed 10 times more employment than in Saudi Arabia.

However, in terms of productivity, as measured by VA per employee and VA to output ratio, Saudi Arabia has significant advantages to the three comparator countries, as revealed in Table 7. In these eight years, the highest VA per employee in Brazil was about USD 44,817, less than 55% of the lowest VA per employee in Saudi Arabia (USD 82,955, in 2015). The lowest VA to output ratio in Saudi Arabia's manufacturing sector was around 0.49 (49%) in 2015, which is almost 1.7 times than the highest value in Brazil (0.30 in 2011) and over 2 times the

TABLE 2.6 | TOTAL VA, OUTPUT, AND EMPLOYEES IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2010-2017

Country		2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	Employee	714	736	773	800	898	960	978	1,001
	VA total	61,310	64,226	71,789	74,743	80,008	79,607	79,388	92,117
	Output	120,738	125,484	136,210	144,096	155,144	162,423	162,191	173,963
Brazil	Employee	7,617	7,832	7,917	8,116	79,747	7,356	6,915	7,071
	VA total	307,426	351,008	311,848	310,721	296,040	200,652	195,448	226,174
	Output	1,014,381	1,180,634	1,090,295	1,095,830	1,054,843	751,336	731,851	846,903
South Africa	Employee	1,170	1,148	1,146	1,144	1,140	1,164	1,286	1,279
	VA total	45,412	47,411	45,290	41,673	40,256	34,843	32,173	37,120
	Output	193,321	206,467	198,967	182,987	176,763	153,219	141,514	163,272
Turkey	Employee	2,618	2,897	3,165	3,361	3,541	3,622	3,634	3,724
	VA total	65,815	77,647	75,489	87,897	88,555	86,482	90,859	94,184
	Output	358,547	425,226	429,707	454,976	455,544	410,605	404,121	431,681

SOURCE | ELABORATION BASED ON THE UNIDO INDSTAT 2 2019 DATABASE (UNIDO, 2019B).
NOTE | UNIT FOR EMPLOYEES: THOUSAND; UNIT FOR VA AND OUTPUT: MILLIONS OF USD, CURRENT PRICES; TABLE 2.7 IS CALCULATED BASED ON DATA IN TABLE 2.6

highest value in Turkey (0.22 in 2017). More surprisingly, VA to output ratio in Saudi Arabia's manufacturing sector during that period was even higher than some leading industrialized countries, such as Germany (period average 0.29) [15] .

The practical interpretation of the above results should be taken with caution. Firstly, the values in Table 2.6 are based on USD current prices rather than constant price. Therefore, the values may be significantly affected by exchange rates. For example, the exchange rate between USD and Brazilian Real fluctuated sharply over the past decade, while the exchange rate between USD and Saudi Arabian Riyals is more stable in the past 10 years. USD's exchange rates with Euros and Japanese Yen also fluctuated significantly over the past decade. Secondly, different countries may be at various levels of industrialization, which possibly have impact on VA to output ratios. For example, as noticed by Long and Zhang (2012), a lower VA to output ratio may indicate a finer division of labor and increased industrial interaction, which exist more often in economies with higher level of industrialization. Thirdly, since the data are obtained from census/surveys, the coverage, measurement, and sampling may differ across countries. Nevertheless the data in Table 2.6 and Table 2.7 provides useful information in addition to the National Accounts data on MVA in previous tables.

It is also observed that the manufacturing employment in Brazil and South Africa did not increase stably between 2010 and 2017. For example, in Brazil, manufacturing employment increased rapidly from around 7,617 thousand in 2010 to near 8,116 thousand in 2013 (the peak), but dropped sharply in the next couple of years to only about 7,356 thousand. Nevertheless, it is not possible to argue that the changes of manufacturing employment in Brazil reflect a shrinking of Brazil's manufacturing, as the reduction of manufacturing employment may be caused by technological improvements (e.g., Chang and Hong, 2006).

By contrast, manufacturing employment in Saudi Arabia and Turkey increased steadily between 2010 and 2017. Manufacturing employment in Saudi Arabia increased from

15 Calculated based on data in UNIDO INDSTAT 2 (UNIDO, 2019b)

TABLE 2.7 | VA PER EMPLOYEE AND VA TO OUTPUT RATIO IN SAUDI ARABIA AND COMPARATOR COUNTRIES, 2010-2017

Country		2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	VA per employee	85,823	87,233	92,858	93,387	89,139	82,955	81,179	92,056
	VA to output	0.51	0.51	0.53	0.52	0.52	0.49	0.49	0.53
Brazil	VA per employee	40,362	44,817	39,389	38,284	37,124	27,276	28,263	31,985
	VA to output	0.30	0.30	0.29	0.28	0.28	0.27	0.27	0.27
South Africa	VA per employee	38,813	41,285	39,514	36,423	35,299	29,932	25,016	29,027
	VA to output	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Turkey	VA per employee	25,139	26,806	23,849	26,151	25,010	23,878	24,999	25,293
	VA to output	0.18	0.18	0.18	0.19	0.19	0.21	0.22	0.22

near 714 thousand to about 960 thousand (34.5%), and in Turkey it increased from about 2.6 million to 3.7 million (42%). This can reflect that the manufacturing sector was expanding during that period, as technology is not likely to decline. This finding corresponds to the results based on MVA as well. Also, it provides some implications to promote the workforce participation of Saudi nationals under the Vision 2030.

To briefly summarize this sub-section, Saudi Arabia demonstrated a steady growth of its capacity to produce, even taking the size of economy (GDP), population size, and oil price into consideration. This is also supported by the increased manufacturing employment in recent years. By contrast, the manufacturing production performances in Brazil and South Africa are less sustainable, as negative growth were recorded several times. Saudi Arabia's commitments to diversify its economy and enhancing manufacturing development under the Vision 2030 were also reflected in the recent increase of manufacturing sector's contribution to economy. The productivity in Saudi Arabia's manufacturing sector was also high, as revealed by the high values in indicators such

as VA to output ratio and VA per employee, but the practical interpretation of data from the INDSTAT 2 database should take a number of other factors into consideration. The next sub-section will further examine the competitiveness of Saudi Arabia and the other comparator countries from the angle of trade capacity.

2.2 CAPACITY TO TRADE

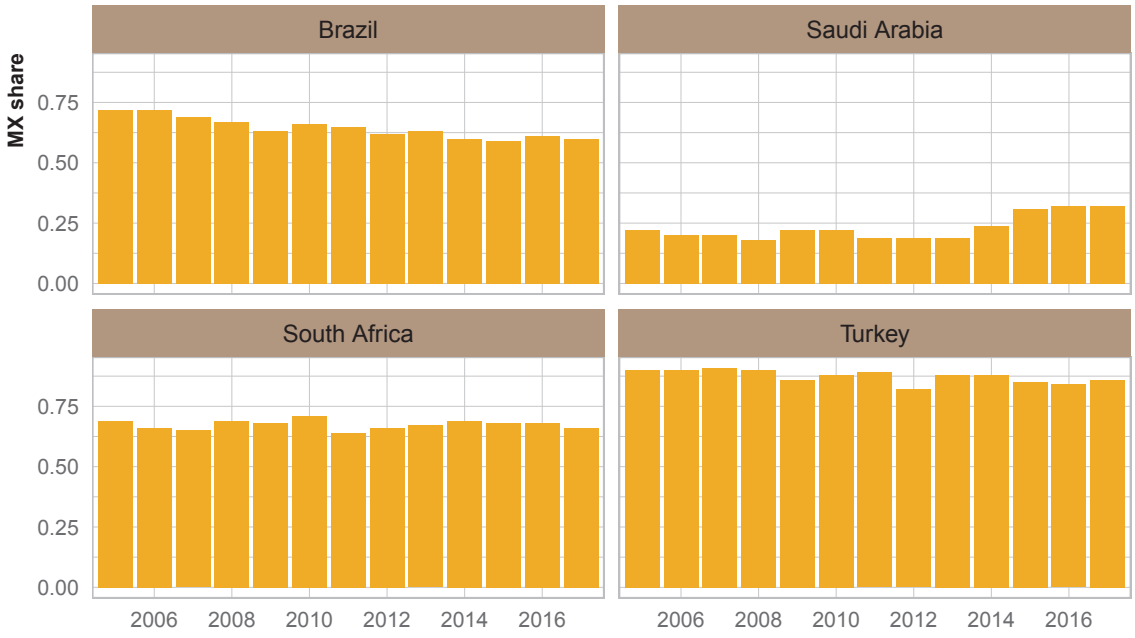
The capacity to trade, which can be understood as the capability to satisfy the demand in addition to the capacity to produce (capability to supply), directly reflects a country's manufacturing competitiveness. This is based on the assumption that the volume and price of manufacturing products sold in market is a suitable measure of a country's manufacturing competitiveness. More specifically, capacity to trade should be considered for both external and domestic markets. In practice, due to easy measurement and data availability, export is usually more noticeable and emphasized. The practice is adopted, and analysis of manufacturing competitiveness in domestic market with data from UNIDO Industrial Demand-Supply Balance (IDSB) database is also added.

2.2.1 COMPETITIVENESS IN EXTERNAL MARKET

Manufactured export performance reveals the competitiveness in external market. One of the most popular indicators to measure manufactured export performance is the share of manufactured export in total exports. As shown in Table 2.7, Saudi Arabia achieved significant increase in the share of manufactured export in total exports between 2005 and 2017, from 22% to 32%. In contrast, share of manufactured export in total exports in Brazil, South Africa, and Turkey decreased during the same period.

However, as noticed in Figure 2.6, the increase of share of manufactured export in total exports in Saudi Arabia is not stable. It dropped from 22% in 2010 to 19% in 2011, and

FIG. 2.6 | SHARE OF MANUFACTURED EXPORTS IN TOTAL EXPORTS, SAUDI ARABIA AND COMPARATOR COUNTRIES



SOURCE | ELABORATION BASED ON THE UNIDO MVA 2019 DATABASE (UNIDO, 2019E).

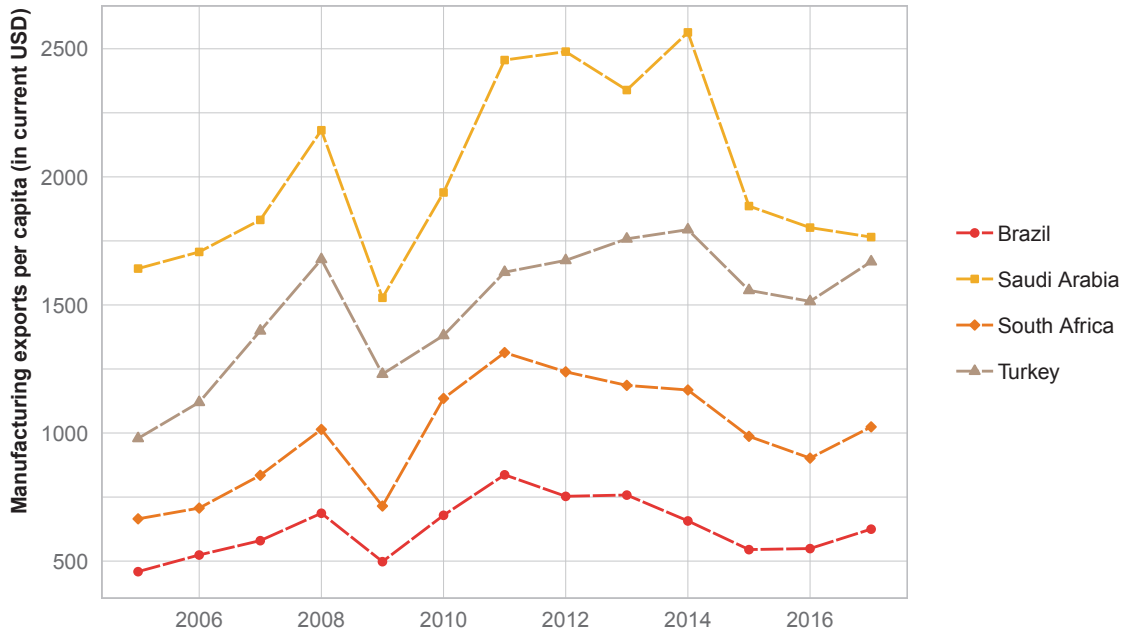
TABLE 2.8 | SHARE OF MANUFACTURED EXPORTS IN TOTAL EXPORTS, SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2005-2017 (IN PERCENT)

Country	2005	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	22	22	19	19	19	24	31	32	32
Brazil	72	66	65	62	63	60	59	61	60
South Africa	69	71	64	66	67	69	68	68	66
Turkey	90	88	89	82	88	88	85	84	86
GCC	22	21	19	19	20	21	21	23	23
MENA	34	36	31	30	33	35	38	41	42
World	78	76	75	74	75	77	79	80	80

SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

remained for 3 years until it jumped to 24% in 2014 and further soared to 31% in 2015. Also, in comparison with Brazil, South Africa, and Turkey, even these three comparator countries' share of manufactured export in total exports dropped between 2005 and 2017, Saudi Arabia is lagging far behind. The core reason of this difference is that the industrialization in Brazil and South Africa are export-oriented (e.g., Young, 1998; Rodrik, 2008). Another reason is that Saudi Arabia's export largely relies on its oil sector instead of manufacturing. That also somewhat explains the share of manufactured export in total exports in Saudi Arabia dropped and remained relatively low between 2011 and 2013 when oil price was relatively high (Figure 2.2).

FIG. 2.7 | CHANGES OF MANUFACTURED EXPORTS PER CAPITA OVER YEARS, SELECTED COUNTRIES



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F).

The indicator manufactured exports per capita, which shows the national efficiency to trade manufactured goods and therefore the competitiveness, is adopted to control the effects of population on manufactured export performance. The manufactured exports per capita of Saudi Arabia and the three comparator countries are presented in Table 2.9 and Figure 2.7.

All four countries demonstrate noticeable increase in manufactured exports per capita between 2005 and 2017. The total increase in manufactured exports per capita is smallest in Saudi Arabia (USD 166.7) among the four countries, and the increase is not table. The three comparator countries also experienced fluctuations in manufactured exports per capita during the same period. However, in the absolute term, Saudi Arabia has significantly higher manufactured exports per capita than Brazil and South Africa. This could be largely ascribed to Saudi Arabia's much smaller population size than Brazil and South Africa, and the manufacturing workforce consists of a large proportion of foreign workers (e.g., GaStat, 2018). It is noted that manufactured exports per capita in Turkey

TABLE 2.9 | SHARE OF MANUFACTURED EXPORTS IN TOTAL EXPORTS, SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2005-2017 (IN PERCENT)

Country	2005	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	1,642	1,939	2,456	2,489	2,339	2,564	1,886	1,802	1,765
Brazil	458	679	837	753	758	657	545	549	626
South Africa	665	1,135	1,314	1,239	1,186	1,168	987	902	1,024
Turkey	979	1,381	1,628	1,674	1,758	1,794	1,557	1,514	1,669
GCC	2,146	2,690	3,424	3,623	3,712	3,575	2,603	2,181	2,159
MENA	514	772	908	914	967	978	806	732	793
World	1,177	1,566	1,822	1,802	1,840	1,856	1,649	1,588	1,716

SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

increased faster than other three countries between 2005 and 2017. In 2017, its manufactured exports per capita were near USD 1,670, narrowly behind Saudi Arabia (USD 1,801). But in 2005, the figures for Turkey and Saudi Arabia were near USD 979 and USD 1,642 respectively. The rapid growth of manufactured exports per capita in Turkey and the trend of changes suggest a possibility that Saudi Arabia's leading status of manufactured exports per capita to be exceeded by Turkey in the coming years.

Saudi Arabia, Brazil, and Turkey's manufactured exports to industrialized and developing countries are further examined with data from the UNIDO IDSB database (UNIDO, 2019d; for country classification, see UNIDO, 2013, 2019g). The popular belief is that large amount of manufactured exports to industrialized economies better demonstrate a country's manufacturing competitiveness than manufactured exports to developing countries, as the market competition in industrialized economies is usually fiercer, there are more and stricter regulations on manufactured products' quality, and exporters may face more challenges in marketing upgrades

TABLE 2.10 | RATIOS OF MANUFACTURED EXPORTS TO INDUSTRIALIZED ECONOMIES AND DEVELOPING COUNTRIES, FROM SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY

Country	2010	2011	2012	2013	2014	2015	2016
Saudi Arabia	1.97	1.83	1.78	1.62	1.64	1.55	1.11
Brazil	0.95	0.97	0.99	0.94	1.13	1.02	1.03
South Africa	0.74	1.12	0.96	0.93	0.95	1.03	1.11
Turkey	1.5	1.5	1.23	1.25	1.37	1.52	1.57

SOURCE | CALCULATED FROM UNIDO IDSB DATABASE (UNIDO, 2019D)
NOTE | DATA ARE AGGREGATED FROM ISIC REV 4- DIGIT LEVEL, MISSING DATA ARE TREATED AS 0 OR NOT EXISTING; THE ABSOLUTE VALUES OF EXPORT TO DEVELOPING COUNTRIES AND INDUSTRIALIZED ECONOMIES ARE DIRECTLY AVAILABLE BUT NOT PRESENTED IN THE TABLE DUE TO LIMITED SPACES.

and adapting their '…products that appeal to foreign consumers in those markets' (Artopoulos et al, 2010, p13).

Table 2.10 shows the ratios of manufactured exports to industrialized economies and developing countries, from Saudi Arabia, Brazil, South Africa, and Turkey. In general, Saudi Arabia sold more manufactured products to industrialized economies than developing economies. The market size for manufactured exports from Brazil is more balanced between industrialized and developing countries. The ratio of Saudi Arabia's manufactured exports to industrialized countries and developing economies fluctuated sharply in the past years. This is particularly the situation in 2015 and 2016, when the manufactured exports to industrialized economies dropped more than a quarter of the previous year . This should not be ascribed to exchange rate as the exchange rate between USD and Saudi Arabia Riyal remained stable over the past decade. This somewhat suggests that Saudi Arabia's manufacturing competitiveness in developed countries is not very stable, as widely perceived. In contrast, Turkey steadily exported more manufactured products to industrialized economies than developing countries, as shown by the relatively stable ratio of manufactured exports to developing economies and industrialized economies between 2010 and 2016. A reason could be Turkey's geographic closeness to industrialized economies (such as European Union).

2.2.2 COMPETITIVENESS IN DOMESTIC MARKET

Analysis of Saudi Arabia's manufacturing competitiveness in the aspect of domestic market is based on the assumption that the primary purpose of importing is for domestic market consumption instead of re-export (or 'import for export')[17]. Therefore, the indicator 'import to apparent consumption ratio' is used to examine a country's manufacturing competitiveness in domestic market, and a high imports to apparent consumption ratio indicates a low competitiveness in domestic market. This is because, a high import to apparent consumption ratio usually suggests that country's manufactured products are not very competitive in the domestic market so that domestic consumers have to choose imported products instead, or the country's manufactured products are insufficient to meet the domestic demands and have to import a lot manufactured products to supplement. Table 2.11 and Figure 2.9 show the import to apparent consumption ratios in Saudi Arabia, Brazil, and Turkey between 2010 and 2016 (the data for Saudi and the 2016 data for Brazil are not available).

17 This assumption is more reliable for countries with large domestic market. In contrast, for small economies the validity of this assumption could be low. For example, the primary purpose of importing in Singapore may be for re-export. But for countries such as Saudi Arabia and the selected comparator countries, which have substantial population sizes and land areas, this assumption should be reliable.

From Table 2.11 and Figure 2.8, it is noticeable that Saudi Arabia's domestic consumption of manufactured products has a high reliance on imports. The import to apparent consumption ratio was 0.76 in 2010, which soared to 0.92 in 2012 and 2014. That means, in these two years, for every USD 100 valued manufactured products consumption in Saudi Arabia, USD 92 valued were imported. However, this ratio dropped significantly to 0.8 in 2015 and further reduced to 0.67 in 2016. It corresponded to the oil price, as lower oil price in 2015 and 2016 significantly reduced Saudi Arabia's capability to import, which can be revealed from the reduction in the absolute value of manufactured imports as well[18]. This again provides evidence to support Saudi Arabia's efforts in reducing the reliance on oil sector, under its national development strategy Vision 2030.

TABLE 2.11 | IMPORTS TO APPARENT CONSUMPTION RATIOS IN SAUDI ARABIA, BRAZIL, AND TURKEY

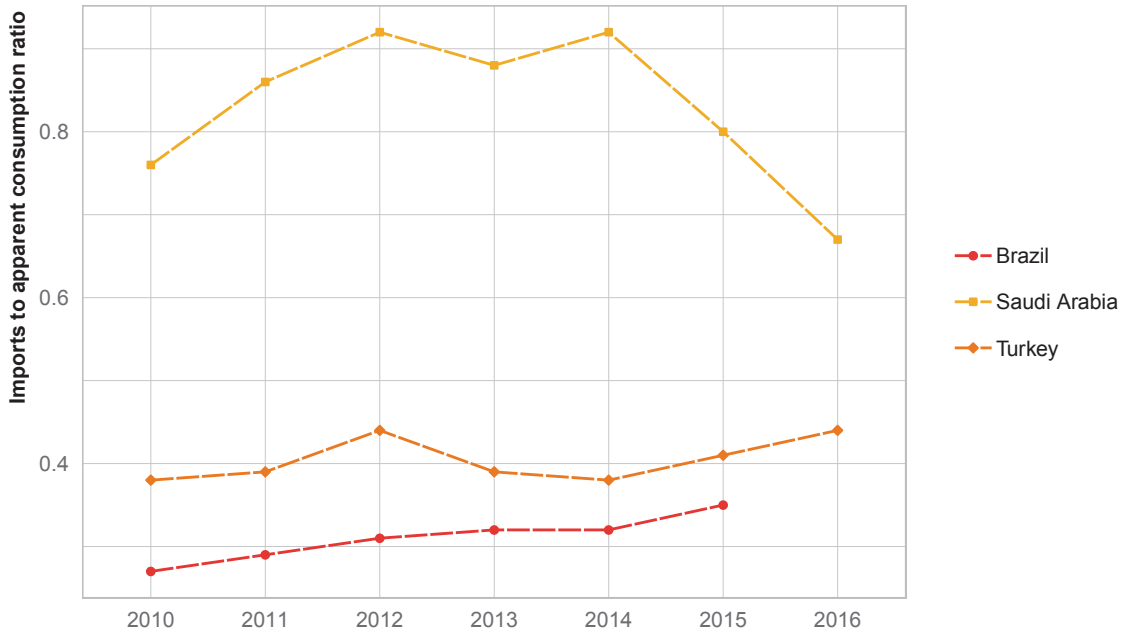
Country	2010	2011	2012	2013	2014	2015	2016
Saudi Arabia	0.76	0.86	0.92	0.88	0.92	0.8	0.67
Brazil	0.27	0.29	0.31	0.32	0.32	0.35	…
Turkey	0.38	0.39	0.44	0.39	0.38	0.41	0.44

SOURCE | CALCULATED FROM UNIDO IDSB DATABASE (UNIDO, 2019D)
NOTE | DATA ARE AGGREGATED FROM ISIC REV.4, 4 DIGIT LEVEL, MISSING DATA ARE TREATED AS VALUE 0, OR 'NOT COUNTED'

18 The absolute values of imports and apparent consumptions are available in the UNIDO IDSB database (UNIDO, 2019d). They are not listed here due to limited spaces. This suggests that the high import to consumption ratio in Saudi Arabia is strongly due to Saudi Arabia's relatively high income levels, especially the oil incomes.

The imports to apparent consumption ratios in Brazil and Turkey are much lower than Saudi Arabia. The variation of this ratio in Brazil was not sharp over the past a few years, however, it increased steadily from 0.27 in 2010 to 0.35 in 2015. This echoes the existing literature and common understanding that Brazil's manufacturing is export-oriented, but also suggests that it relies heavily on foreign investment. For example, the political unrest in Brazil since 2014 has significantly reduced investment in Brazil from other countries (e.g., Doval and Actis, 2016), which is a possible reason of the sharp decrease of manufactured outputs and consumption in the country, and the increase of import to apparent consumption ratio. The import to apparent consumption ratio in Turkey is relatively stable, remained at around 0.4 during the selected period.

FIG. 2.8 | RATIO OF IMPORTS TO APPARENT CONSUMPTION IN SAUDI ARABIA, BRAZIL, AND TURKEY, 2010-2016



SOURCE | CALCULATED FROM UNIDO IDSB DATABASE (UNIDO, 2019D)

2.3 TECHNOLOGICAL UPGRADING AND DEEPENING (STRUCTURAL CHANGE)

Technological upgrading and deepening implies that the manufacturing sector has become more competitive through managing to transform the industrial structure towards higher value-added activities that require sophisticated medium- and high-technology. The level of technological upgrading and deepening is directly linked with the level of technology intensity and quality of goods, and therefore the manufacturing competitiveness. This is why countries often encourage their manufacturing sectors to progressively upgrade and adopt new technologies. A country's technological level can be examined by looking at their main manufacturing economic activities.

Structural change in this context refers to the changes in the share/composition and distribution of economic activities over periods. It is important because it is closely related to the transition of an economy from lower to higher level of productivity and fosters industrial development. Moreover, structural change can indicate that there has been repositioning of a sector in the economic structure, resulting diversification of the production and export bases. This means that the economy is more sophisticated, in terms of the level of technology adoption.

Therefore, two indicators are adopted to evaluate the technological upgrading and deepening (structural change): 1) share of medium- and high-technology value added in total

TABLE 2.12 | SHARE OF MEDIUM- AND HIGH-TECHNOLOGY MVA IN TOTAL MVA, SAUDI ARABIA AND COMPARATOR COUNTRIES (IN PERCENT)

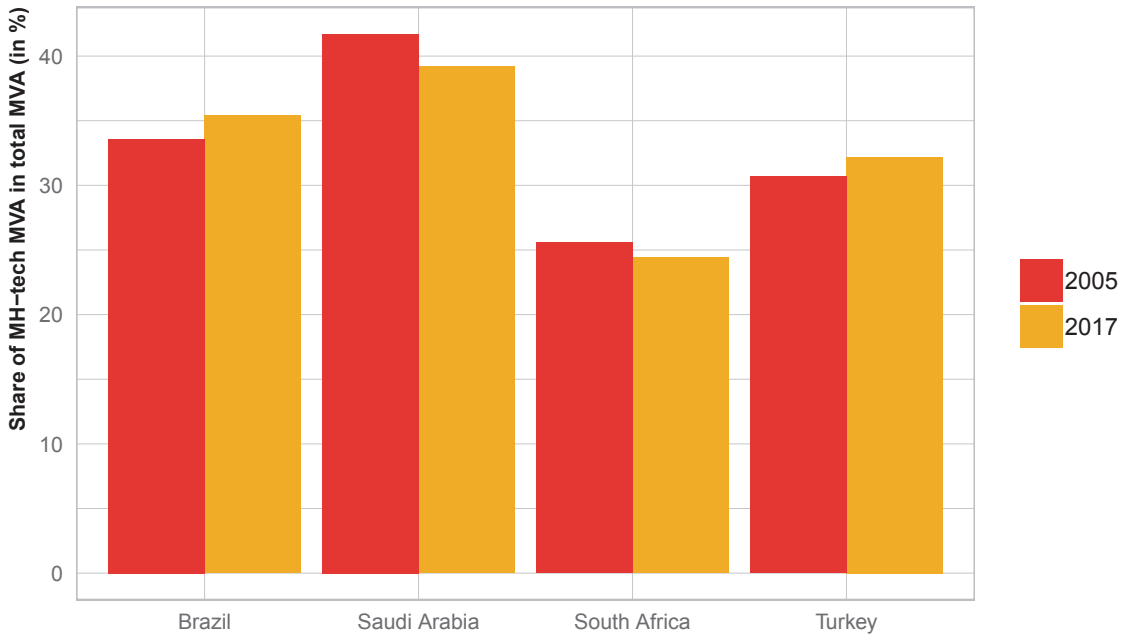
Country	2005	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	42	32	34	34	35	35	38	38	39
Brazil	34	36	36	35	36	34	35	35	35
South Africa	26	25	24	24	24	24	24	24	24
Turkey	31	33	32	32	31	32	33	33	32

SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F).

manufacturing value added; and 2) medium- and high-tech manufactured exports' share in total manufactured exports. The former is defined according to the OECD definition (OECD 2003, 2011) and adapted by UNIDO (UNIDO, 2010) while the latter is based on the classification proposed by Lall (2000). The tables for classification of manufacturing exports and production used in compiling the CIP index are provided in Appendix A. These two indicators will also be examined in relation to MVA's contribution to GDP and manufactured exports in total exports. In addition, the structure of manufactured exports will be examined according to the technology intensity.

Table 2.12 and Figure 2.9 show the share of medium- and high-technology value added in total MVA of Saudi Arabia, Brazil, South Africa, and Turkey over recent years. It is noticed that the shares of medium- and high-technology MVA in total MVA fluctuated sharply in Saudi Arabia between 2005 and 2017, for example, it dropped significantly between 2005 and 2009, and increased by 7 percentage points from 32% in 2010 to 39% in 2017. In contrast, the value of this indicator in Brazil, South

FIG. 2.9 | SHARE OF MEDIUM- AND HIGH-TECHNOLOGY MVA IN TOTAL MVA, SAUDI ARABIA AND SELECTED COUNTRIES, 2005 AND 2017



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

Africa, and Turkey remained rather stable between 2005 and 2017. In comparison with South Africa and Turkey, technology intensity in Saudi Arabia's manufacturing is higher.

However, if taking the absolute amount of MVA into consideration, as shown in Table 2.1, it is possible to notice that although the share of medium- and high-technology value added in total MVA in Saudi Arabia decreased sharply between 2005 and 2010, the absolute amount of medium- and high-technology MVA still increased over that period. This is because the total MVA (2010 constant price) soared from USD 41,991 million in 2005 to USD 58,179 million in 2010, and further increased to USD 84,858 million in 2017. In contrast, although the share of medium- and high-technology MVA in total MVA in Brazil and South Africa remained stable between 2005 and 2017, the absolute amount of medium- and high-technology MVA actually fluctuated significantly because the total MVA in these two comparator countries experienced sharp fluctuations over the period. For example, the share of medium- and high-technology MVA in total MVA in Brazil stayed at around 35% between 2015 and 2017. However, the total MVA in Brazil dropped from USD 257,000 million in 2015 to USD 248,932 million in 2017. Therefore, the absolute amount of medium- and high-technology value added in Brazil also decreased accordingly. Saudi Arabia has higher technology intensity in its manufacturing than South Africa, because it has both significantly higher absolute amount and share of medium- and high-technology value added in total MVA as shown in Table 2.12.

The high technology intensity in Saudi Arabia manufacturing leaves spaces for the Kingdom's commitments of improving its education and providing equal opportunities under the Vision 2030. High technology intensity in Saudi Arabia's manufacturing demands a large amount of well-educated talents who have the knowledge and skills, which requires the Kingdom to enlarge educational investments and take more efforts to connect the market needs and its educational system. This also corresponds to the Kingdom's objective under the Vision 2030 to have at least five Saudi universities among top 200 in international rankings.

With over 50% percent of Saudi Arabia university graduates being female and more than half of the Kingdom's population are younger than 25 (The Kingdom of Saudi Arabia government, 2016, p37), the high technology intensity in manufacturing of the Kingdom also creates spaces for providing equal opportunities to females and youth. For example, high-tech jobs[19] in manufacturing may provide suitable opportunities to female university graduates, which will reduce the gender inequalities in accessing high-tech jobs. In addition, since high-tech jobs usually offer higher remuneration packages, the gender wage gaps may also be reduced. Similarly, since innovators in knowledge-intensive sectors are significantly younger than experience-based sectors (e.g., Mariani and Romanelli, 2007), high technology intensity in Saudi Arabia's manufacturing also provides more opportunities to the youth, which contributes to reduce youth unemployment and age inequalities.

19 Although there is a long-running debate about whether technology reduces gender inequalities, it is a consensus that jobs with higher knowledge and technology intensity usually do not require heavy physical labor work, therefore males' physical strengths in these jobs are not that obvious in comparison to jobs with lower knowledge and technology intensity.

Table 2.13 has information on medium- and high-tech manufactured exports' share in total manufactured exports from Saudi Arabia, Brazil, South Africa, and Turkey. It is observed that Saudi Arabia's competitiveness in medium- and high-tech overseas market was not as strong as the three comparator countries before 2015. Its share of medium- and high-tech manufactured exports in total manufactured exports in was only about 24%, half as Brazil and South Africa in the same year. However, Saudi Arabia's share of medium- and high-tech manufactured exports in total manufactured exports increased sharply from 37% to 47% between 2015 and 2016, and stayed in 47% in the following year. In these two years, its shares of medium- and high-tech manufactured exports in total manufactured exports were higher than Brazil and Turkey, and were narrowly lower than South Africa.

Figure 2.10 compares the relationship between the levels of technological upgrading in manufactured exports and the share

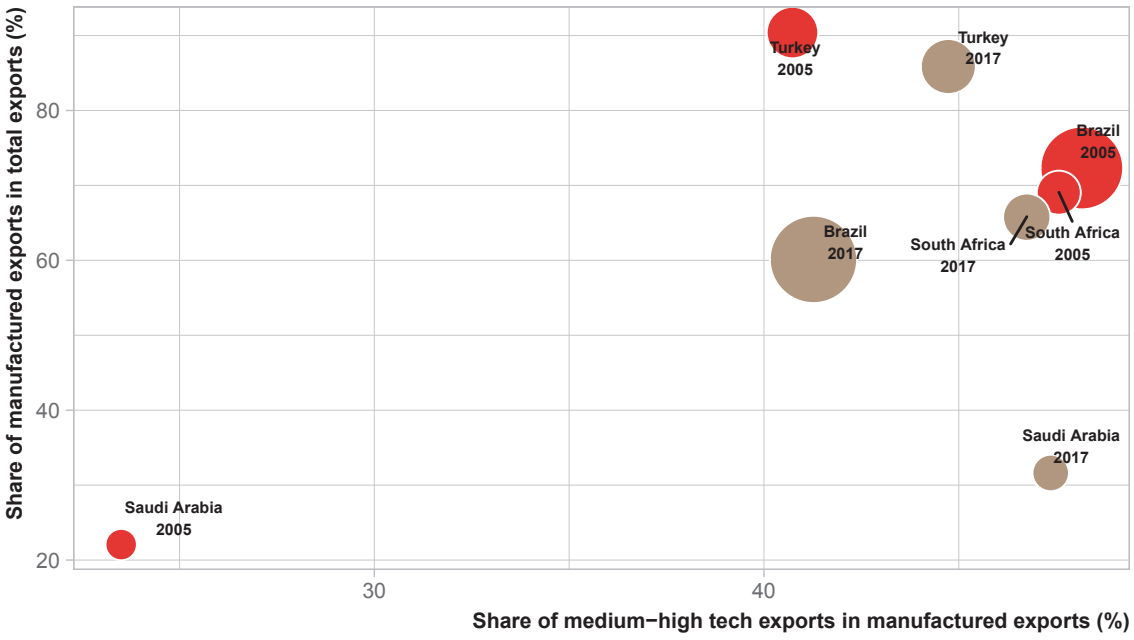
TABLE 2.13 | SHARE OF MEDIUM- AND HIGH-TECH MANUFACTURED EXPORTS IN TOTAL MANUFACTURED EXPORTS FROM SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY (IN PERCENT)

Country	2005	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	24	36	37	36	36	34	37	47	47
Brazil	48	36	36	39	40	38	41	43	41
South Africa	48	46	44	45	44	46	50	50	47
Turkey	41	43	41	40	41	41	42	43	45

SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F).

of manufactured exports in total exports, in 2005 and 2017. Saudi Arabia showed positive growth in the two indicators, and the share of its medium-and high-tech manufactured exports expanded more visibly that its share of manufactured exports in total exports. By contrast, Brazil and South Africa witnessed a decrease in these two indicators. This demonstrates that the technology intensity in manufactured exports is positively associated with share of manufactured exports in total exports. Turkey's share of medium- and high-tech manufactured exports increased between 2005 and 2017, but its share of manufactured exports in total exports dropped during the same period. However, the situation of Turkey is significantly different, as its share of manufactured exports in total exports was quite high between 2005 and 2017 (near 90%). Such a decrease is more possibly a natural fluctuation of the country's overall export structure and a reduction of reliance on manufactured exports[20].

FIG. 2.10 | SHARE OF MEDIUM- AND HIGH-TECH MANUFACTURED EXPORTS AND SHARE OF MANUFACTURED EXPORTS IN TOTAL EXPORTS, SAUDI ARABIA AND THE COMPARATOR COUNTRIES, 2005 AND 2017



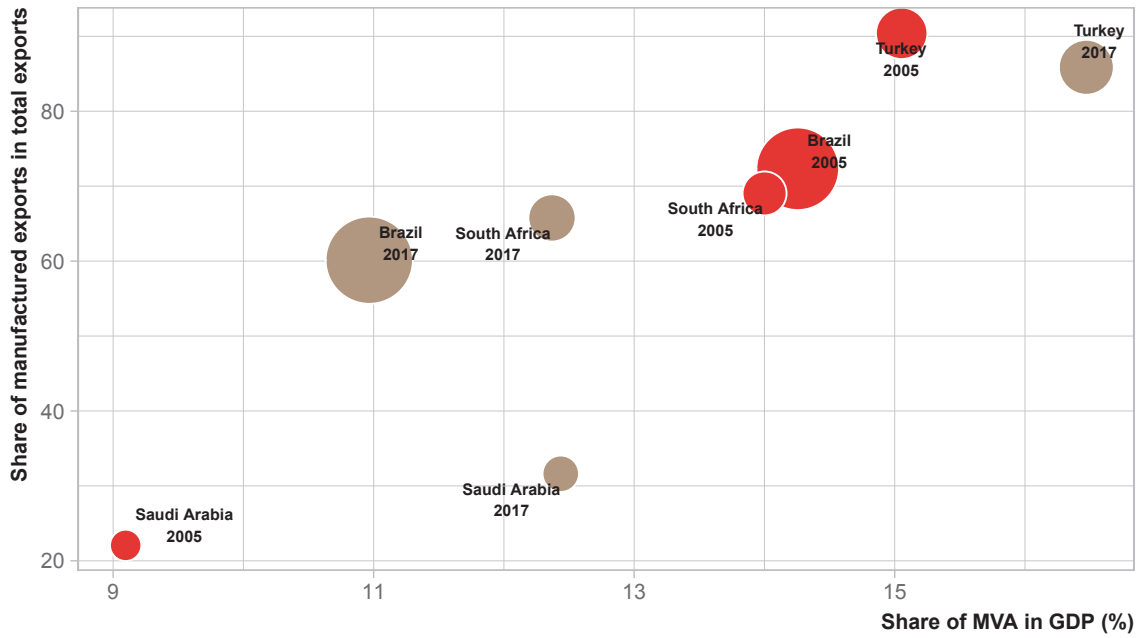
SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

20 Although a high percentage of manufactured exports in total exports is a positive indicator of the development of a country's manufacturing or even its whole economy, such a high reliance on manufactured exports usually indicates that country's other sectors are not competitive (at least in global market). That is not a good sign of its economy as a whole.

Figure 2.11 compares the relationship between production structure and trade structure of Saudi Arabia and the comparator countries in 2005 and 2017. These are reflected by the contribution of MVA to GDP and share of manufactured exports in total exports. Saudi Arabia also experienced positive growth in these two indicators. By contrast, Brazil and South Africa demonstrated negative growth in these two indicators. Findings of these two figures again provide evidence of improvement of capacity of production and trade of Saudi Arabia's manufacturing.

Figure 2.12 compares the technology intensity in manufactured exports and manufacturing production, indicated by share of medium- and high-tech exports in total manufactured exports and medium- and high-tech VA in total VA respectively. Saudi Arabia's share of medium- and high-tech VA in total VA dropped slightly from 42% to 39% between 2005 and 2017, but its share of medium- and high-tech exports in total manufactured

FIG. 2.11 | PRODUCTION STRUCTURE AND TRADE STRUCTURE OF SAUDI ARABIA AND THE COMPARATOR COUNTRIES IN 2005 AND 2017

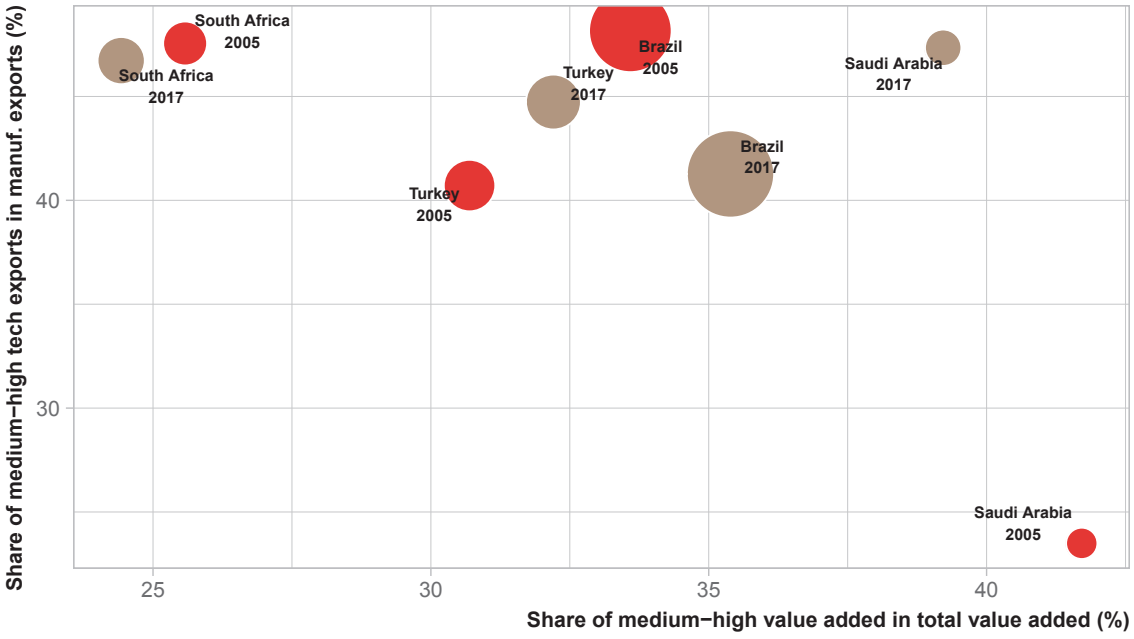


SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F) AND UNIDO MVA 2019 DATABASE (UNIDO, 2019E).

exports soared from 24% to around 47%, almost doubled. Similarly, Brazil's share of medium- and high-tech exports in total manufactured exports also increased while experienced a reduction in share of medium- and high-tech VA in total VA between 2005 and 2017. This finding contradicts to the popular belief that the changes of technology intensity in manufactured exports and manufacturing production should be consistent. Therefore, the findings provide evidence to support that such a popular belief does not reflect the situation of all countries. In addition, the association between technology intensity in manufactured exports and manufacturing production may be affected by other factors as well (e.g., Roper and Love, 2002).

In terms of manufactured export based on technology intensity, as shown in Figure 2.13, although Saudi Arabia has the smallest share of high-technology manufactured exports in comparison with the three comparator countries, it has the largest proportion of medium-tech manufactured exports. This

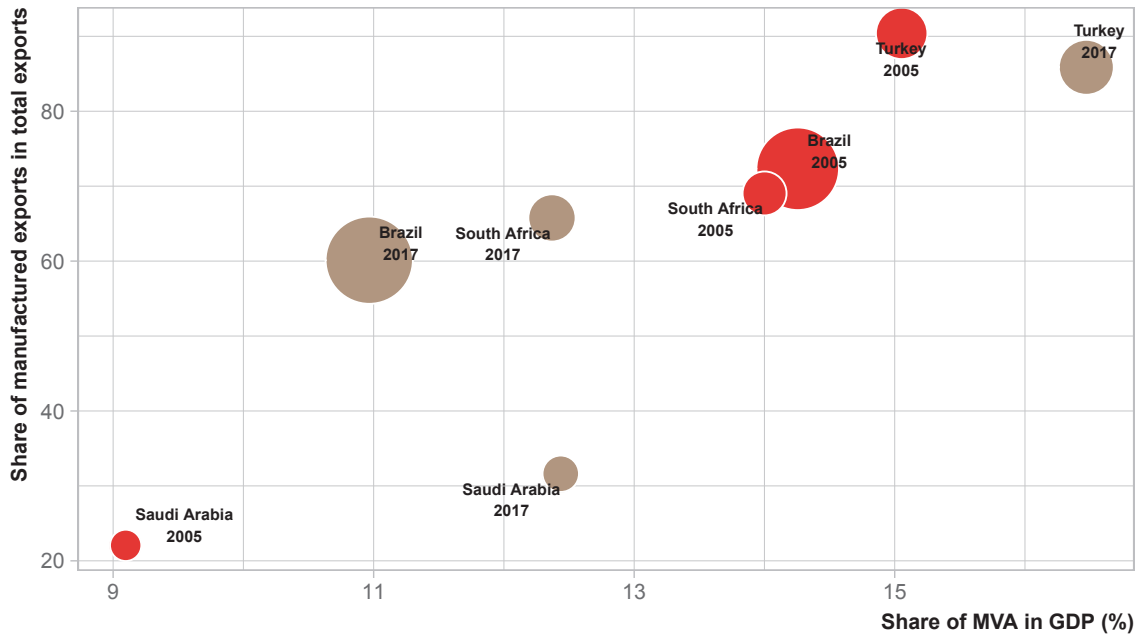
FIG. 2.12 | TECHNOLOGY INTENSITY IN MANUFACTURING PRODUCTION AND EXPORTS



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

again demonstrates Saudi Arabia's technological strengths in its manufacturing. Brazil has the largest share of resource-based manufactured exports (near 50%), which is the highest in these four countries. In contrast, Turkey has the lowest share of resource-based manufactured exports in these four countries, but it has the highest proportion of low-tech manufactured exports.

FIG. 2.13 | SHARE OF MANUFACTURED EXPORT BY TECHNOLOGY INTENSITY



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)
NOTE | RB, LT, MT, AND HT STAND FOR 'RESOURCE-BASED', 'LOW-TECH', 'MEDIUM-TECH', AND 'HIGH-TECH' RESPECTIVELY

03. WORLD COMPETITIVENESS RANKINGS

The world competitiveness rankings show the competitiveness and the position of a country in the global market. With the growing interest of policy-makers to evaluate and compare the competitiveness of countries, a number of tools to compare competitiveness internationally have been developed. In order to cover more specifically on industrial competitiveness and how countries perform on this dimension, UNIDO has constructed the Competitive Industrial Performance (CIP) Index.

The CIP Index evaluates and ranks industrial competitiveness by capturing the ability of countries to produce and export (UNIDO, 2017)[21]. It has eight indicators which are grouped into three different dimensions: 1) National manufacturing capacity; 2) Level of technological deepening and upgrading; and 3) World impact of their production export. Due to the strong connection between competitiveness and UNIDO's mandate Inclusive and Sustainable Industrial Development (ISID), as well as the United Nations Sustainable Development Goal 9 on industrial innovation and infrastructure (SDG 9), the CIP Index also functions as an effective tool to evaluate and monitor the ISID and SDG 9.

21 This is one of the best references which introduces the CIP Index in detail. Although there are later versions of CIP reports in later years, this reference lays out a theoretical and methodological foundation of describing the core contents of the CIP Index and its relationships with ISID and SDG 9.

Table 3.1 and Figure 3.1 show the CIP rankings of Saudi Arabia, Brazil, South Africa, and Turkey from 2001. A most noticeable common feature of these four countries, especially Saudi Arabia, is that the fluctuation of the CIP ranking was not significant between 2001 and 2017. For example, Saudi Arabia's rank in CIP Index improved gradually and steadily from 46th in 2001 to 38th in 2005, and remained 38th until 2008 when it further increased to 37th. Its CIP ranking remained in the 37th place for another 10 years. Similarly, the CIP ranking of South Africa varied between 40th and 45th over the same period. The CIP rankings of Brazil and Turkey did not fluctuate sharply either, however, it is noticed that Brazil's CIP ranking quintile was 'top' between 2001 and 2006, which dropped to and remained in the quintile of 'upper middle' since 2007[22]. By contrast, CIP rankings of Turkey progressed to the top class from 2011. For all other years, all these four countries were in the quintile of 'upper middle'. The closeness of CIP

TABLE 3.1 | CIP INDEX RANKING OF SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2010 AND 2017

Country	CIP rank in 2005	CIP rank in 2010	CIP rank in 2017	Change (2010-2017)
Saudi Arabia	38	37	37	0
Brazil	29	31	35	-4
South Africa	41	40	45	-5
Turkey	30	30	28	2

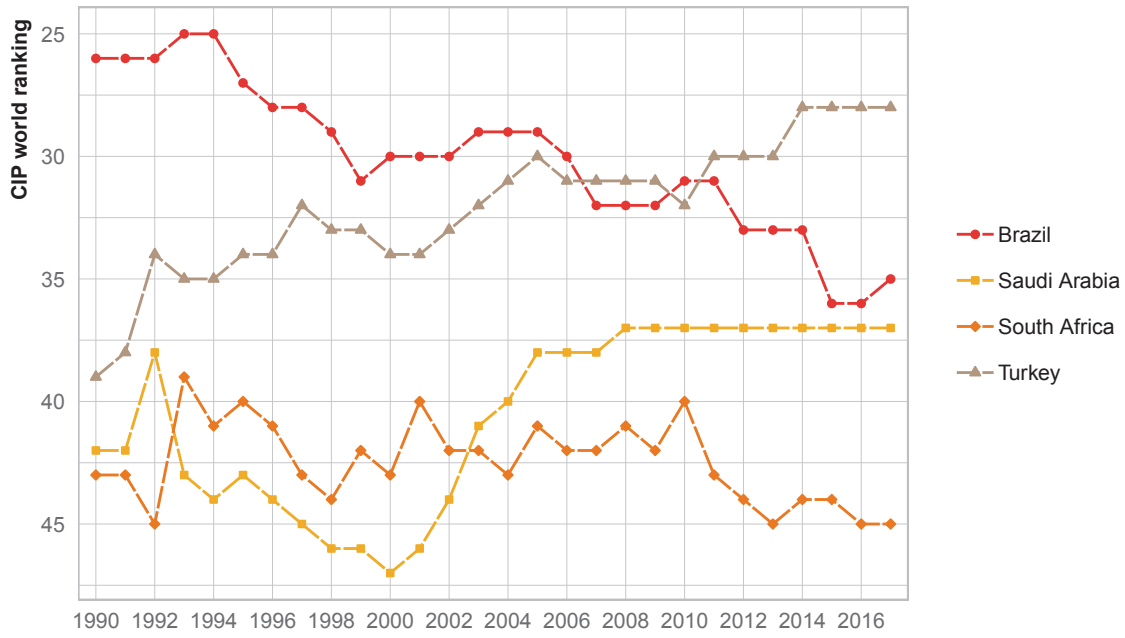
SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F).

22 The information on the quintile of rankings are available in the UNIDO CIP database. They are not listed here due to limited spaces.

Index ranks and similarity in the CIP ranking change patterns are also reasons to select Brazil, South Africa, and Turkey as the comparator countries when evaluating Saudi Arabia's industrial competitiveness.

Saudi Arabia's CIP landscapes in 2005 and 2017 have been further decomposed according to the eight indicators under the three main dimensions, as revealed in Figure 3.2. In comparison with the two other dimensions, the indicators under the dimension of technological deepening and upgrading experienced much sharper variations between 2005 and 2017. For example, the ranking of Saudi Arabia's share of MVA in total GDP improved from 107th in 2005 to 63rd position in 2017. However, Saudi Arabia's performance measured by the two indicators under the dimension of national manufacturing capacity dropped. For example, its ranking of manufactured export per capital dropped from 46th in 2005 to 53th in 2017.

FIG. 3.1 | CIP RANKINGS, 1990-2017, SAUDI ARABIA AND THE COMPARATOR COUNTRIES



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F)

Another widely-used world competitiveness ranking system is the Global Competitiveness Index (GCI), which is published by the World Economic Forum on an annual basis. GCI covers 12 dimensions which include 1) Institutions; 2) Appropriate infrastructure; 3) Stable macroeconomic framework; 4) Good health and primary education; 5) Higher education and training; 6) Efficient goods markets; 7) Efficient labor markets; 8) Developed financial markets; 9) Ability to harness existing technology; 10) Market size; 11) Production of new and different goods using the most sophisticated production processes; and 12) Innovation. These 12 dimensions are operationalized by over 100 indicators. It is able to understand that in GCI, competitiveness has a much broader meaning than in CIP Index, which focuses on industrial competitiveness with specific analysis on production, trade, and technology intensity (structural change).

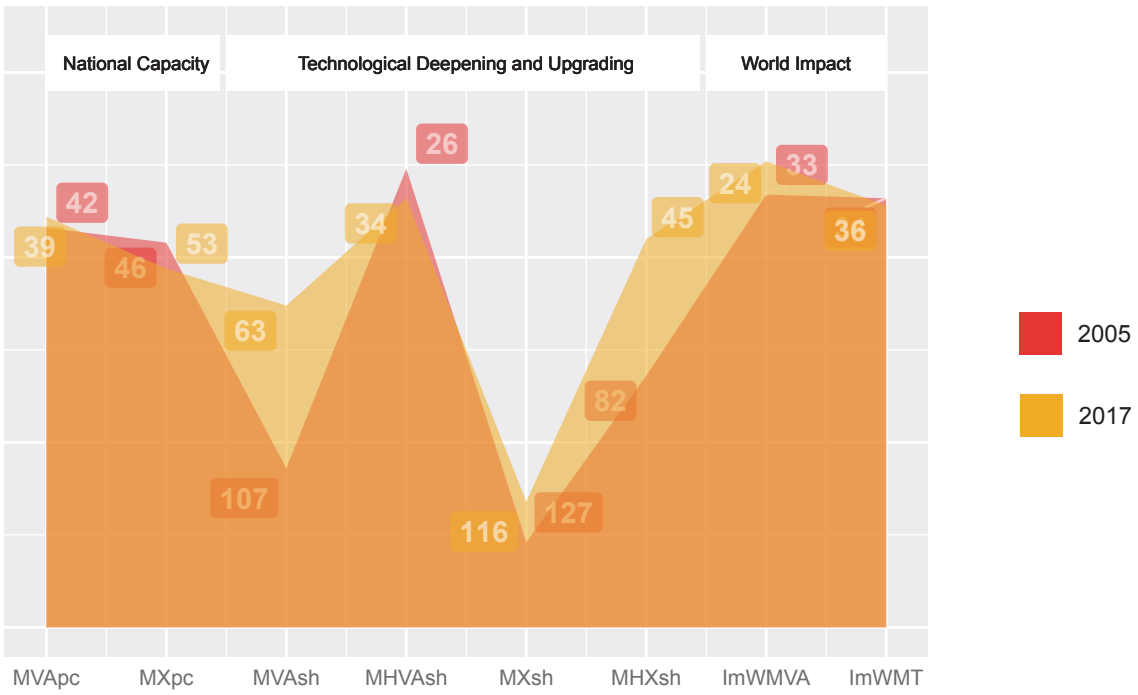
TABLE 3.2 | CIP INDEX RANKING OF SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2010 AND 2017

	GCI Ranking								
	2011	2012	2013	2014	2015	2016	2017	2018	Changes (2011-2018)
Number of countries	142	144	148	144	140	138	127	140	
Saudi Arabia	17	18	20	24	25	29	30	39	-22
Brazil	53	48	56	57	75	81	80	72	-19
South Africa	50	52	53	56	49	47	61	67	-17
Turkey	59	43	44	45	51	55	53	61	-2

SOURCE | WORLD ECONOMIC FORUM, VARIOUS YEARS
NOTE | DATA AVAILABILITY AND NUMBER OF COUNTRIES IN THE RANKING VARY ACROSS YEARS. THE NUMBER OF COUNTRIES RANKED IN THE RESPECTIVE YEAR IS GIVEN IN THE FIRST LINE

Table 3.2 presents the GCI of Saudi Arabia, Brazil, South Africa, and Turkey from 2011 to 2018. It is observed that, in comparison with CIP Index, these three countries' ranks fluctuated much sharper. For example, Saudi Arabia's ranking dropped from 30th in 2017 to 39th in the following year. Similarly, Brazil's ranking dropped suddenly from 57th in 2014 to 75th in 2015, but improved from 80th in 2017 to 72nd in 2018. South Africa also experienced a fall of 20 positions from 47th in 2016 to 67th in 2018. Turkey's ranking dropped from 45th in 2014 to 61st in 2018. Such sharp fluctuations are possibly due to the wide coverage of competitiveness in the context of GCI, which includes a number of factors related to but are not directly part of manufacturing or industry. These factors are more likely to change quickly on a yearly basis. The GCI correctly reminds that the research and evaluation of manufacturing competitiveness should be in line with the country context and the supporting environment (such as health, education, and financial market). This is an important

FIG. 3.2 | DECOMPOSITION OF SAUDI ARABIA'S CIP LANDSCAPES IN 2005 AND 2017



SOURCE | UNIDO CIP 2019 DATABASE (UNIDO, 2019F).

reason that leading industrialized economies such as Germany and Japan are not included as comparator countries, as did in some other research (e.g., Lenzen and Wachsmann, 2004).All the four countries' GCI rankings dropped between 2011 and 2018. Turkey's declining in the GCI ranking in recent years is possibly associated with its debt crisis.

The International Institute for Management Development (IMD) produces the World Competitiveness Ranking, which is also a popular index to measure competitiveness of countries. The criteria of the IMD World Competitiveness Ranking include four main dimensions: 1) Economic performance; 2) Government efficiency; 3) Business efficiency; and 4) Infrastructure. Following these four main dimensions, over 200 indicators with data from official statistics and surveys are used to calculate final scores of competitiveness. In comparison with UNIDO's CIP and World Economic Forum's GCI rankings, the IMD World Competitiveness Ranking compares significantly fewer countries (less than 70 countries are included in the IMD World Competitiveness Ranking). This makes its results not very comparable with other rankings.

Saudi Arabia's position in the IMD World Competitiveness Ranking list improved significantly from 36th in 2017 to 26th in 2019. In contrast, positions of all three comparator countries dropped during the same period. Nevertheless the fall of positions of the comparator countries may be ascribed to the changes of number of countries on the list each year. The limitation of data availability significantly reduces the popularity and generalizability of the IMD World Competitiveness Ranking.

Deloitte Touche Tohmatsu Limited (Deloitte Global) and United States Council on Competitiveness develop the Global Manufacturing Competitiveness Index (GMCI). It sent

surveys to chief executive officers (CEOs) to learn first-hand information of how manufacturing CEOs view competitiveness around the world[23]. The respondents have a wide coverage of different industries, regions, and firm sizes. Although it is titled with manufacturing, GMCI investigates three dimensions: 1) Business confidence and current environment; 2) Manufacturing competitiveness; and 3) Demographics. Indicators under the three dimensions are different in various versions of GMCI.

It is observed that the relative position of Saudi Arabia remained rather stable in these three publications of GMCI, since the numbers of countries on the GMCI lists are different each year. The limited number of countries and low data availability are significant shortcomings of GMCI, as the over-period comparisons are therefore not plausible. However, its direct involvement of business managers and the strong emphasis on business environment increase GMCI's popularity in the commercial context.

Focusing on the aspect of innovation, which is a driver of increasing competitiveness, industrialization, and economic development, the Global Innovation Index (GII) aims to capture the multi-dimensional facets of innovation and rank world economies' innovation capabilities and results. GII includes seven pillars: 1) Institutions; 2) Human capital and research; 3) Infrastructure;4) Market sophistication;5) Business sophistication; 6) Knowledge and technology outputs; and 7) Creative outputs. GII is produced and published annually by Cornell University, Institut Européen d'Administration des Affaires, and the World Intellectual Property Organization.

Saudi Arabia's GII ranking dropped from 54th in 2010 to 61st in 2018. Its GII rankings fell particularly significantly between 2014 (38th) and 2018 (61st). South Africa also experienced

23 The respondents, however, may not necessarily be CEOs. Juniors or representatives may respond on behalf of CEOs.

a fall in the GII ranking during the same period. Turkey demonstrates a more sustainable improvement as measured by GII. However, in the most recent year, its GII ranking noticeably dropped from 43rd to 50th. Table 3.3 summarizes Saudi Arabia and the three comparator countries' rankings on IMD, GMCI and GII list.

TABLE 3.3 | A SUMMARY OF SELECTED COUNTRIES RANKINGS ON IMD, GMCI, AND GII LIST

	IMD		GMCI		GII	
	Most recent (2019)	Change from 2011	Most recent (2016)	Change from 2010	Most recent (2019)	Change from 2011
Number of countries	63		40		129	
Saudi Arabia	26	+10 (from 2017)	34	-8	68	-14
Brazil	59	-15	29	-24	66	-19
South Africa	56	-4	27	-5	63	-4
Turkey	51	-12	16	+4 (from 2013)	49	16

SOURCE | INTERNATIONAL INSTITUTE FOR MANAGEMENT DEVELOPMENT WEBSITE, DELOITTE GLOBAL AND UNITED STATES COUNCIL ON COMPETITIVENESS, AND GLOBAL INNOVATION INDEX WEBSITE

NOTE | DATA AVAILABILITY AND NUMBER OF COUNTRIES IN THE RANKING LISTS VARY ACROSS YEARS AND DIFFERENT LISTS. THE NUMBER OF COUNTRIES RANKED IN THE RESPECTIVE INDEX IS GIVEN IN THE FIRST LINE

04. PRODUCTION AND EXPORT DIVERSIFICATION

It is widely agreed that diversification of a country's production and export structure is a driving factor of economic development and industrialization (e.g., Saviotti and Frenken, 2008; Wiig and Kolstad, 2012; Hartmann et al, 2017). This is particularly the situation for resource-based economies which are seeking new areas to reduce their dependence on a narrow set of economic activities and/or external markets (UNIDO and GIZ, 2015, p1). Therefore, the diversification of a country's production and export structure is positively associated with its industrial competitiveness. The following two sub-sections examine Saudi Arabia's production diversification and export diversification respectively, in comparison with the comparator countries.

4.1 PRODUCTION DIVERSIFICATION IN SAUDI ARABIA

Two indicators are selected to measure production diversification: 1) Share of top three manufacturing industries in total manufacturing value added, and 2) Hirschman-Herfindahl Index (HHI) of the domestic manufacturing production. The first indicator is the most straightforward measurement due to its simplicity to be understood and good data accessibility with UNIDO INDSTAT database. However, it only monitors the top segment of the distribution in manufacturing and neglects the remaining economic activities. Therefore, HHI is incorporated as a more sophisticated indicator to examine the wider spectrum of manufacturing. In the context of measuring domestic manufacturing diversification, HHI is obtained by summing the squares of the shares of the value added of the economic activities in the total manufacturing value added.

It is noted from the Table 4.1 and Figure 4.1 that Saudi Arabia has a much higher level of industrial concentration. Although the share of three largest economic activities in total manufacturing value added in Saudi Arabia fluctuated in the past years, it increased from around 63.7% in 2010 to 66.7% in 2017, with an increase of 3 percentage points. Also, the largest economic activities were very stable between 2010 and 2017, either 'Coke, refined petroleum products, nuclear fuel' or 'Chemicals and chemical products', which had a share more than twice of the third largest economic activity 'Food and beverages'[24]. This high industrial concentration as revealed by the dominance of 'Coke, refined petroleum products, nuclear fuel' and 'Chemicals and chemical products' suggests that Saudi Arabia's manufacturing, or even its whole economy, still has a strong reliance on oil sector. This is because both 'Coke, refined petroleum products, nuclear fuel' and 'Chemicals

TABLE 4.1 | SHARE OF TOP THREE MANUFACTURING INDUSTRIES IN TOTAL MANUFACTURING VALUE ADDED, SAUDI ARABIA, BRAZIL, SOUTH AFRICA AND TURKEY (IN PERCENT)

Country	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	63.7	63.5	63.9	62.4	62.3	60.4	61.5	66.7
Brazil	39.4	39.8	40.0	39.0	41.5	44.4	44.4	44.4
South Africa	43.1	43.7	43.7	43.7	43.7	43.7	43.7	43.7
Turkey	30.7	30.7	29.9	30.2	30.3	30.2	30.0	30.5

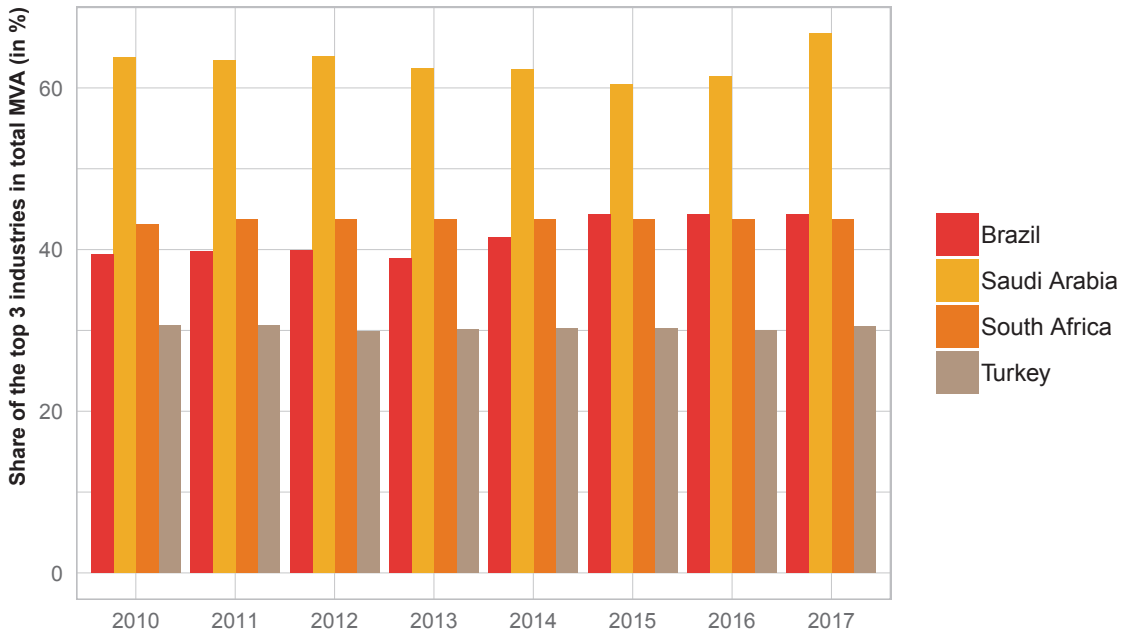
SOURCE | UNIDO INDSTAT 2, 2019 DATABASE (UNIDO, 2019B).

24 Due to limited space, the exact shares of each economic activity's VA in total manufacturing value added are not presented in the table. Readers interested in this information may access it at UNIDO INDSTAT 2 database.

and chemical products' are heavily relied on oil production and refinery. Strong industrial concentration on economic activities heavily relying on the oil sector may be negative for Saudi Arabia's competitiveness, as oil production and refinery are easily affects by uncontrollable factors. This provides evidence to support the commitments to reduce Saudi Arabian economy's reliance on oil sector under Vision 2030.

In comparison with Saudi Arabia, the three comparator countries have higher industrial diversification. For example, the share of three largest economic activities in total manufacturing value added in Turkey during the same period was stable at around 30%, which was less than half of that in Saudi Arabia. In addition, the three comparator countries all have higher diversity in their three largest economic activity of manufacturing. For example, in Brazil, 'Coke, refined petroleum

FIG. 4.1 | SHARE OF VALUE ADDED OF THE THREE LARGEST MANUFACTURING INDUSTRIES TO THE TOTAL MANUFACTURING VALUE ADDED, SELECTED COUNTRIES



SOURCE | UNIDO INDSTAT 2 2019 DATABASE (UNIDO, 2019B).

products, nuclear fuel' is among the three largest economic activity of manufacturing in the year 2010, 2011, and 2014, but its place was replace by 'Motor vehicles, trailers, semi-trailers', 'Chemicals and chemical products', or 'Machinery and equipment n.e.c.' in 2012, 2013, and 2015 to 2017.

In Saudi Arabia, Brazil, and Turkey, there is a mixture of economic activities with different technology intensity (according to the UNIDO classification). 'Food and beverage' is among the top three largest manufacturing economic activities in all countries. These three countries all have MHT economic activities such as 'Motor vehicles, trailers, semi-trailers', 'Chemicals and chemical products', or 'Machinery and equipment n.e.c.'. However, the situation is different in South Africa, in which the three largest manufacturing economic activities are all on the low-technology list. This demonstrates the level of industrialization and economic development of these countries, and their distance with leading industrialized economies which have significantly higher dominance of MHT economic activities in manufacturing. Strong presence of low-technology economic activities in South Africa reflects, and is also reflected by its relative lower position in the CIP rankings.

The Hirschman-Herfindahl index HHI is used to measure the industrial concentration and evaluate the extent to which a country's manufacturing is diverse across various economic activities. The widely adopted HHI is expressed by the following equation:

$$HHI = \sum_{i=1}^{n} s_i^2 \qquad (1)$$

In this equation, the HHI is the sum of the squared shares of all economic activities in the total manufacturing value added, s_i is the share of the value added of economic activity *i* in the total manufacturing value added, and *n* is the number of all economic activities which are included in the calculation. The HHI defined in equation (1) takes values between *1/n* and 1 and this renders it not suitable to compare different countries which might use different number of economic activities *n*. For this purpose the normalized HHI, which will take values in the range 0 to 1 is defined as follows:

$$HHI_{normalized} = \frac{HHI - 1/n}{1 - 1/n} \tag{2}$$

The normalized HHI of manufacturing production in Saudi Arabia and the comparator countries between 2010 and 2017 are calculated and presented in the following Table 4.2 and Figure 4.2.

Table 4.2 and Figure 4.2 show that Saudi Arabia has a significantly higher HHI (normalized) than any comparator country, which suggests a relatively higher industrial concentration.

This provides further evidence to support the findings based on the share of three largest economic activities in total manufacturing value added. In all the eight years between 2010 and 2017, HHI value of manufacturing production in Saudi Arabia was larger than 0.10, whereas the highest HHI value in comparator countries was around 0.057 (2011-2017 in South Africa). Turkey had the lowest and most stable HHI values over these years, which demonstrates a relatively high diversity of manufacturing production. The high diversity of manufacturing production is a contributing factor to its competitiveness. In addition, high diversity of manufacturing production usually

TABLE 4.2 | HHI OF MANUFACTURING PRODUCTION IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY

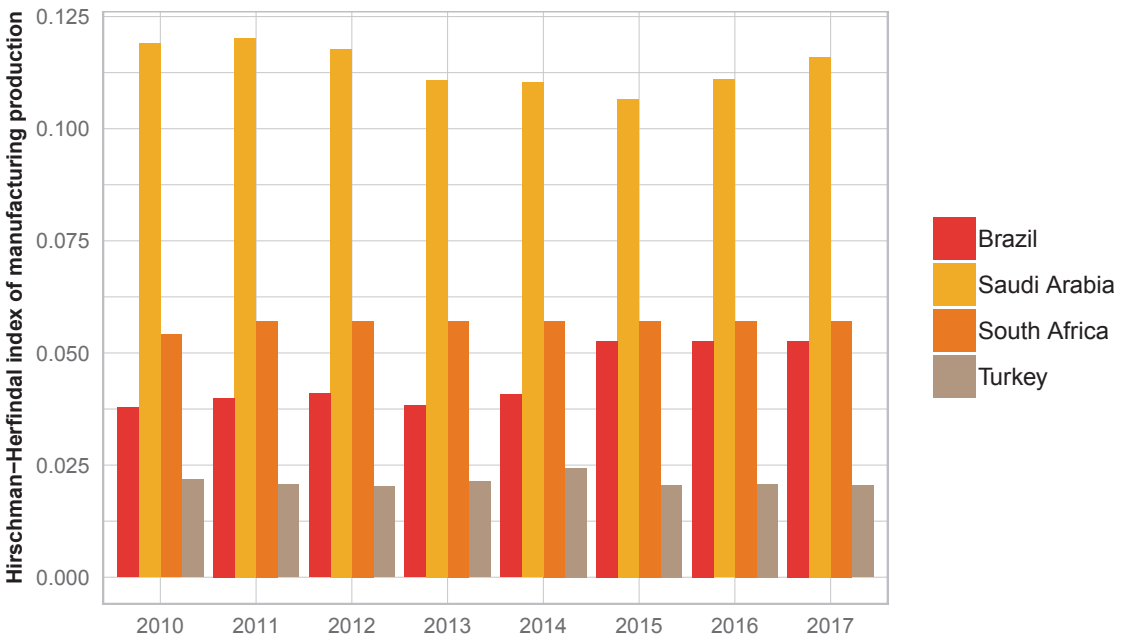
Country	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	0,119	0,120	0,118	0,111	0,110	0,107	0,111	0,116
Brazil	0,038	0,040	0,041	0,038	0,041	0,053	0,053	0,053
South Africa	0,054	0,057	0,057	0,057	0,057	0,057	0,057	0,057
Turkey	0,022	0,021	0,020	0,021	0,022	0,021	0,021	0,021

SOURCE | UNIDO INDSTAT 2 2019 DATABASE (UNIDO, 2019B).
NOTE | THE ROUND UP TO THREE DECIMAL SPACES INSTEAD OF TWO DECIMAL SPACES AIMS TO SHOW MORE EXACT FLUCTUATIONS OF THE HHI

reflects a more comprehensive and dependent industrial system, which reduces a country's reliance on import from other countries (e.g., Pardesi and Matthews, 2007). That is also a positive sign of competitiveness.

HHI of manufacturing production in Saudi Arabia also had sharper fluctuation than South Africa and Turkey between 2010 and 2017. The value of HHI of Saudi Arabia's manufacturing production was 0.119 in 2010, which dropped significantly to 0.110 in 2014, and further decreased to the bottom at 0.107 in 2015. However, two years later it returned to 0.116. Sharp fluctuation of HHI of Saudi Arabia's manufacturing production suggests the relatively lower stability of industrial diversity in Saudi Arabia, which could be a negative factor of its competitiveness.

FIG. 4.2 | BAR CHART OF HHI OF MANUFACTURING PRODUCTION IN SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY



SOURCE | UNIDO INDSTAT 2 2019 DATABASE (UNIDO, 2019B).

4.2 SAUDI ARABIA'S EXPORT DIVERSIFICATION

To evaluate the export diversification of Saudi Arabia, especially its manufacturing, two indicators are adopted: 1) The share of the top three manufactured products exports to the total manufactured exports[25], and 2) the HHI in manufacturing export across products[26]. The first indicator enables a solid understanding of the concentration of the largest three manufactured export products, and the possible fluctuations over years. The second indicator, similar to HHI in manufacturing production, examines the full spectrum of distribution of economic activities in manufacturing, from the perspective of manufacturing export.

TABLE 4.3 | SHARE OF THREE MAIN MANUFACTURED PRODUCTS IN TOTAL MANUFACTURED EXPORTS FROM SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY (IN PERCENT)

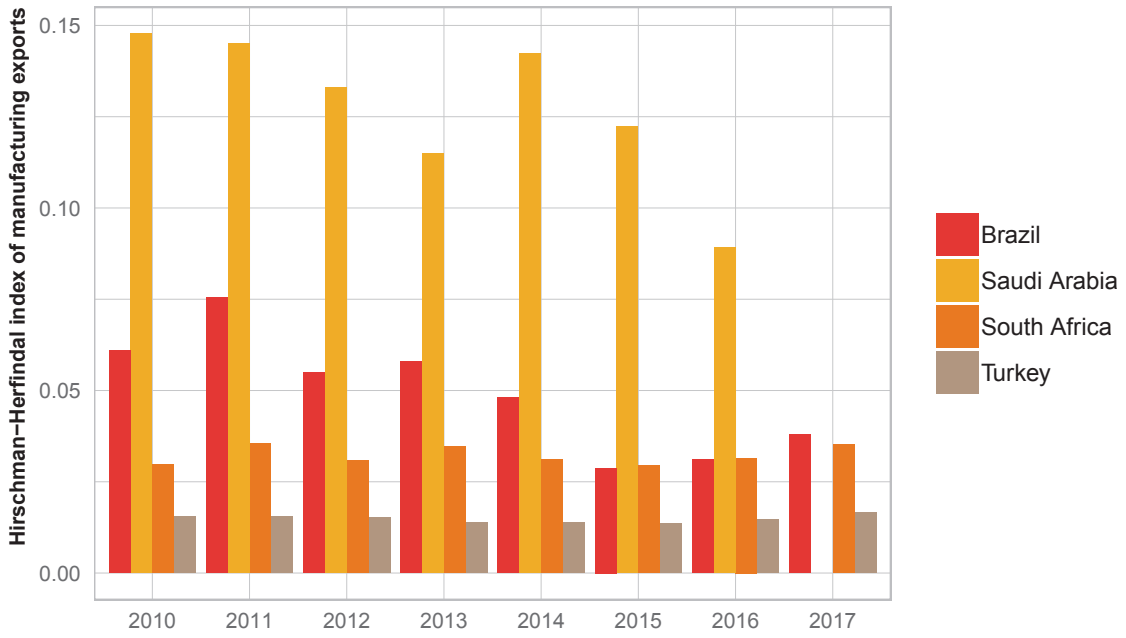
Country	2010	2011	2012	2013	2014	2015	2016	2017	Average
Saudi Arabia	56.0	54.0	52.3	49.4	54.1	51.9	45.8	…	51.9
Brazil	34.8	37.3	32.5	34.1	30.3	24.4	25.8	28.6	31.0
South Africa	25.7	27.3	24.0	26.1	24.8	24.6	24.7	27.9	25.6
Turkey	15.8	16.3	16.3	14.7	14.1	13.6	15.2	16.4	15.3

SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)
NOTE | THE DATA FOR SAUDI ARABIA IN 2017 IS CURRENTLY UNAVAILABLE

25 This is calculated based on Standard International Trade Classification Rev. 3, 3 digit level.
26 The mathematical expression of HHI has been introduced in the previous subsection. HHI in this subsection adopts the same equation and normalization.

Table 4.3 and Figure 4.3 reveal that Saudi Arabia has a much higher ratio of export of top three manufactured products to the total manufactured exports than its competitor countries. The top three manufactured products take up on average 52% of all manufactured products from Saudi Arabia. By contrast, this figure in South Africa and Turkey is around 26% and 15% respectively. The average ratio of export of top three manufactured products to the total manufactured exports in these years was around 31%, which is 20 percentage points lower than Saudi Arabia. However, this ratio in Saudi Arabia has decreased significantly from 56% in 2010 to less than 46% in 2016, which is more significant than all three comparator countries.

FIG. 4.3 | FLUCTUATIONS OF THE SHARE OF THREE MAIN MANUFACTURED PRODUCTS IN TOTAL MANUFACTURED EXPORTS FROM SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY, 2010-2017



SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)

Table 4.4 and Figure 4.4 report the HHI in manufacturing exports from Saudi Arabia, Brazil, and Turkey. As illustrated, Saudi Arabia has much higher HHI in manufacturing exports than the three comparator countries. HHI in manufacturing exports from Saudi Arabia is near 10 times higher than HHI in manufacturing exports from Turkey during the same period. However, HHI in manufacturing exports from Saudi Arabia has reduced significantly since 2010, from 0.148 in 2010 to around 0.089 in 2016, with fluctuations in between. This again provides evidence that Saudi Arabia's industrial concentration is high, which has a strong dependence on a few economic activities. This is a negative sign for its competitiveness. This demonstrates the importance of the Kingdom's commitments to diversify its economy under the Vision 2030.

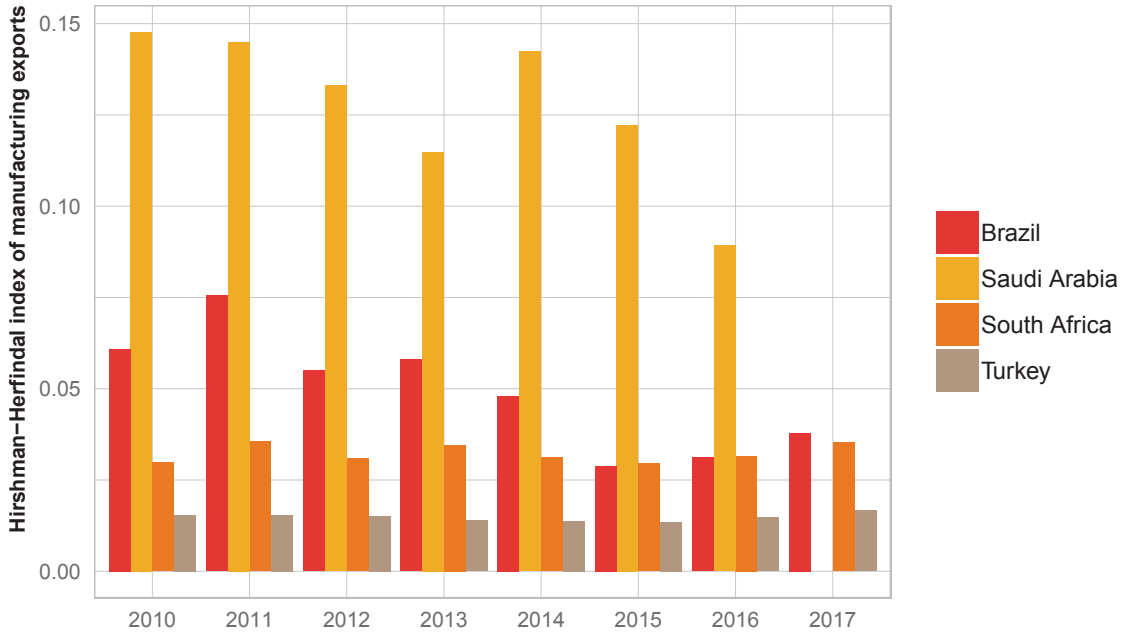
TABLE 4.4 | HHI OF MANUFACTURED EXPORTS FROM SAUDI ARABIA, BRAZIL, SOUTH AFRICA, AND TURKEY

Country	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	0.148	0.145	0.133	0.115	0.142	0.122	0.089	…
Brazil	0.061	0.075	0.055	0.058	0.048	0.029	0.031	0.038
South Africa	0.030	0.036	0.031	0.035	0.031	0.030	0.032	0.035
Turkey	0.015	0.015	0.015	0.014	0.014	0.014	0.015	0.017

SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)
NOTE | DATA FOR SAUDI ARABIA IN 2017 IS CURRENTLY UNAVAILABLE

In comparison with Saudi Arabia, HHI of manufactured exports from South Africa and Turkey are significantly lower, and remained rather stable between 2010 and 2017. HHI of manufactured exports from Brazil also dropped rapidly from 0.061 in 2010 to 0.038 in 2017. These suggest that the manufacturing in these three comparator countries have lower industrial concentration, and do not heavily rely on a few manufactured export products as Saudi Arabia.

FIG. 4.4 | FLUCTUATIONS OF HHI OF MANUFACTURING EXPORTS FROM SAUDI ARABIA, BRAZIL, AND TURKEY, 2010-2017



SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)

Table 4.5 and Table 4.6 provide information on HHI of manufactured export market concentration and overall export market concentration respectively. HHI of manufactured export market concentration is a good measurement of manufacturing export diversification, as it reflects a country's reliance on certain (a few) markets. Strong reliance on a few markets is likely to generate external risks which may lead to significant fluctuations of manufacturing export. That is widely believed as a negative sign of competitiveness.

Table 4.5 shows that Saudi Arabia has a relatively high HHI of manufactured export market concentration in comparison with its three comparators. Also, it fluctuated sharply between 2010 and 2016. For example, this figured dropped from 0.096 in 2014 to 0.072 in 2015, but a year later it bounced to 0.093. HHI of manufactured export market concentration of

TABLE 4.5 | HHI OF MANUFACTURED EXPORT MARKET CONCENTRATION BETWEEN 2010 AND 2017, SELECTED COUNTRIES

Country	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	0.122	0.104	0.100	0.094	0.096	0.072	0.093	…
Brazil	0.053	0.059	0.057	0.061	0.060	0.062	0.063	0.065
South Africa	0.040	0.047	0.041	0.048	0.040	0.041	0.041	0.042
Turkey	0.031	0.031	0.030	0.029	0.030	0.030	0.031	0.031

SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)

the three comparator countries are lower than Saudi Arabia, and remained much more stable than Saudi Arabia during the same period.

Comparing HHI of manufactured export market concentration with HHI of export (overall) market concentration also generates some results deserving attention. Saudi Arabia's HHI of manufactured export market concentration is significantly lower than the HHI of its overall export market concentration. However, this is possibly caused by that the destination of a large proportion (over 70%) of exports from the Kingdom is defined as 'unspecified'. By contrast, all the three comparator countries' HHI of manufactured export market concentration are roughly similar to the overall HHI of export market concentration.

TABLE 4.6 | HHI OF EXPORT (OVERALL) MARKET CONCENTRATION BETWEEN 2010 AND 2016, SELECTED COUNTRIES

Country	2010	2011	2012	2013	2014	2015	2016
Saudi Arabia	0.358	0.342	0.336	0.333	0.316	0.278	0.556
Brazil	0.053	0.059	0.059	0.066	0.062	0.065	0.067
South Africa	0.043	0.048	0.044	0.045	0.040	0.040	0.040
Turkey	0.034	0.035	0.035	0.033	0.033	0.034	0.036

SOURCE | CALCULATED FROM UN COMTRADE (UNSD, 2019)

05. PRACTICAL IMPLICATIONS

The above analyses generate more thoughts on how to improve the industrial competitiveness of Saudi Arabia, especially if experience and lessons of the comparator countries were taken into consideration. In addition, based on evidence from existing research and practice, a number of implications can be provided. The implications and recommendations are presented below.

- Saudi Arabia has a strong and solid foundation of industrial development, especially in manufacturing. This is revealed by its manufacturing productivity, manufactured exports, and increasing employment in manufacturing. This foundation provides good opportunities for the Kingdom to further enhance the development of not only manufacturing, but also the whole economy, as envisaged in Vision 2030.

- As explained in Vision 2030, Saudi Arabia's commitments in the diversification are important for the industry and the economy. This report provides evidence that with the Kingdom's efforts in diversification, the reliance on oil sector decreased after the unveiling of Vision 2030. However, as shown in the report, the Kingdom, particularly its manufacturing sector, still strongly depends on oil production and export, which suggests that there is a long way forward to achieve the Kingdom's objective to reduce such strong oil dependence. High dependence on endowment of resources (including oil) and raw materials has led to negative outcomes for economic development and industrialization, which has been demonstrated in a

number of resource-rich countries (e.g., Auty, 1994). Saudi Arabia's industrialization and economic development should avoid such 'resource curse' (e.g., Venables, 2016).

- Saudi Arabia's manufacturing sector has good technology intensity, in comparison with comparator countries. Since high technology/knowledge-intensity jobs usually require less physical strengths, this provides suitable opportunities to promote gender equality in the Kingdom, particularly by increasing workforce participation of females, which is an important objective of Vision 2030. In addition, technology-intensive jobs in manufacturing sector also increase the demanding of suitable talents in Saudi Arabia, which is a stimulus to promote the Kingdom's commitment in developing suitable education to contribute to economic growth, as revealed in Vision 2030.This also provides further reference to launch a thorough program for nurturing the Kingdom's human talent, which will be one of the most important executive programs to implement Vision 2030.

- A proper use of export-oriented strategy, foreign investment, and external debt would be essential for Saudi Arabia's industrialization and economic development. There are successful examples of adequately developing export-oriented industries and economies, with strong support of FDI (e.g., China, as shown by Wei and Liu, 2006). However, Brazil, South Africa, and Turkey have all provided painful lessons of improper using or relying on export, foreign investment, and/or external debt in their industrialization

and economic development (e.g., MahonJr, 1992; Yao, 2014; Aria and Cergibozan, 2018). Therefore, evidences are provided to support Saudi Arabia's commitments to develop an open environment for business, such as its objective to increase FDI from 3.8% to 5.7% of GDP (as indicated in Vision 2030). At meantime, this report also supports the Kingdom's efforts in localization, especially in some sectors which directly affect people's living standard. It is noted in the report that Saudi Arabia's domestic market has a high dependence on imported manufactured products, and its manufacturing also has a strong reliance on foreign workers.

- For emerging economies such as Saudi Arabia, its economic development and industrialization should not over-pursue for high-speed and/or knowledge-driven. There is still a long distance between emerging economies such as Saudi Arabia and established leading industrialized economies such as Germany and Japan. As shown by the structure of manufacturing production, Saudi Arabia has a significant proportion of labor-intensive, low-technology, and/or resource intensive economic activities in its manufacturing. Although have disadvantages, they can in fact generate significant positive impact on its economic development and industrialization which correspond to the context of the Kingdom. For example, labor-intensive economic activities contribute significantly to manufacturing employment, which alleviates the overall employment pressure in the Kingdom. Over-radical reform or transition

27 Many countries have suffered negative effects caused by over-radical reform towards unrealistic objectives of economic development and industrialization. The most significant examples are Latin America from early 1980s and East-Europe and former USSR from late 1980s.

towards unrealistic objectives of economic development and industrialization should be avoided in Saudi Arabia's economic development and industrialization.[27]

- The calculation of population in Saudi Arabia deserves more attention. Although the survey and measurement of population in the Kingdom correspond to well-established practice and widely-accepted standards, it is essential to notice that Saudi Arabia has a large sum of foreign workers, which is a significant proportion of workforce and residential population in the Kingdom. This fact is strongly linked with not only statistical techniques, but also employment pressure in Saudi Arabia (e.g., Ramady, 2010). The implementation of Vision 2030 should take this demographic issue into consideration, particularly in achieving the objectives of reducing unemployment and taking advantage of demographic dividend of a young population.

- Last but not least important, a country's manufacturing or industrial competitiveness is not only about manufacturing or industry, but is associated to the general country context and a large number of supporting factors, such as positive business environment, reliable public services, easy access to finance, and suitable education. That is why in different world ranking systems of competitiveness, which usually have different emphasis on various factors, well-established leading industrialized countries are always ranking in the front of lists with only minor changes of their

positions. Therefore, although it is recommended for Saudi Arabia to learn from the best practices of these leading economies, it must be quite prudential. The significant differences between the contexts of Saudi Arabia and leading industrialized economies must be well-observed before adopt relevant experiences. In addition, efforts to improve manufacturing development should not focus on manufacturing, but must be in line with other socioeconomic factors. In one sentence, a country's manufacturing competitiveness determines, and is also determined by, the country's overall socioeconomic development.

06. CONCLUSION

The report examines the manufacturing competitiveness of Saudi Arabia. In comparison with the three selected countries, Saudi Arabia's manufacturing competitiveness is relatively high. This is directly reflected by its positions in world rankings systems such as CIP. Also, Saudi Arabia demonstrates a relatively high manufacturing productivity, knowledge& technology intensity, and capacity to export. However, although Saudi Arabia has a relatively good performance in manufacturing export, the most manufacturing exports are for developing societies, which somewhat reflects its relatively low competitiveness in the developed world. Saudi Arabia's domestic market of manufacturing products relies strongly on imports.

In comparison with the three selected countries, diversity of Saudi Arabia's manufacturing is relative low, either in terms of production or export. Although the diversity is improving, manufacturing in the Kingdom is still dominated by a few economic activities which are strongly associated with oil production. This is a negative factor of improving Saudi Arabia's manufacturing competitiveness.

In combination with existing studies, findings are analyzed in comparison with the three selected countries. A number of practical implications have been generated based on the analyses, in line with the Kingdom's national development strategy Vision 2030. Experiences and lessons from the three comparator countries contribute to the implications. To conclude, although Saudi Arabia has not yet entered an advanced stage of industrialization, the positive pattern in most industrial performance indicators and the impressive growth path demonstrate that the Kingdom is progressively attaining its objectives of economic development and industrialization.

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APPENDIX A
TECHNOLOGY CLASSIFICATION OF MANUFACTURING EXPORTS AND PRODUCTION

A.1 TECHNOLOGY CLASSIFICATION OF EXPORTS

Type of export	SITC Rev. 3
Resource-based	016, 017, 023, 024, 035, 037, 046, 047, 048, 056, 058, 059, 061, 062, 073, 098, 111, 112, 122, 232, 247, 248, 251, 264, 265, 281, 282, 283, 284, 285, 286, 287, 288, 289, 322, 334, 335, 342, 344, 345, 411, 421, 422, 431, 511, 514, 515, 516, 522, 523, 524, 531, 532, 551, 592, 621, 625, 629, 633, 634, 635, 641, 661, 662, 663, 664, 667,689
Low technology	611, 612, 613, 642, 651, 652, 654, 655, 656, 657, 658, 659, 665, 666, 673, 674, 675, 676, 677, 679, 691, 692, 693, 694, 695, 696, 697, 699, 821, 831, 841, 842, 843, 844, 845, 846, 848, 851, 893, 894, 895, 897, 898, 899
Medium technology	266, 267, 512, 513, 533, 553, 554, 562, 571, 572, 573, 574, 575, 579, 581, 582, 583, 591, 593, 597, 598, 653, 671, 672, 678, 711, 712,713, 714, 721, 722, 723, 724, 725, 726, 727, 728, 731, 733, 735, 737, 741, 742, 743, 744, 745, 746, 747, 748, 749, 761, 762, 763, 772, 773, 775, 778, 781, 782, 783, 784, 785, 786, 791, 793, 811, 812, 813, 872, 873, 882, 884, 885
High technology	525, 541, 542, 716, 718, 751, 752, 759, 764, 771, 774, 776, 792, 871, 874, 881, 891

A.2 MEDIUM-HIGH AND HIGH TECHNOLOGY (MHT) MANUFACTURING CATEGORIES

Description	ISIC Rev. 3
Manufacture of chemicals and chemical products	24
Manufacture of machinery and equipment	29
Manufacture of office, accounting and computing machinery	30
Manufacture of electrical machinery and apparatus	31
Manufacture of radio, television and communication equipment and apparatus	32
Manufacture of medical, precision and optical instruments, matches and clocks	33
Manufacture of motor vehicles, trailers and semi-trailers	34
Manufacture of other transport equipment, excluding: ISIC Revision 3: • 351=Building and repairing of ships and boats ISIC Revision 4: • 3011=Building of ships and floating structures • 3012=Building of pleasure and sporting boats • 3315=Repair of transport equipment, except motor vehicles	35

SOURCE | OECD 2003, 2011 AND UNIDO 2010.

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

المملكة العربية السعودية
وزارة الصناعة والثروة المعدنية