



Sultanate of Oman
Ministry of Commerce and Industry



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

'MANUFACTURING FOR WELLBEING': THE SULTANATE OF OMAN'S MANUFACTURING STRATEGY 2040





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‘Manufacturing for Wellbeing’: The Sultanate of Oman’s Manufacturing Strategy 2040

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His Majesty Sultan Qaboos Bin Said

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Foreword:

Oil has brought considerable progress to the Sultanate of Oman. The standards of living have risen, Omanis enjoy access to goods, services and cultures from around the world, and the Sultanate has made significant strides in health, literacy and education. Oil revenues have also contributed to the modernization of infrastructure that will be available to our children and grandchildren. Oil will surely continue to play a role in facilitating development in coming years.

Unfortunately, reliance on oil also has its perils. It generates dependency and—like any dependency—limits potential, clouds judgment and biases decision-making. The future is only seen in terms of the price and volume of oil, and economic management is reduced to ensuring that all incentives and resources are geared towards oil activities and the prevention of interruptions of the oil industry's smooth operation. The concentration of resources in the oil industry crowds out other economic activities and exposes the economy to the oil market's fluctuations, thus consolidating the country's dependency on oil.

The Sultanate of Oman's economic diversification cannot focus exclusively on achieving a more varied portfolio of economic activities, but must, above all, ensure that the country does not fall into a vicious dependency cycle. The diversification of the Sultanate of Oman's economy already started over two decades ago, but we must continue to curb the present and future instabilities caused by the vagaries of the oil market. Possibilities of diversification exist in all sectors of the economy, but the opportunities the manufacturing sector provides are boundless.

Manufacturing today accounts for close to 10 percent of GDP. It has trebled in size over the last twenty years but is currently concentrated in a

handful of industrial commodities. Global manufacturing is the hotbed for innovation as the majority of research and development investments and product and process experimentation takes place in industrial firms. Many of the innovations being used in other sectors originated in manufacturing. There is no reason why this should not be the case in the Sultanate of Oman as well. A small economy does not represent a constraint, as some of the top innovators in the world have a population size similar to the Sultanate of Oman's.

Manufacturing for Wellbeing sets a vision for the manufacturing sector of 2040, where knowledge-driven industries focused on health and environmental clusters produce goods that will enhance the welfare of peoples around the world and that will sustain diversification, innovation and high-tech development in the Sultanate of Oman. This will be supported by an expanding, modern capital-intensive industry that is heavily involved in the emerging Fourth Industrial Revolution and hence continuously adopts the most advanced production and communication technologies and the accompanying cutting-edge sets of skills. Natural resource-based industries will gradually evolve away from their formerly dominant role to one of supporting other industries and sectors. The manufacturing sector of 2040 will be able to compete globally and will thus not only serve the local Omani or GCC markets, but the entire world, very much like Singapore or Ireland currently do.

Achieving the goals of Manufacturing for Wellbeing 2040 requires substantial efforts to be invested in building the necessary skills and technologies and embracing the most efficient and effective forms of governance. Generating sophisticated skills means redirecting our

academic education towards creativity and application while integrating our technical and vocational training system much more closely with the workplace. Technological change entails a focused expansion of research and development and openness towards novel ideas and advanced technologies that can be incorporated in our manufacturing strategy. Simplifying, upgrading and modernizing government procedures and regulations, while at the same time making them attractive to local and foreign investors requires

fundamental transformations in how we run government business. By pursuing such transformations, we can take control of our future destiny and determine how manufacturing will evolve in upcoming revolutions. This will fully depend on our creativity and resourcefulness.

Ministry of Commerce & Industry

Technical notes and abbreviations

Reference to dollars (\$) are to United States dollars, unless otherwise indicated.

This report defines *developed countries* or *developed economies* as the group identified as “high-income countries” by the World Bank and *developing countries* or *developing economies* as all other economies.

Components in tables may not sum precisely to totals shown because of rounding.

4ir	Fourth Industrial Revolution	IMF	International Monetary Fund
ALB	Acid Lead Batteries	INDSTAT	United Nations Industrial Development Organization Industrial Statistics Database
BN	Billion	IPA	Investment Promotion Agency
BRI	Belt Road Initiative	IPP	Independent solar power
CBO	Central Bank of Oman	IPR	Intellectual property rights
CI	Capital-intensive industries	ISIC	Industrial Standard Industrial Classification
CSP	Concentrated solar power	IT	Information technology
DRI	Direct reduction iron	ITHRAA	Public Authority for Investment Promotion and Export Development
ECGA	Export Credit Guarantee Agency	KD	Knowledge-driven industries
EEZ	Exclusive Economic Zone of Oman	KM	Kilometre
EU	European Union	KPI	Key performance indicators
FDI	Foreign direct investment	LLC	Limited liability company
GCC	Gulf Cooperation Council	LNG	Liquefied natural gas
GDP	Gross domestic product	MEXP	Manufacturing exports
GGDC	Groningen Growth and Development Centre	MHT	Medium- and high-technology
GHG	Greenhouse gas	M	Million
HDI	Human Development Index	MOCI	Ministry of Commerce and Industry
ICT	Information and communications technology	MOM	Ministry of Manpower
IEA	International Energy Agency		
ILO	International Labour Organization		

MVA	Manufacturing value added	PV	Photovoltaic
MW	Megawatts	R&D	Research and development
NCD	Non-communicable diseases	RB	Resource-based industries
NCSI	National Centre for Statistics and Information	SARDS	Sustainable Agriculture and Rural Development Strategy
NIS	National Innovation Strategy	SCP	Supreme Council for Planning
NTF	National Training Fund	SDGs	Sustainable Development Goals
OAPFD	Oman Authority for Partnership for Development	SEZ	Special economic zone
OCIPED	Omani CENTER for Investment Promotion and Export Development	SEZAD	Duqm Special Economic Zones Authority
ODB	Oman Development Bank	SOLS	The Sultanate of Oman Logistics Strategy
OECD	Organisation for Economic Co-operation and Development	SME	Small and medium-sized enterprise
OFIC	Oman Food Investment Holding Co.	SQU	Sultan Qaboos University
OMIFCO	Oman India Fertiliser Company SAOC	TANFEEDH	National Program for Enhancing Economic Diversification
OMR	Omani Rials	TVET	Technical and vocational education and training
OMRAN	Oman Tourism Development Company	UAE	United Arab Emirates
OPAL	Oman Society for Petroleum Services	UN	United Nations
ORPIC	Oman Oil Refineries and Petroleum Industries Company	UNIDO	United Nations Industrial Development Organization
OSTC	Occupational Standards and Testing Centre	UNSD	United Nations Statistical Division
PEIE	Public Establishment for Industrial Estates	US	United States
PPP	Purchasing Power Parity	USD	United States Dollars
PPP	Public private partnership	WB	World Bank Group
		WDI	World Development Indicators
		WTO	World Trade Organization

Executive Summary

• **Manufacturing for Wellbeing: Strategy and objectives**



- *'By 2040, the Sultanate of Oman will have a modern and technologically advanced manufacturing base, fully utilizing the creativity of the Omani population together with*

the most innovative production techniques and focused on improving the wellbeing of the peoples in the region and the world at large'.

- The 2040 manufacturing strategy pursues the following objectives:
 - To diversify the Sultanate of Oman's manufacturing into technology and knowledge-driven activities;
 - To develop unique products focused on improving the health and welfare of people;
 - To expand Omani industry into regional and new markets;
 - To upgrade the Sultanate of Oman's manufacturing to 'state of the art' technologies;
 - To create an industrial innovation culture.

• **Background**

- The Sultanate of Oman's manufacturing industry has been growing steadily since the 1970s. The share of the manufacturing industry increased from 0.8 percent of GDP in 1970 to around 3 percent in 1999 and again to around 9.9 percent in 2017. The country's manufacturing industry has witnessed ups and downs but especially since the advent of the new millennium, manufacturing has become a key driver of the Omani economy.

- Manufacturing growth has been accompanied by profound structural transformation. Industries such as textiles, wearing and apparel and handicrafts have disappeared and have been replaced by refined petroleum, chemical, steel and aluminium industries, which on average accounted for more than 70 percent of manufacturing during 2001-2016. Diversification into these industries has reduced the Omani economy's oil-dependency but did not fully liberate it from the perils of volatile prices, since the goods being produced were industrial commodities.
- Despite impressive growth, the Sultanate of Oman's manufacturing industry remains the second smallest in the GCC region with the lowest productivity. The share of manufacturing exports over total exports is lower than in Costa Rica, Norway or Jordan, which have similar populations or resource endowments and far fewer workers are employed in manufacturing than Norway, a high-wage economy.

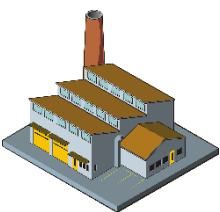
• **Global and domestic societal trends affecting manufacturing in the Sultanate of Oman**

- The world population is rapidly growing in Asia and Africa. The two continents are projected to account for 80 percent of the world's population by 2050. Over the next 10 years, China will see a significant increase in its wealthier population while India's population will rise sharply, with a very large youth population. Africa will account for 55 percent of the increase in world population by 2050. The European and Japanese populations will decrease, resulting in a marked shift in the geography of markets.
- The world's population will also continue to age. By 2050, the number of people over the

age of 60 years will amount to 2.1 BN. This phenomenon is not restricted to western countries as China's population is also aging. This trend will put considerable pressure on social security systems around the world and will require major investments in health care.

- The near future will also be characterized by rapid technological change. The so called *Fourth Industrial Revolution (4ir)*, the convergence of cyber and physical systems, is already affecting production systems across the world and is expected to have pervasive effects on manufacturing and society as a whole. Production will become faster, more diverse and more automated, and integration within and between firms, between them and their value chains as well as with consumers will grow. Employment could be affected significantly, although less so, if at all, in companies and countries that have the ability to innovate.
- Global demands for the protection of the environment will get louder. Since manufacturing emits around one-fifth of emissions and thus accounts for a major share of pollution, there will be growing pressure on companies and countries to reduce emissions and other forms of pollution as well as to take accountability for their environmental footprint.
- The Sultanate of Oman's economy has created 1.2 M jobs during 2008-2017. This impressive growth in employment has not, however, benefitted the local population. Lack of employment opportunities are being felt at all levels of education: universities, technical and vocational schools. Employment challenges, especially for the youth, could become particularly acute as more advanced technologies are deployed in the country.

• *Why manufacturing matters*



- Manufacturing is a well-known 'engine of growth' for many economies. There is plenty of evidence that manufacturing helps sustain a high, stable and durable

economic growth rate. This is because the potential for the division of labour, automation and process integration is more developed in manufacturing. Capital intensity leads to economies of scale and higher productivity; continuous progress is only limited by the creativity of those involved in manufacturing.

- The impact of manufacturing on the economy is extensive. Manufacturing exhibits very high forward and backward linkages as measured by multiplier effects. For every US\$ dollar spent in the US's manufacturing sector, an additional US\$ 1.33 was generated through the activities it generated in the rest of the economy. Multiplier effects in manufacturing have been shown to be higher than in other economic sectors.
- Manufacturing is the hotbed of innovation and change. While it was traditionally believed that research and development (R&D) was separate from production, experiences made in recent years suggest deep interconnections between product design and development and the production processes used to manufacture these products. Around 60 percent of all R&D takes place in manufacturing. R&D intensity (the R&D share of value added) in manufacturing is around 6 percent while it is only 0.5 percent in other sectors.
- Manufacturing is a major source of indirect employment. It is characterized by a relatively low number of well-paid higher skill jobs, particularly when countries reach higher levels of per capita income. Manufacturing, however, is second to none in its capacity to generate indirect employment. For every job created in manufacturing, it has been estimated that two to three additional jobs are created elsewhere. Some industries, like the steel industry, can generate up to six indirect jobs.

• *Drivers of 'manufacturing for wellbeing'*

- Establishing a modern manufacturing industry by 2040 will require the efforts of all industries, not only those of prioritized industries. No industry should be left behind



unless it can no longer generate any value, in which case it is recommended to replace it with an industry that can. At the same time, it

will be necessary to structurally transform the manufacturing sector so new industries can emerge in more advanced sub-sectors of manufacturing and already established firms and activities can improve their products, quality and efficiency and upgrade their production processes. There are 30 priority industries expected to assume this role.

- Natural resource-based industries include 15 industries whose main input is either agricultural, oil, gas, bauxite, iron or other minerals. They accounted for 58 percent of total manufacturing value added in 2015. These industries can be grouped into three clusters: food, oil and gas and other metals and minerals.
 - The oil and gas cluster will continue to play a key role in the development of manufacturing in the next 21 years. The strategy aims to address the demands of energy allocation, improve energy efficiency and reduce emissions and the challenges of Omanization as its main focus of attention.
 - Developments in steel and glass activities are anticipated in flat steel and intensification of glass exports to Asia and Africa as well as an upgrading of the glass industry to higher quality containers in conjunction with the emergence of the fragrances industry.
 - In the food industry, the focus will be on complementing food security objectives by positioning existing activities in the healthy food segment.
- Capital-intensive industries include 9 industries with a relatively high capital-labour ratio, accounted for around 10.8 percent of the Sultanate of Oman's manufacturing industry in 2015 and are classified into two groups based on their relative labour and technological intensity.
 - At the lower level and with a focus on the structural metals industry, the strategy envisages the adoption of advanced 4ir technologies as well as an increased product range destined for foreign markets. In the shipbuilding industry, the intention is to move into small boat and trawler construction.
 - At the higher level, electric motors, generators, transformers and electricity distribution and control apparatus activities will tackle the challenge of increasing its product range to cater to domestic construction and electricity projects, with some segments such as switchgears and electrical panels setting their eyes on the African markets. The pumps and valves industry will need to modernize its processes along 4ir lines and achieve economies of scale to export to neighbouring countries. Demand for air conditioning is high and rapidly rising hence Manufacturing for Wellbeing explores the potential for import substitutions. The future challenge for the wires and cable industry will be to move further up the value chain to offer integrated solutions and identify new markets.
- Knowledge-driven industries include six industries grouped into two activity clusters, namely health and environment. The industry is minuscule, accounting for only 0.6 percent of total manufacturing value added (2015) but at the same time, the health and environmental industries are research-intensive and high-tech industries that need to be promoted if the Sultanate of Oman's economy is to diversify.
 - There is considerable potential for building a health cluster around three industries, pharmaceuticals, medical instruments and fragrances. In pharmaceuticals, the patent of several drugs to treat autoimmune diseases are expiring, which could open an opportunity for Oman. At the same time, the Sultanate of Oman is well-known for its high medical standards, which can be leveraged to attract foreign investors into surgical and orthopaedic equipment

industries. The fragrances industry, in particular frankincense, is a well-established handicraft industry in the Sultanate of Oman that has not yet jumped onto the bandwagon of industrial production. All of these industries would focus on global markets.

- The environmental industry would be spearheaded with the establishment of a solar energy products industry driven by the high future demand from industry and government. Considerable potential for recycling of waste from construction, derived fuel, steel, organic sources, fish and batteries is also anticipated.

• Enablers of 'manufacturing for wellbeing'



- For the industries to achieve their development objectives by 2040, a number of challenges will have to be addressed. This will enable the achievement of the industrial priorities of the Strategy 2040. The three

types of challenges include: people, technology and governance.

- **People:** The Sultanate of Oman's impending industrial transformation will require people with a new and advanced set of skills that will have to be developed in parallel to the establishment of new industries. Skills dynamics in the Sultanate of Oman appear to be framed by two interconnected sets of challenges, one related to the labour market context, the other to general education and the Technical and Vocational Education and Training (TVET) system. The labour market context arises from an economic model based on the import of cheap labour and a lack of incentives for Omani youth to find jobs in the private sector. General education and TVET, for their part, faces the following challenges:
 - There are substantial gaps in the general education level, namely in basic language, mathematics and science skills. Technical skills of operators and technicians, especially mechanical, electronic and instrumental skills, seem to be lacking.

The level of IT taught at schools appears to be good, but this does not seem to carry over to work.

- Several important changes in the curriculum have been recently made, and new methods of teaching as well as teacher training programmes introduced at schools, but they have yet to yield solid results. The education system needs to include more vocational training and establish links with businesses.
- Enrolment numbers in the TVET system, albeit growing, remain marginal and it is perceived as being secondary to an academic education track because manual labour ranks very low in Omani society. Skills standards among graduates from technological colleges have improved, but instruction at colleges still focuses too much on theory and there is very little exposure to the practical workplace. Internships are only mandatory in the last year of college due to the lack of sufficient apprenticeships in private sector companies.
- Company involvement in skills formation in the Sultanate of Oman is fragmented and scarce. There are only few company apprenticeships and there is insufficient public-private dialogue to identify occupational standards and develop training curricula.
- A major share of the total student population at the tertiary level attends private universities and colleges, accounting for over 50 percent in the academic year 2015/16. The quality of training provided at private universities and colleges seems to be mixed, is not particularly relevant for subsequent employment and biased towards academic rather than technical careers.
- A major paradox of the supply and demand of skills in the Sultanate of Oman, especially at the academic and professional level, is that many women graduated from universities and ICT-related training courses with very good results do not enter the labour market or limit themselves to the public sector.

- **Technology:** There is broad agreement in the Sultanate of Oman that the country faces tremendous challenges in relation to emerging 4ir and digital technologies. Furthermore, overall consensus exists on specific shortcomings observed in the national innovation system, which act as barriers to the digitalization of Oman’s manufacturing sector. Three areas, in particular, need to be addressed: the generation, diffusion and deployment of technology:

- As regards technology generation, while research has been growing in terms of volume and quality, overall R&D activity remains low, amounting to only 0.24 percent of GDP. Private R&D is also very low. The most in demand skills for the 4ir have yet to be developed since local universities are not integrating digital manufacturing concepts and themes into their syllabus, resulting in graduates without adequate expertise in new digital technologies.
- As regards technology diffusion, Omani industry lacks mechanisms to spread knowledge and 4ir demonstration examples from which industry can learn. There are only few expert networks/ forums/ communities that can compensate for this. Companies, particularly SMEs, seem to struggle with the high investment requirements of advanced technologies as well as with the red tape challenges to import them. The digital infrastructure needs to be developed for speedy man-machine interaction to take place.
- As regards technology deployment, the lack of labour and labour legislation flexibility is often mentioned as a constraint. Official recognition of reputable institutions’ online training programmes also seems to be a problem, although it is unclear why this is the case in the private sector. Companies also point out at difficulties in integrating their existing technologies with new equipment and find the industrial support system to be too limited to deal with these or any issue related to the deployment of new technologies.

- **Governance:** One important principle and a lesson for countries like the Sultanate of



- Oman is that if the manufacturing sector is to become a key driver of economic growth and transformation, the government should first and foremost develop a modern governance system that delivers on developmental outcomes. Four challenges emerge in relation to the Sultanate of Oman’s system of governance: policy coordination, clear institutional mandates, efficient ministries and effective rules and regulations.

- As economic development progressed in Oman, the executive branch of government also evolved institutionally. Increased government functions have also meant more personnel and further managerial complexity, with an increasing risk of confusion, duplication and the emergence of “gaps” in the coverage of critically interrelated activities, thereby undermining the synergy needed to achieve national economic objectives.
- A related problem is the plethora of institutions with similar mandates. While the extent and depth of the duplication of functions and responsibilities vary, the fact that different public institutions believe that they have the mandate to perform the same roles leads to fragmentation, lack of coherence and poor policy coordination.
- Although the Ministry of Commerce and Industry (MOCI) has relocated a number of operational functions over time, it still seems to be burdened with a number of responsibilities for which there is no clear line of authority while key regulatory functions have yet to be fully dispensed for lack of adequate personnel.
- Public sector governance is fundamentally determined by the nature and quality of rules, regulations and incentives applied to influence economic relationships and to achieve the desired development outcomes. Three types of incentives are

key for the Sultanate of Oman's industrial development: incentives to attract foreign investment, location incentives and SME support. Significant progress has been achieved over the years, but the approach to these three incentives now requires updating to adapt to the current era. Making foreign investment and SME support mechanisms or ensuring that the benefits of special economic zones are distributed more widely are just some of the present challenges.

- **Linkages with other sectors' strategies**

- Manufacturing for wellbeing can generate synergies with economic sectors' strategies such as agriculture and fisheries inasmuch as it involves further processing and value addition over the natural resources. Furthermore, by emphasizing the development of healthy and nutritious products, the manufacturing strategy positions itself



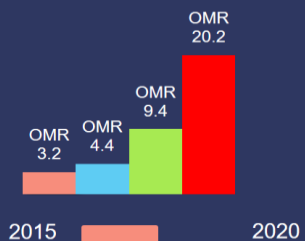
at the core of food security, which by definition involves healthy food.

- The manufacturing sector's strategy converges with the 2040 education strategy and the 2050 health strategy. Manufacturing will require a consistent supply of skilled personnel in coming decades, a factor that the education strategy must take into consideration. The health strategy builds on 'health security', calling for the establishment of *a thriving local pharmaceutical, instruments and equipment*, which lies at the core of the manufacturing strategy.
- Manufacturing for wellbeing also builds on logistics and tourism strategies. Making full use of logistics services will require a flow of goods in both directions, i.e. into and outside of Oman. As for tourism, manufacturing can supply the goods a growing tourism industry requires and collaborate with the tourism industry to develop joint approaches and branding.
- Manufacturing for wellbeing will be pivotal in achieving Goal 9 of the SDGs and will at the same time contribute to the achievement of many others as well.

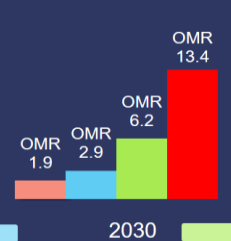
'Manufacturing for well-being' 2040 KPIs

Target of manufacturing 2040

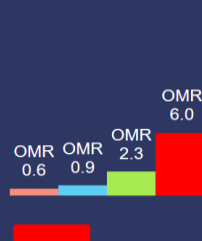
Manufacturing value added (OMR, billion)



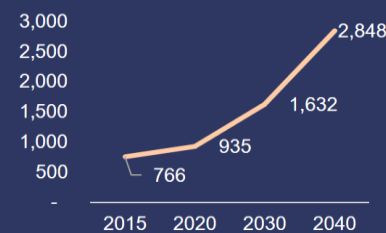
Manufactured export (OMR, billion)



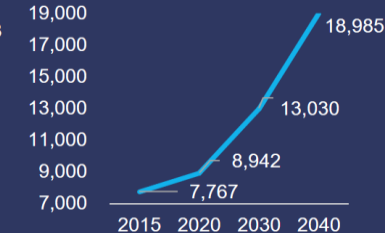
Medium- and high-tech value added (OMR, billion)



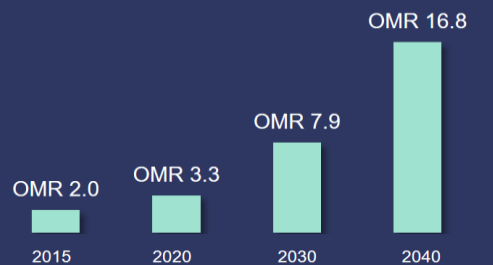
MVA per capita (OMR)



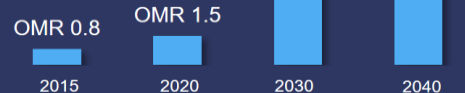
GDP per capita (OMR)



Projection of 30 strategic manufacturing activities 2040

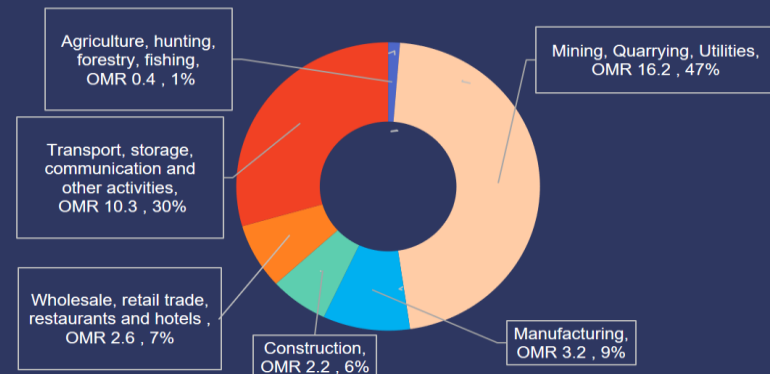


The value added of 30 strategic industries (OMR constant 2011 billion)



The value added of 30 strategic industries (OMR constant 2011 billion), excluding refined petroleum, basic chemicals and plastics activities

Structure of economy 2016 (OMR, billion)



Note: All OMR at 2011 constant price and fixed exchange rate (1 OMR = 2.6 US\$) are applied.
 Economic annual growth is projected at 6 percent (2018-2040).
 Population annual growth rate is projected at 1.81% (2018-2020) and 2.08% (2021-2040).
 Source: Elaboration based on INDSTAT4 rev.4 (UNIDO, 2018) and NAMAD (UNSD, 2018).

Source: UNIDO elaboration based on United Nations Statistics Division (2018) and INDSTAT2 rev.3 (UNIDO, 2018)

1 Background

1.1 Economic and social development in the Sultanate of Oman 1970-2017: oil dependency



The Sultanate of Oman is privileged to have a diverse geography, abundant natural resources and a peaceful, independent and stable population. Geographically, the Sultanate of Oman benefits from a combination of deserts, inland mountain

ranges and associated valleys, very fertile soil in the south of the country and a strategically located coastline, all of which provide the Sultanate with relatively rich agricultural, agro-processing and fishing potential and unique maritime pathways to India and the Far East as well as to Africa and Europe. The Sultanate of Oman is rich in oil and gas, with an estimated proven reserve of 5.4BN barrels of oil and 23 trillion cubic feet of gas in 2017 and annual LNG production capacity of 10.4 M tonnes. The Sultanate of Oman furthermore has substantive mineral reserves in copper, gold, iron, cobalt, chromite, dolomite, silica, limestone and gypsum. The country is considered to be among the most peaceful countries in the world and has coped particularly well with the social challenges that have affected other countries in the region in recent years. It is a beacon of stability in the Middle East and Gulf Cooperation Council (GCC) and bases its international relations on cooperation rather than conflict. The Sultanate of Oman ranks eighth in the 2017 World Economic Forum's ranking on Safety and Security and 22nd happiest country in the world in 2012-2014.

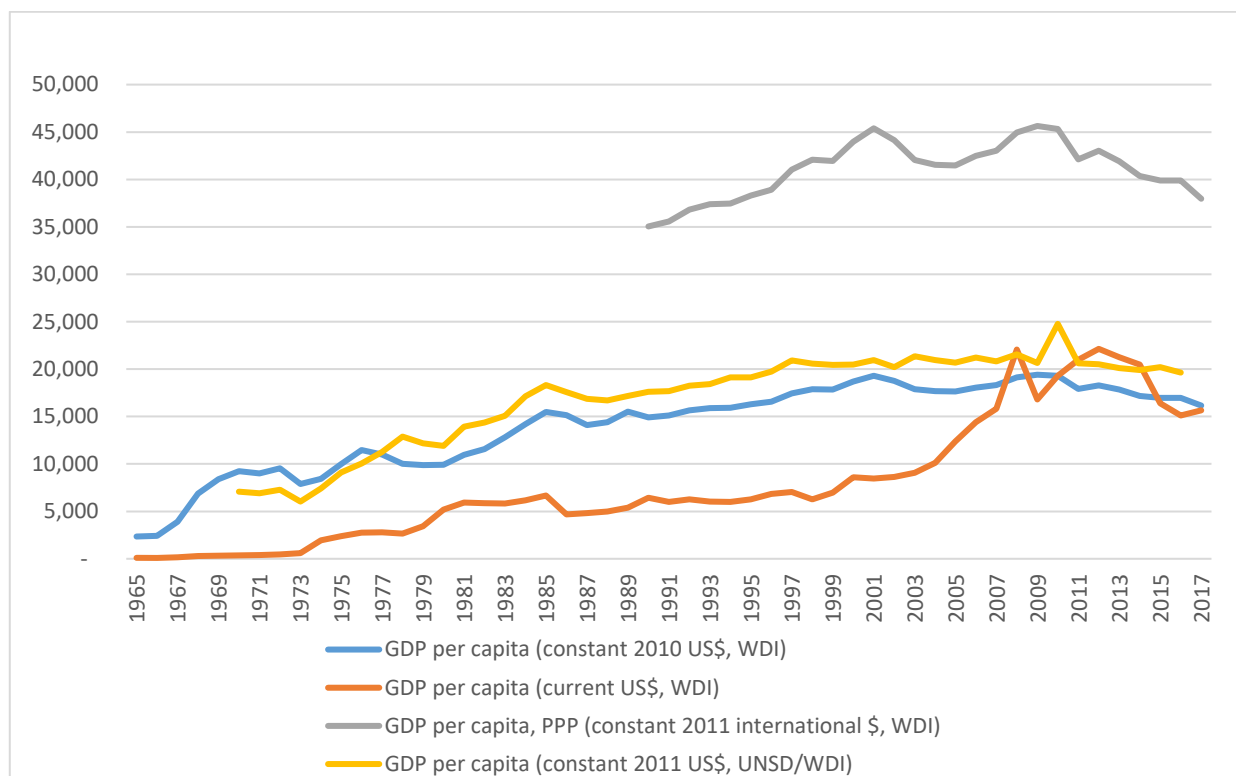
By the end of the 1960s, the Sultanate of Oman faced dire economic and social conditions. The country's economy essentially relied on a few agricultural, fishing and traditional handicraft activities. Foreign trade, which had contributed to

Oman's rise to an international player in the past, came to a near standstill. Socially, there were clear signs of collective discontent, high illiteracy rates, poor health conditions and widespread disease and poverty. Oil, which had been discovered in 1964 and began being produced in 1967, only took on the role of the country's economic driver towards the end of the decade.

The assumption of power of His Royal Highness Sultan Qaboos bin Sa'id in 1970 was the starting point of a remarkable turnaround of the Sultanate of Oman's economy and society that continues to this day. Despite the fluctuations in economic growth, the country's GDP per capita in constant terms grew at an average annual rate of 1.3 percent or 2.2 percent between 1970 and 2016, according to the United Nations Statistical Division and the World Bank database, respectively (**Figure 1-1**).

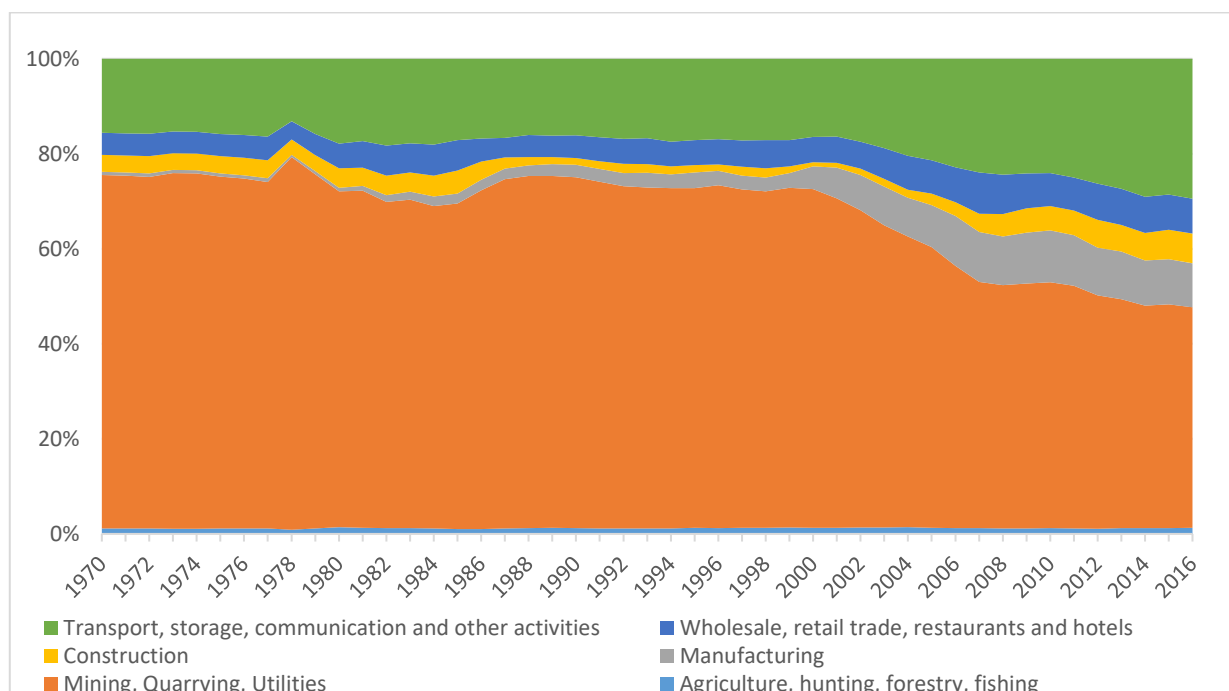
While the economy has been characterized by steady growth over the last 46 years, two distinct trajectories emerged from a structural transformation perspective. The first one, which roughly spanned the years 1970 to 1999, was heavily dependent on the mining sector—predominantly oil and gas—with the share of mining persistently accounting for over 70 percent of GDP. During this period, Oman's economic growth was largely dictated by the production and export of oil, with the rest of the economy, simply following the developments in the oil and gas industry. Consequently, there was very little change in the composition of the rest of the economy. The second trajectory, which commenced at the beginning of the new millennium, has been characterized by a significant structural transformation in production away from mining into transport, manufacturing and construction. The fastest growing sector has been manufacturing, which increased its share of GDP from around 2.8 percent in 1998 to 9.3 percent in 2016 (**Figure 1-2**).

Figure 1-1: GDP per capita of the Sultanate of Oman (US\$ current and constant)



Source: UNIDO elaboration based on World Development Indicators and UN Statistics Division (2018)

Figure 1-2: The Sultanate of Oman: Structure of economic activities (1970-2016, US\$ constant 2011, UNSD)



Source: UNIDO elaboration based on UN Statistics Division (2018)

Export figures seem to confirm this structural break and at the same time indicate a change in the composition of commodity exports. The bulk of the Sultanate of Oman’s exports consisted of oil and gas until 1998, with other mineral

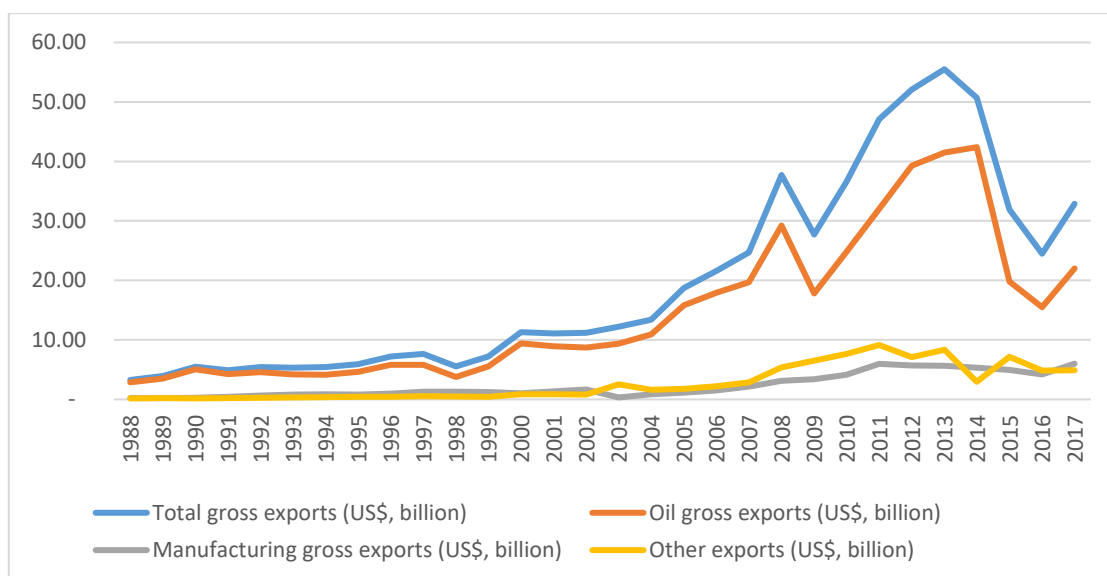
commodities such as copper, iron ore, gypsum and limestone as well as manufactured goods contributing very little to total exports. With the advent of the new millennium, new commodities as well as manufacturing exports have increased

their share in total exports, suggesting that structural change has not only occurred towards other sectors of the economy, but also within the mining sector.

Oil and gas, nonetheless, by far remain Oman’s most important economic activity, particularly in terms of exports averaging more than 70 percent of total exports over the last few years (Figure 1-3). Well known risks are associated with oil dependency. One risk is the so called ‘Dutch Disease’ where the high income generated by a substantive oil exports appreciates the nation’s currency and crowds out the export of other products, reducing the cost of imports but at the same time also reducing import substitution opportunities. Oil dependency exacerbates macroeconomic volatility; when the price of oil drops, the balance of payments results and fiscal revenue decrease, thus severely impeding

economic growth, particularly in non-oil industries and public services. The oil industry tends to be capital intensive and generates only few direct and indirect jobs. This, moreover, leads to gross disparities in income across sectors and contributes to the absorption of the most qualified employees from other activities into the oil and gas industry. In countries that are heavily reliant on oil and in which oil reserves are exhaustible, the consequence of resource depletion could prove severe as the ensuing decline in aggregate and personal income results in an acute drop in the standard of living, poverty and major social strife, all within a relatively short period of time. Environmental regulations are getting more stringent and it is furthermore conceivable that the day will come when environmentally conscious consumers across the globe simply refuse to continue purchasing hydrocarbon-based energy.

Figure 1-3: The Sultanate of Oman export trends (US\$, billion)



Source: UNIDO elaboration based on UN Comtrade (2018)

One of the most important transformations in the Sultanate of Oman in recent decades has been the upgrading of the country’s economic infrastructure. Major investments have been made in roads, ports, airports, telecommunications, electricity and water. Over 35,000 km of paved roads connect the entire country and link the Sultanate of Oman to neighbouring countries. New ports have been built in Sohar, Salalah and Duqm, providing modern and competitive cargo and trans-shipment alternatives to ports inside the Gulf. Modern airports and

facilities have been built in Muscat, Salalah, Duqm and Khasab and represent a major driver of national integration. The Sultanate of Oman also enjoys a high level of mobile phone and internet penetration, but additional investments in broadband seem necessary. Today, around 97 percent of the population has access to electricity and gas and 93 percent have improved water sources.

Improvements have not only been recorded in economic wellbeing but also in social welfare. Between 1970 and 2010, the Sultanate of Oman

had the fastest growth in the Human Development Index (HDI), with significant improvements in education and health, particularly in gross enrolment in school, literacy rates and life expectancy. Life expectancy increased by 27 years during this period, from 49 to 76 years and the literacy rate stood at nearly 94% in 2015. Today, Omanis have access to a variety of social services, pensions and health insurance, all of which ensure a dignified life and old age.

In parallel to—and to some extent underlying the economic and social progress achieved thus far—has been the progressive establishment of a modern state. From a regionally and institutionally fragmented country in 1970, the Sultanate of Oman now has a partially elected consultative council, which has some legislative and regulatory powers, a relatively independent judiciary and several oversight institutions. The country's legislation is based on Royal Decrees and it is governed through 11 governorates and 39 ministries or ministerial level bodies, with the government's executive branch exercising significant influence over the running of the country. Legislation has been incrementally introduced to emphasize the role of the free market, competition and free trade. The private sector is considered the main player in economic growth. There has also been increasing interest in environmental protection and sustainable development at the highest levels of government.

1.2 Manufacturing development 1990-2017: diversifying into industrial commodities

1.2.1 Early industrialization



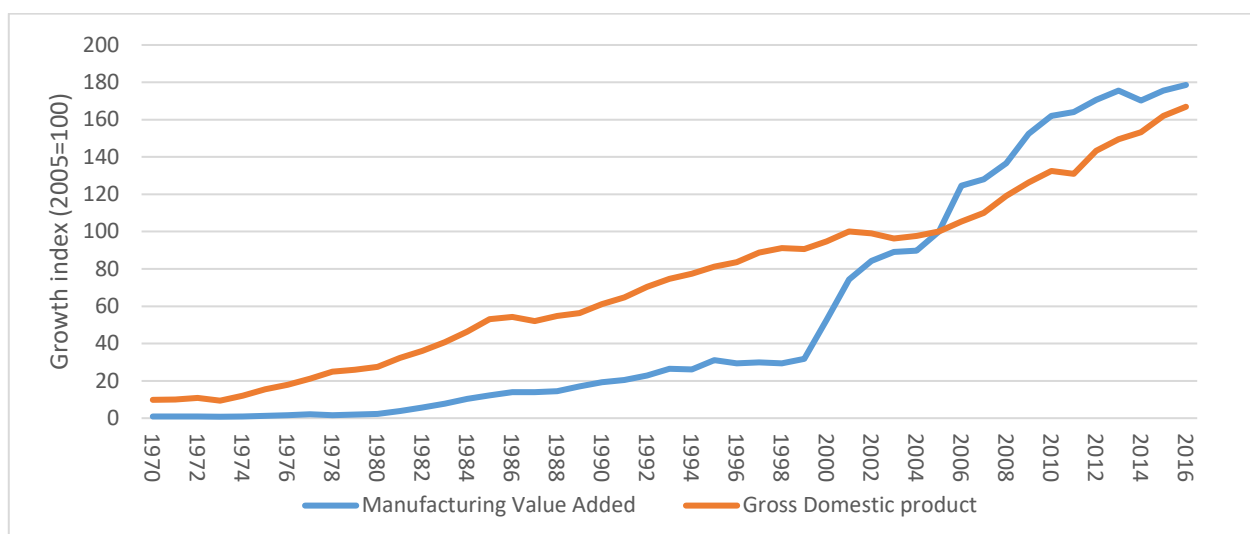
The initial years of industrial development in the Sultanate of Oman were fairly modest. A 1978 industrial survey found that the country's manufacturing sector consisted of 357 establishments employing 3,926 workers. The average size of an establishment was 11 workers, with an average salary of OMR 1190 annually. The small size of Omani firms was confirmed in the first industrial census, which took place in 1980: there were only 53 establishments with a capital of OMR 50,000 or higher employing 10 workers or more. The main activities included cement and cement products, food and

beverages, wood and wood products, textiles, jewellery and some basic metal products. Basic foods, housing and commercial buildings were the main drivers of industrial demand during that period. Between 1970 and 1979, the share of manufacturing value added in GDP remained at under 1 percent of total GDP.

The early days of industrial development in the Sultanate of Oman also witnessed the establishment of initial government regulations and institutions to promote industry. In 1972, the Department of Industry was established under the then-Ministry of Development, and in 1974, the Ministry of Commerce and Industry (MOCI) was created with a Directorate General for Industry that was tasked with promoting and assisting Oman's nascent industrial sector. To accelerate industrial development, the government promulgated Royal Decree No: 1/79 in 1979, one of the first laws that specifically encouraged and regulated industry in the Sultanate, introducing a number of income and custom tax exemptions for industrial firms. Other policy instruments MOCI used during those years included identifying and making land available for industrial purposes; nominating companies for special land, electricity and water rates; preparing and offering feasibility studies to the private sector; assisting the government in identifying and implementing investment opportunities in industry; and providing loans to manufacturing.

The 1980s saw the consolidation of the first stage of industrial development and the onset of the processing of natural resources. The government invested heavily in the food industry by establishing a cattle feed facility with a capacity of 60,000 tonnes as well as the Sultanate of Oman Fishing Company, which procured fish from own deep-sea trawlers and from local fishermen along the Omani coast. The fish was kept in cold storage or processed before being sold in major cities. Other large government projects involving natural resource processing included the Sultanate of Oman Oil Refinery in Muscat, with an initial refining capacity of 50,000 bd and a copper refining project in Sohar. Private investors expanded the food industry by opening water, juice and vegetable oil facilities as well as small chemicals, plastics and packaging plants. The increase in natural resource processing capacity meant that the manufacturing share in GDP grew from 0.8 percent in 1980 to 2.8 percent in 1989 (Figure 1-4).

Figure 1-4: The Sultanate of Oman: MVA and GDP real growth index



Source: UNIDO elaboration based on United Nations Statistics Division (2018)

Industrial policy in those years lacked strategic direction and focused primarily on providing adequate infrastructure for industry through the establishment of the Rusail Industrial Park in 1985 and workers' residences, which were eventually completed in 1989. A number of government vocational training centres were created to meet the expected rise in demand for trained manpower. Key efforts, however, were undertaken in industrial financing. The Sultanate of Oman Development Bank, which launched its operations in 1979, began taking a very active role in financing small and medium-sized enterprises (SMEs). For its part, MOCI increased its loans and subsidies for industrial projects. Between 1980 and 1990, MOCI provided OMR 185 M in soft loans and grants to manufacturing firms. The Muscat Securities Market as well as several financial institutions and funds—partially catering to industry—were created during these years.

1.2.2 Shifting policy direction

Although it took another decade before structural transformation set in, the government efforts during the 1990s clearly laid the foundations for what was to come with the advent of the new millennium.

While strongly emphasizing the importance of diversification and industrialization for Oman's development in his 1991 national day speech, His Royal Highness Sultan Qaboos bin Sa'id stated that industrial "initiatives must focus on the

exploitation of the national resources with which God has blessed us." This approach to natural resource-based industrialization was picked up in the Fourth Five Year Plan 1991-1995, which guided much of the public and foreign investments in the following years.

The direction given by the Sultan was further reinforced in the Fifth Five Year Plan 1996-2000 and Strategy 2020, published in 1995. Strategy 2020 was a long-term plan aimed at building on the last 25 years of Sultan Qaboos bin Sa'id's leadership and to guide the Sultanate of Oman into the next millennium. It tasked the private sector with becoming the main driver of structural transformation and pledged commitment to the diversification and globalization of Oman's economy. Manufacturing, together with tourism, was to become one of the leading sectors of the economy through natural resource processing, including natural gas-based hydrocarbons such as ammonia, urea, fertilizers, methanol and petrochemicals; by increasing domestic value added; by promoting exports; by attracting foreign capital; by streamlining investment procedures; and by stimulating technology transfer.

The 1990s were marked not only by long- and short-term plans, but also by a host of concrete interventions. The Export Credit Guarantee Agency was established in 1991 to guarantee Omani exports. The Public Establishment for Industrial Estates (PEIE) was created in 1993,

based on the experience of the Rusail industrial estate. The Sohar (1992), Raysut (1992), Nizwa (1994), Al Buraimi (1998), Sur (1998) and Al Maziuma (1999) industrial estates followed. The Omani Center for Investment Promotion and Export Development (OCIPED), today ITHRAA, started its activities in 1997, focusing on promoting foreign investment in the Sultanate of Oman and developing Omani exports. Other interventions included an investment by the government in a 7 M tonne per year capacity of liquefied natural gas (LNG) plant; quadrupling financial institution and government lending to industry; leveraging gas allocation for power generation as a mechanism to attract investors; allowing 100 percent equity for certain foreign investors; privatization; tax exemptions on income tax for salaries and wages; increasing the proportion of local population in enterprises; special local residency permits for foreigners; and attractive incentives for export-oriented companies.

The tremendous policy efforts of the 1990s did not, however, bear immediate fruits. During 1996-2000, 40 firms were established in Rusail, 34 in Sohar, 22 in Raysut, 12 in Al Buraimi and 4 in Nizwa. The firms included chemicals, food processing, pharmaceutical, marble and mechanical engineering. The large LNG plant, as well as other planned investments in natural resource processing did not gain momentum until the following decade. As a result, the manufacturing share in GDP hardly changed, from 2.8 percent in 1990 to 3.2 percent in 1999.

1.2.3 Structural transformation towards industrial commodities



Policy measures to accelerate industrialization continued unabated with the arrival of the new millennium. The Sixth Five Year Development Plan (2001-2005) expanded some of the already existing investment incentives to include loans at reduced rates from the Sultanate of Oman Development Bank, making land available to investors at favourable rates, freedom to repatriate profit and capital, providing interest-

free loans to partly foreign-owned industrial firms, introducing export credit insurance and creating a one-stop shop for investors. Two additional sets of measures were developed during those years. As regards the development of human resources, the government allocated OMR 440 M to vocational training. As regards trade, the Sultanate of Oman joined the World Trade Organization (WTO) in 2000, ensured duty free access for its products to Gulf Cooperation Council markets and began negotiating a free trade agreement with the US in 2004, which it eventually signed in 2006.

The Seventh Five Year Plan (2005-2010) and the Eighth Five Year Plan (2011-2015) focused on knowledge and technology through the establishment of the Knowledge Oasis (2007), with the aim of bringing together IT companies and entrepreneurs. Entrepreneurship and particularly youth entrepreneurship were to be promoted, and support for companies facing difficulties due to external factors was introduced. Technical cooperation programmes bringing together government, academia and industry to solve the problems the industrial sector faced were developed. Omanization, which entailed the development of local employment targets, became a central plank of economic policy, and was reinforced following the eruption of social unrest in 2011. Equally important was the development of industrial SMEs, given their employment generation potential. In 2013, the Public Authority for the Development of SMEs was created and tasked with providing technical, financial and managerial support to local entrepreneurs.

There has been no lack of resolution by the government to bring about diversification and industrial development. The key objective of the Ninth Five Year Plan (2016-2020) is the reduction of the share of oil activities and the increase in the manufacturing share in GDP. Compared to previous plans, it focuses on spatial and regional aspects of development and on government performance. In Manufacturing the Ninth Five Year Plan set a target of a 10% share of manufacturing value added on GDP by 2020, while the most ambitious 2020 Strategy sets a target of 15% MVA/GDP ratio for the same year. It envisaged OMR 2.6BN investment in the sector with the private sector taking a commanding role

in the execution of investment projects. The plan considered improving the business environment through privatization, a special fund for Public Private Partnership (PPP) Projects and the attraction of foreign investment. The “Invest Easy” program for making the process of establishing a business more efficient and transparent was to be actively implemented and promoted together with the cancellation of the minimum limit of capital requirements for establishment of a business.

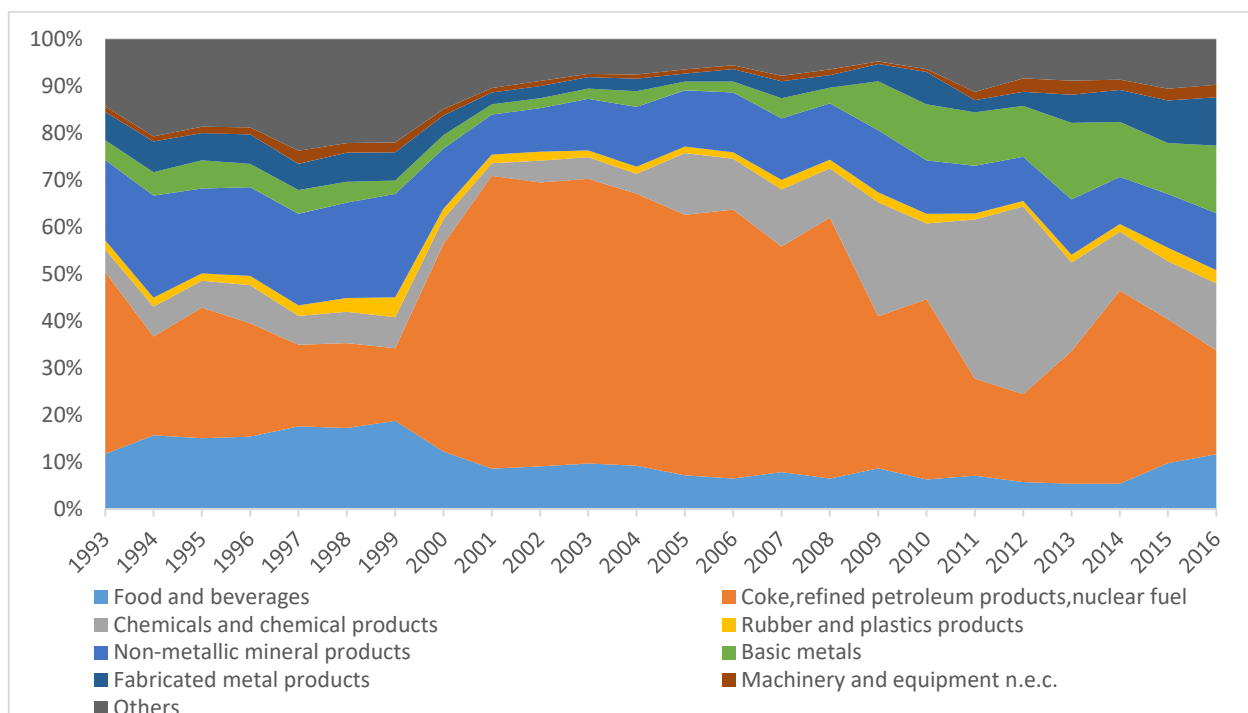
Perhaps the most novel policy mechanism introduced by the plan was Tanfeedh. The National Program for Enhancing Economic Diversification (Tanfeedh) aims to address the challenges and difficulties both the public and the private sector as well as civil society face in achieving the objectives of the Ninth Five-Year Development Plan. It aims to identify the necessary responsibilities, available resources and timeframe needed to implement initiatives that drive economic diversification; set clear standards and Key Performance Indicators (KPIs) for said initiatives; and provide periodic reports on the progress achieved in the implementation of the initiatives. Public awareness of achievements—or lack thereof—is expected to deliver implementation. While Tanfeedh is still underway, a number of projects in petrochemicals (polyethylene terephthalate - PET and ammonium), basic metals (aluminium expansion), non-metallic minerals (cement expansion), castings and structural metal products (metal dies and moulds, scaffolding and its parts, downstream steel and aluminium

products), and food (processed vegetables, seafood, dairy, poultry and dates) will follow.



Unlike the last years of the previous millennium, the early years of the new millennium have been associated with progressive, positive and radical changes to the Sultanate of Oman’s industry. Two trends have been particularly notable during this period. The first one is the manufacturing sector’s very rapid growth rate. It grew at an annual constant compound rate of around 10.7 percent between 1999 and 2016. The rate has decelerated in recent years, turning negative in 2014 as the entire economy slowed down. The long run rate has, however, been very impressive. The share of manufacturing value added peaked at 11.4 percent of GDP in constant terms in 2011, although it has dropped since to 9.7 percent of GDP in 2016 as prices of industrial commodities began to falter. The second notable trend has been the significant change in the composition of manufacturing value added. A major retrenchment took place in the textile and garments, non-metallic minerals and food industries, although the latter began recovering in 2014. The largest increases were observed in the refined petroleum, chemical and basic metals industries, which at their peak accounted for nearly two-thirds of total manufacturing value added and in 2016, still accounted for more than 50 percent of total manufacturing value added (Figure 1-5).

Figure 1-5: The Sultanate of Oman Structural change within manufacturing



Source: UNIDO elaboration based on INDSTAT2 rev.3 (UNIDO, 2018)

Refined petroleum products include gasoline, kerosene, diesel oil and LPG. In addition to its Mina Al Fahal Refinery in Muscat, established in 1982 with a present capacity of 106,000 b/d, the Sultanate of Oman Oil Refineries and Petroleum Industries Company (ORPIC) opened the Sohar Refinery in 2006, adding an additional capacity of 116,000 b/d. The Sohar Refinery also has a polypropylene (used in plastics, clothing and medicine) plant as well as aromatics (paraxylene and benzene) plant. A new refinery with a capacity of 230,000 b/d is being developed in Duqm.

Chemicals and chemical products include basic chemicals, pharmaceuticals, paints and varnishes, detergents, soaps and cosmetics and other chemicals. The most important product by far is basic chemicals, including chemicals such as ethanol, methanol, ammonia and sulfuric acid as well as fertilizers. The basic source for these products is oil and gas. Two plants account for the bulk of methanol production: the Salalah Methanol Company LLC, which started production in 2010 and has an annual capacity of 3 million MT mainly destined for export, and the Sultanate of Oman Methanol Company, which started production in Sohar in 2007, with an installed capacity of around 1 M MT. There are also two large players in the fertilizer industry: the Sultanate of Oman India Fertiliser Company SAOC (OMIFCO),

which started production in Sur in 2005, with a capacity to produce 2x1750 MT/day of anhydrous ammonia from 2 ammonia plants and 2x2530 MT/day of granular urea from 2 urea plants, as well as the Suhail Bahwan Group, whose production started in 2009 in Sohar, with a 2000 MT/day ammonia plant and a 2x1750 MT/day urea plant.

Companies in the iron and steel industry are divided into manufacturers of iron and steel products from imported scrap and iron ore, and foundries that process imported scrap castings. There is only one steel integrated company, Jindal Shadeed, which began production in 2010 in Sohar and operates a 1.4 M tonne per year rolling mill, a direct reduction iron (DRI) plant and a steel melt shop. There are two other plants that produce iron, namely Vale and Sohar Steel. There is also only one aluminium producer, Sohar Aluminium, which started operating in 2008 and whose smelter has an annual production capacity of 375,000 tonnes.

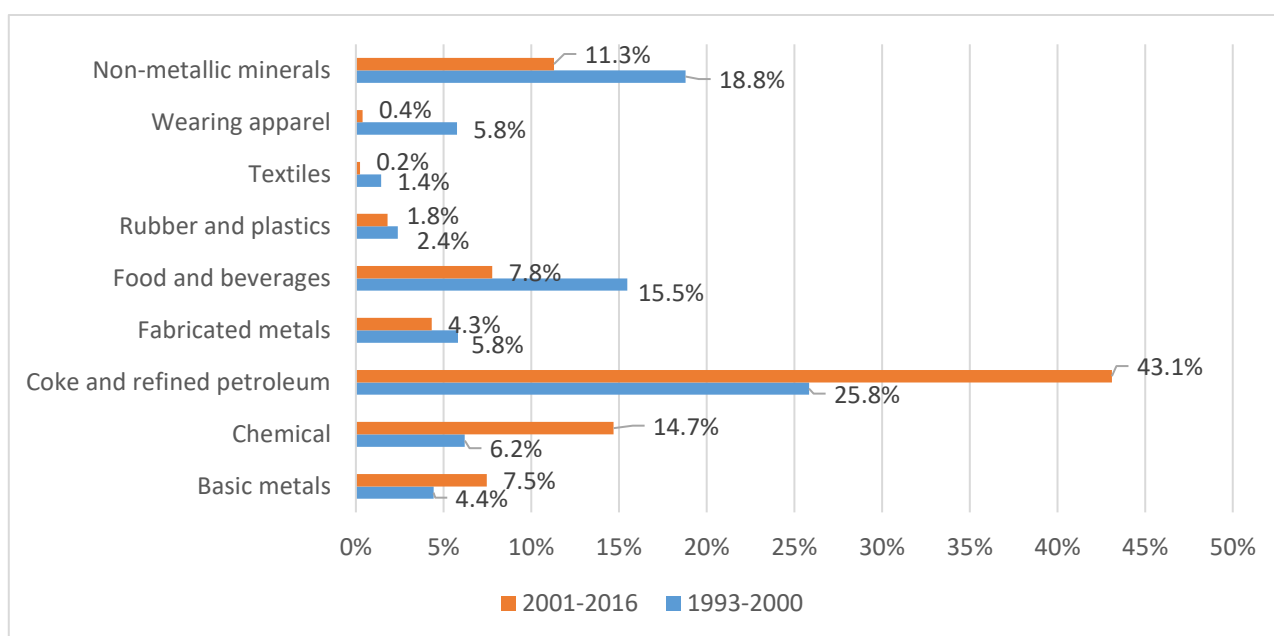
The quest for industrial diversification that started nearly half a century ago has yielded substantial results. Oman's manufacturing sector is becoming larger, more complex and more broad-based, and is moving away from labour intensive, low-tech goods into medium-tech, capital intensive products (Figure 1-6). This change in direction is what could

be expected for a country with the natural resource endowment and income per capita of Oman. Government incentives seem to be effective, at least as far as large natural resource-based industries are concerned. But there are some inherent risks in this industrial strategy that will have to be addressed with further diversification to ensure that the growing share of manufacturing value added remains sustainable and that a 'deeper' and more advanced manufacturing sector can evolve in the future.

The biggest risk by far is for Omani manufacturing to become heavily dependent on industrial commodities. Industrial commodities are

manufactured goods that are identical to those being produced by the competition and are therefore interchangeable in the production process. Producing industrial commodities requires large amounts of fixed assets and energy to turn raw materials into finished products, and factories must achieve economies of scale to keep costs low. The price of industrial commodities is driven by the prices of their underlying raw materials, which normally constitutes a large share of their total costs. Profitability per unit of output is very low and depends on the volumes sold, and competition is based on the extent of investment in plants, equipment and related technologies to achieve efficiency.

Figure 1-6: Sultanate of Oman: Structural change within manufacturing (change in shares)



VA shares: [Value added (US\$ current prices) / manufacturing value added (US\$ current prices)] x 100

Source: UNIDO elaboration based on INDSTAT2 rev.3 (UNIDO, 2018)

Insofar as a large proportion of Omani industry is based on oil and gas either as a source of raw material or of energy, the problems associated with oil dependency will continue to affect the performance of the Sultanate of Oman's manufacturing sector and of the economy as a whole. Some types of plastics which have become commodities are facing severe scrutiny from environmentalists. Diversification into other industrial commodities has helped reduce dependency on oil and gas prices, but they are nonetheless commodities. Steel and aluminium are characterized by widespread over-capacity

around the world and some countries have already started invoking protectionist measures to shield their failing local industries. The profitability and competitiveness of industrial commodities is becoming even more sensitive to minor variations in the prices of their underlying raw materials and the economic conditions surrounding them.

An associated risk relates not so much to the overreliance on industrial commodities but to the fact that their production is concentrated in a few plants. Around ten refineries, mills and plants would seem to easily account for at least one-third of manufacturing production in the Sultanate of

Oman. This makes the country's industries and the economy extremely vulnerable to natural disasters or man-made accidents, or even worse, terrorist attacks. While such events do not occur very often, when they do, their effect can be devastating. Many industrial disasters have been associated with the oil and nuclear industries, but refineries, chemical plants and even large food processing facilities have been at high risk of fire, explosions or flooding. Jindal Shadeed, for example, had to close some of its facilities for several days as a precautionary measure due to flooding at its Sohar location.

1.3 The Sultanate of Oman's manufacturing in comparative perspective



Of the GCC countries, the Sultanate of Oman's industry has been the fastest growing in the region since the beginning of the millennium, more than doubling the growth rates of

Kuwait and the UAE (Table 1-1). Oman's manufacturing sector is the second smallest after Bahrain's and the second smallest after Kuwait in terms of manufacturing share in GDP, producing US\$ 16.6 BN (OMR 6.4 BN) in 2016. Of the GCC countries, Saudi Arabia has the largest manufacturing sector, producing US\$ 80.5 BN in 2016. Normalizing by population, however, the Sultanate of Oman's industry becomes the smallest in size among the GCC countries, accounting for 4.4 percent of the GCC's total manufacturing value added. The productivity of Oman's industry is lowest in the region at around US\$ 48,511 per worker and less than half of the productivity of Qatar, Saudi Arabia and the UAE. Low technological and capital intensity would seem to account for this.

It is worth exploring what the economies of countries around the globe with small populations like the Sultanate of Oman look like. Compared to Costa Rica, a country with substantive agricultural exports, and to Norway, rich in oil-based exports, set at two very different levels of income, the sultanate of Oman's manufacturing sector trails behind in absolute and relative size and export share. Oman's manufacturing productivity is higher than Costa Rica's due to the latter's

relatively higher levels of manufacturing employment. Costa Rica's industrial strategy has focused on building an export-oriented manufacturing base that is relatively advanced technologically while generating employment, especially in its free trade zones. Key industrial exports include medical instruments, integrated circuits and orthopaedic appliances, where Costa Rica specializes in the labour-intensive steps of the process.

Norway has a very similar endowment structure to the Sultanate of Oman, yet a very different industrial base. A very high-wage economy which, nonetheless, is able to employ nearly double the amount of people in manufacturing than the Sultanate of Oman and also employ them much more productively. Norway's industry covers the metals, pulp and paper, chemical and petroleum industries, where the work is carried out in large companies, with a vibrant textile and ready-made clothing, wood products, mechanical engineering, machine tools and graphic industries based on SMEs. Knowledge, research and innovation as well as export orientation, particularly to Europe, are the foundation of small Norwegian firms' competitiveness.

At the other end of the industrialization scale, measured by manufacturing value added as a percentage of GDP, countries like Jordan, Ireland and Singapore can be identified. These countries are currently at different stages of development but have made manufacturing the cornerstone of their development strategy. Jordan, which has by far the lowest income per capita of all comparator countries and is home to millions of refugees from other countries in the region, is building a relatively large and highly productive industry focused on fertilizers, including potash and phosphates; as well as other industrial products such as cement, clothes, pharmaceuticals and general-purpose machinery. It benefits from a free trade agreement with the US. The largest pharmaceutical company in Jordan, Hikma, reported an income of nearly US\$ 2BN in 2017. Singapore and Ireland are notable for the large employment the manufacturing sector has generated in the former and the tremendous productivity in the latter associated with the high-tech industry.

Table 1-1: Comparative Indicators (2016)

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	United Arab Emirates	Costa Rica	Jordan	Ireland	New Zealand	Norway	Singapore
Population (Total, WDI)	1,425,171	4,052,584	4,424,762	2,569,804	32,300,000	9,269,612	4,857,274	9,455,802	4,755,335	4,693,200	5,234,519	5,607,283
Total employment (headcount, UNIDO elaboration)	698,370	2,023,410	2,331,000	1,832,210	10,300,000	3,950,180	2,912,240	1,550,350	1,794,780	2,266,850	2,900,000	3,775,000
Manuf. employment (headcount, UNIDO elaboration based on ILO and other sources)	83,791	116,487	131,000	126,026	753,164	305,869	254,538	119,230	194,303	251,388	252,547	559,495
Manuf. employment share (UNIDO elaboration, based on ILO and other sources)	12.0%	5.8%	5.6%	6.9%	7.3%	7.7%	8.7%	7.7%	10.8%	11.1%	8.7%	14.8%
Income per capita (US\$, current, WDI)	22,561	27,368	15,102	59,324	19,982	38,518	11,733	4,088	64,100	40,332	70,890	55,243
Income per capita (PPP, constant 2011, WDI)	43,643	68,862	39,884	118,207	50,423	67,706	15,195	8,390	63,227	35,777	64,160	82,622
GDP growth 1999-2016 (US\$, constant 2011, UNSD)	4.8%	4.3%	3.7%	9.9%	3.9%	4.6%	4.2%	4.9%	4.8%	2.7%	1.7%	5.3%
MVA (US\$ M, current, UNSD)	5,835	6,679	6,355	13,792	80,505	32,230	6,968	6,191	97,967	20,475	25,009	54,497
MVA share (US\$, constant 2011, UNSD)	15.5%	3.9%	9.3%	9.5%	11.0%	8.5%	14.0%	17.0%	33.1%	11.4%	7.1%	17.6%
MVA growth 1999-2016 (US\$, constant 2011, UNSD)	5.7%	0.5%	10.7%	7.7%	6.2%	5.3%	1.8%	6.3%	7.6%	0.7%	0.8%	4.8%
MVA per worker (US\$, current, UNSD)	69,642	57,340	48,511	109,436	106,889	105,371	27,376	51,925	504,200	81,446	99,025	97,405
Oil export share (SITC rev.3, UN Comtrade)	46.9%	89.6%	63.4%	81.6%	78.9%	15.3%	0.0%	0.1%	0.6%	1.4%	53.0%	11.1%
Manuf. export share (SITC rev.3, UN Comtrade)	29.5%	8.6%	17.1%	0.4%	17.7%	24.0%	52.1%	74.7%	87.6%	21.1%	23.0%	76.4%
Other export share (SITC rev.3, UN Comtrade)	23.6%	1.8%	19.5%	18.0%	3.4%	60.7%	47.9%	25.2%	11.8%	77.5%	24.0%	12.5%

Source: UNIDO elaboration based on International Labour Organization (2018), UN Comtrade (2018), United Nations Statistics Division (2018) and World Development Indicators (2018)

The Sultanate of Oman's industry clearly has a long road ahead, but much can be learned from these comparator countries. Size, income levels and high wages were not obstacles to a modern productive industry. Specific areas in which countries could excel domestically and internationally were identified and developed. Those comparator countries that undertook extensive measures in technology, research and

skills achieved very high levels of industrial productivity. High levels of manufacturing employment were also possible by selecting appropriate industries. Large resource processing plants could be combined with an efficient ecosystem of internationally competitive SMEs. Clear strategic direction and industrial policies have come a long way in these countries to achieve sustainable industrialization.

2 Emerging economic and social challenges

2.1 Global trends affecting manufacturing



Industrial development in coming years will be profoundly affected by a number of global trends that will also influence the Sultanate of Oman's economy. These trends are

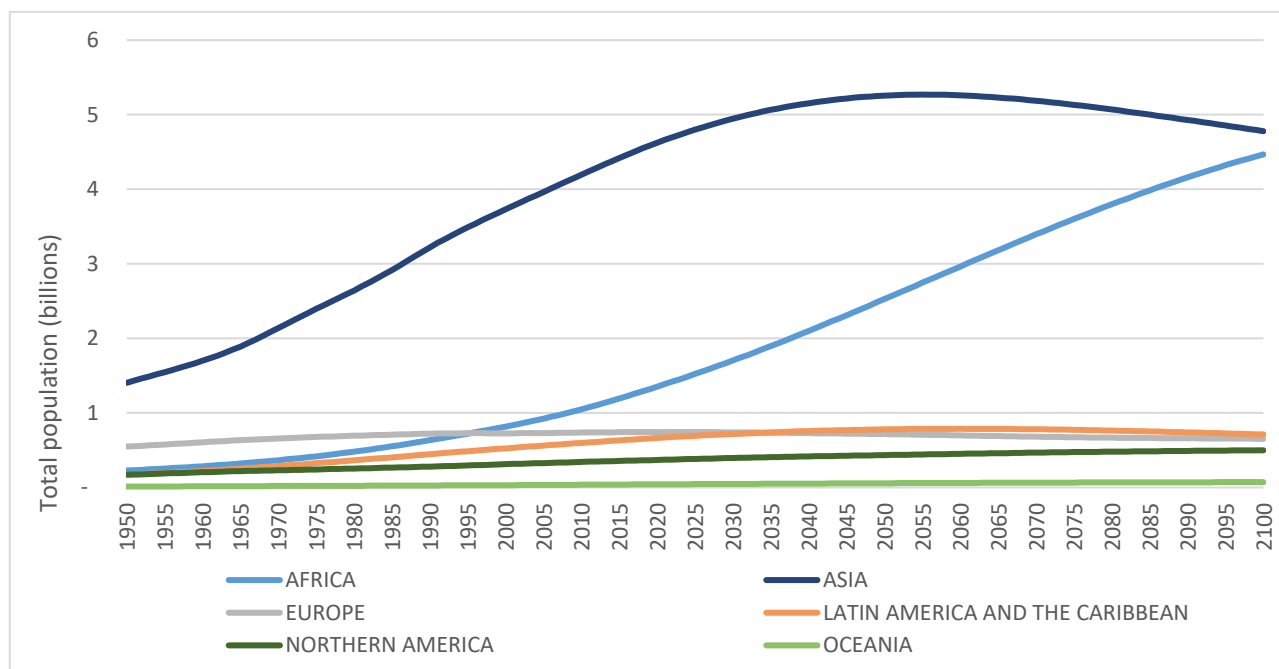
pervasive in that they will affect all aspects of manufacturing and will have to be taken into account when preparing any industrialization strategy.

Two key features of world population trends have emerged. The first is related to the changing location of the world population as its number grows. By 2030, the world population will amount to 8.6 BN, rising to 9.8 BN by 2050 (Figure 2-1) Africa and Asia are expected to account for around 80 percent of the global population by 2050, with 55 percent of the global increase expected in Africa. The African population will tend to be young. India's total population is also expected to increase considerably. Europe and Japan's populations are expected to decrease while increases in North America's population by and large will be the result of migration. The upshot of this trend is that global markets will continue shifting into Asia and expand into India. The emergence of a large middle class with significant purchasing power is already evident in Asia. China is already becoming one of the largest luxury goods markets in the world. In the medium to long run, provided that population growth is accompanied by rises in income, markets will predominantly shift towards Africa. By 2050, Africa alone will account for more than 25 percent of world population. Rapid access to these markets and the exploitation of first mover advantages will be key to benefit from these emerging markets.

The second population trend is aging. Due to the

rapid increase in life expectancy over the last decades, there will be over 2.1 BN people—over one-fifth of the global population—aged 60 or older by 2050. This trend is already evident in some developed countries but is also becoming apparent in developing countries such as China. Aging will impact the ratio of workers to retirees, with consequences for the sustainability of health care and old-age social protection systems. Japan has the lowest ratio of employees to retirees in the world, with 2.1 workers between the age of 20 and 64 years to one retiree. On the supply side, a growing number of retirees may result in difficulties for firms to find workers with the appropriate skills. On the demand side, lifestyle and consumption patterns of an aging population may significantly differ from those of today's population, with health and old age care, medical treatment and medicinal expenditures becoming a larger product in the global consumption basket.

A related trend is the growing concentration of people living in cities. In 1950, 30 percent of the world's population resided in urban areas, while today 55 percent of the global population live in cities. By 2050, 68 percent of the world's population is expected to live in cities. Urban growth is driven by overall population increase and rural urban migration, with nearly 90 percent of this growth being concentrated in Asia and Africa. India, China and Nigeria are expected to account for 35 percent of the growth in the world's urban population between 2018 and 2050, with India alone adding 416 million urban residents. The growing concentration of people in cities will intensify demand for urban infrastructure to address the growing demand for urban mobility, energy, housing and telecommunication solutions, and will hence become a leading driver of new manufacturing activities.

Figure 2-1: Population by region: estimates, 1950-2015, and medium-variant projection, 2015-2100

Source: United Nations, Department of Economic and Social Affairs, Population Division (2017)

Another major trend that has already had global effects is technology, the so called *Fourth Industrial Revolution* (4ir). The 4ir involves the convergence of a number of technologies, including cyber-physical systems that allow real time interaction between machines and computers (thanks to very fast sensors and actuators and related software), the internet of things, big data or very large databases, artificial intelligence that allows the use of data to make decisions and learn and advanced automation (3D printing, automation technologies and robotics). Rapid advances have been made in other technologies, some of which may eventually converge into the 4ir, like photonics that allows the carrying of information signals, biotechnology (especially since deciphering of the genetic code), nanotechnology that allows the construction and use of functional structures designed from atomic or molecular scales, and advanced materials such as super-alloys, novel and advanced polymers, advanced ceramics and superconductors, novel composites and biomaterials.

These technologies are expected to have pervasive effects on manufacturing and on society as a whole. At the level of industry, the 4ir will grow the need for asset and resource efficiency, reduce product lifecycles and open opportunities for creating new products and increase

manufacturing complexity. At the level of organization, data processing (data gathering, analysis and data sharing), improved control mechanisms (machinery and manpower) and greater connectivity will become more entrenched in day to day operations. At the level of the individual, demand for product variety, personalized products and services will increase and faster response to requests, including advanced tracking systems, will become necessary. Major increases in productivity and cost reductions are expected once technologies are mastered, but this requires new skill sets. Employment will decrease in firms that adopt the new technologies but will increase in those that develop new products and processes, with the aggregate effect yet to be defined. Corporate competitiveness and aggregate growth will be contingent on the capacity to create new products and production processes and hence innovation will be at a premium.

It is difficult to treat globalization as a continuing worldwide trend when one of the major international players is erecting protectionist barriers around its economy. Powerful national movements across the world are also voicing their concerns about globalization. Nonetheless, globalization has been a prevailing trend over the last decades and many of its achievements cannot

be easily overturned. International production systems and value chains have progressively become more integrated over the years. Specific activities in value chains have reached such degrees of specialization (upstream activities) while other downstream activities cannot be disentangled without causing major corporate disruptions. Globalization has gone beyond production since R&D, design and professional services have also been offshored around the world as part of global industrial restructuring. While some reshoring is taking place where it may make economic sense, the bulk of global corporations are practically keeping their international production systems untouched and when they do end up yielding to political pressures, compensate by offshoring other activities to keep costs down. Reshoring demands have been made by western countries, but 2030 trade estimates envision the bulk of intrafirm trade—and trade in general—to take place in Asia, a region that remains firmly committed to globalization.

Global environmental concerns will also shape the way manufacturing develops in the near future. Industry emits around one-fifth of all CO₂ emissions and hence has always been a target to reduce emissions. Continuous process industries such as oil refineries, chemical, fertilizer, cement, steel and other similar industries are energy intensive and as a result, heavy emitters of CO₂. Yet the environmental impact of manufacturing goes well beyond a few energy intensive industries and calls for decisive action across manufacturing (Table 2-1).

Calls for ‘circular economy’ approaches are increasingly being heard around the world. It will not suffice for manufacturing to reduce emissions,



but it will have to gradually redesign products and processes so that they are less resource and energy intensive, it will have to use more environmentally friendly materials that can be easily disassembled and recycled. Consumer boycotts and environmental protectionism are the mechanisms that some governments and environmental groups have been using, and these are likely to intensify to steer manufacturing towards a more environmentally friendly path.

Manufacturing is making a comeback into the world scene. One of the reasons may be because old industrial powerhouses may want to recover lost jobs, due to the role manufacturing has played in raising countries like China or the Republic of Korea out of poverty and turning them into major world economic players, or because of the close connections between manufacturing and innovation, in particular in the context of the 4ir. The fact of the matter is that manufacturing is drawing far more attention than it has in previous decades. The consequence of the resurgence of manufacturing is that developed and developing countries alike are carefully designing their industrial and technological strategies and policies that will allow them to improve their international competitiveness and maximize the economic benefits of manufacturing. They are also refocusing their investments and incentives to the sector. Whether this will lead to increased manufacturing activities worldwide is unclear, but countries that do not carefully rethink the role of their manufacturing industry in their development processes will certainly miss out on rising opportunities.

Table 2-1: Pollutants resulting from manufacturing

Pollutant	Effect
Greenhouse gas (GHG) emissions from direct and indirect energy use, landfill gases	Global climate change
Emission of toxins, carcinogens, etc. including use of heavy metals, acids, solvents, coal burning	Human organism damage
Water usage and discharges, e.g. cooling and cleaning use, in particular	Water availability and quality
Electricity and direct fossil fuel usage, e.g. power and hearing requirements, reducing agents	Depletion of fossil fuel resources
Land use, water usage, acid deposition, thermal pollution	Loss of biodiversity
Emissions of CFCs, HCFCs, nitrous oxides, e.g. cooling requirements, refrigerants, cleaning methods, use of fluorine compounds	Stratospheric ozone depletion
Land appropriated for mining, growing of bio-materials, manufacturing, waste disposal	Land use patterns
Material usage and waste	Depletion of non-fossil fuel resources
Sulphur and NOx emissions from smelting and fossil fuels, acid leaching and cleaning	Acid disposition

2.2 Key local economic and social issues

There are four key aggregate challenges the Sultanate of Oman has faced for some time and/or that will need to be addressed in the next few years: employment generation, the fixed exchange rate, raising the populations' standard of living and the Sustainable Development Goals (SDGs).

While the economy as a whole has recorded sustained growth over the last few years, employment generation has not increased at the same pace. The Sultanate of Oman's economy employed around 2.4 M people in 2017. Between 2008 and 2017, the economy generated 1.2 M jobs, a remarkable feat by any standard given the country's size. This does not suffice, however, to address a population that is growing at around 4 percent per annum.

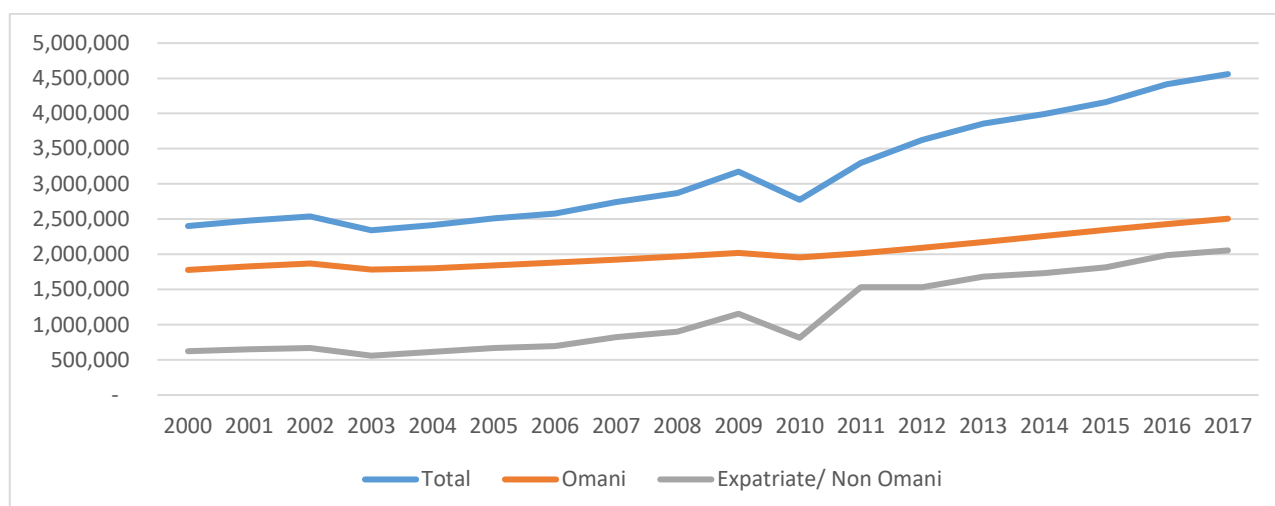
The most recent International Labour Organization (ILO) estimates of unemployment in the Sultanate of Oman was 17 percent in 2017, with youth unemployment even higher, a rather worrying trend since over 40 percent of the population is under the age of 25.

The aggregate employment and unemployment figures mask a number of important underlying trends. Most of the employment generation has

been in the expat community and this is a relatively recent phenomenon. The demand for employment seems to have fuelled an overall increase in the expat population, which rose from 31 percent in 2008 to 45 percent in 2016 and climbed again to 45.1 percent in 2017 (Figure 2-2). From 74.6 percent of total employment in 2008, expat employment grew to 81 percent in 2016. In 2013, foreign workers tended to be male, young and unskilled. They predominantly took blue collar, industry or handicraft jobs and accounted for nearly 90 percent of private sector employment. Around 50 percent worked in the construction industry, while manufacturing accounted for around 13 percent of the total.

The bulk of Omani employment is in the public sector with most of the jobs being clerical in nature. The private sector mostly consists of large capital intensive, resource-based industries, requiring staff of all skill levels. The high level of unemployment clearly disproportionately affects the local Omani population despite the high demand for manpower, especially for unskilled labour. Recent regulations and incentives for hiring local staff have been successful in attracting nationals to government jobs but have yet to significantly change the hiring practices of the private sector.

Figure 2-2: Omani Population by type, 2000-2017



Source: UNIDO elaboration based on NCSI (2018)

The Sultanate of Oman's exchange rate has been pegged to the US dollar at one Omani Rial worth US\$ 2.6 since 1986. Given the country's dependency on oil and the open nature of its economy, the fixed peg system has provided exchange rate stability and allowed for systematic and disciplined monetary policy management. However, maintaining a fixed exchange rate may limit the potential for further diversification away from oil-based products and industrial commodities.

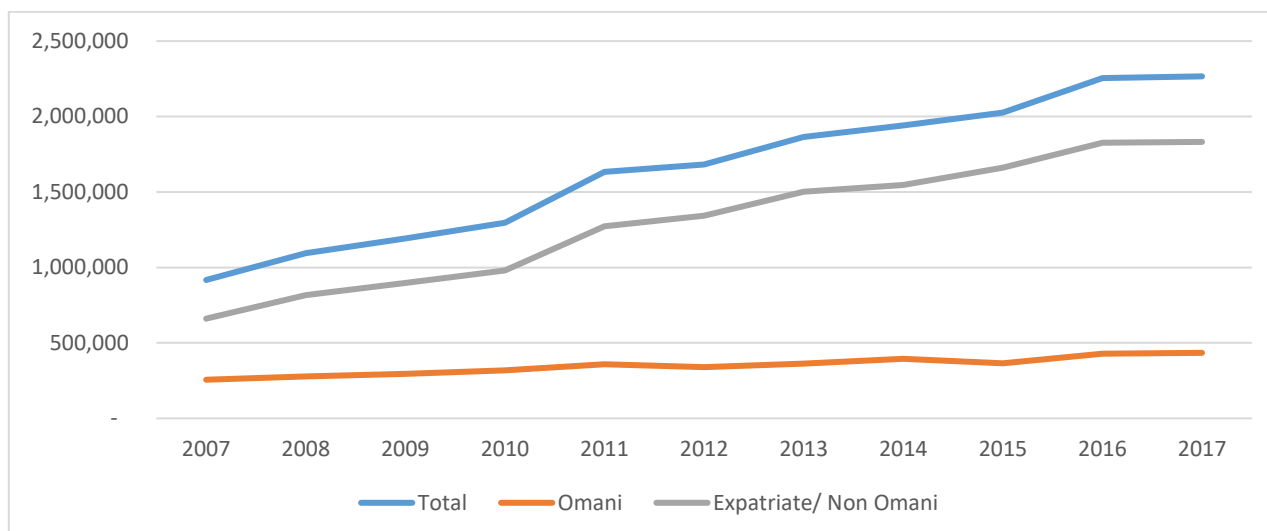
In oil-exporting countries with fixed exchange rate regimes, changes in the price of oil have significant effects on real exchange rates, induce imported inflation and reduce the competitiveness and profitability of the manufacturing industries (the Dutch disease effect referred to earlier). Positive oil price shocks appreciate the exchange rate while falling oil prices tend to depreciate it. To the extent that the currency is only pegged to the US dollar, US inflation and variations in the US exchange rate *vis à vis* other currencies may affect the local economy in the shape of domestic inflation and higher/lower prices relative to foreign prices. As the elasticity and structure of supply and demand of oil exporting economies differ considerably from US's, changes in domestic prices may add to the higher/lower prices relative to foreign ones.

Since the Sultanate of Oman's currency is pegged to the US dollar, it has been difficult to adjust to

the fluctuations of oil prices and the continuous devaluation of the value of the US dollar. Monetary policy has focused on keeping the exchange rate anchored to the US dollar, implying that fiscal policy has been the main policy response to external trends. However, falling oil prices have left little room for manoeuvre on the fiscal front, resulting in soaring deficits and debt. Furthermore, demands for higher wages have grown, increasing inflationary pressure and adding to the fiscal burden. The upshot has been that according to the International Monetary Fund (IMF), since 2010 the Omani Rial has kept appreciating more than the weighted average of the 18 currencies of its major trading partners (95 percent of total imports), making exports of non-oil goods more expensive and imports more affordable. Diversification into new non-oil economic activities and managing a more complex economy will require a fundamental rethinking of the exchange rate policy in the near future.

Another major challenge the Sultanate of Oman's economy faces is how to sustain its current high standard of living, particularly once oil exports and reserves become exhausted, or if there is a global reduction in demand for fossil fuels as concerns about climate change become more urgent, or simply to reduce dependency on the oil sector. In other words, the key challenge will be how to continue growing while diversifying the economy.

Figure 2-3: Number of employees (Sultanate of Oman), 2007-2017



Source: UNIDO elaboration based on NCSI (2018)

The Sultanate of Oman's GDP per capita growth of 2.2 percent lies in the top third of all countries' growth rates during 1970-2016. It has by far outperformed all GCC countries, as well as comparator countries such as Costa Rica and Jordan. Singapore and Ireland lie far ahead of the Sultanate of Oman in terms of growth performance and Norway ranks just one position above Oman. China with a constant GDP per capita growth rate of 7.7 percent and the Republic of Korea with a constant GDP per capita growth rate of 5.9 percent lead all countries.

Halving the oil-based economy from its recent average of 44 percent of GDP in the next 10 years while keeping the same standard of living based on the Sultanate of Oman's past population growth rate will demand substantive societal and individual efforts. The non-oil economy would have to grow at around 8.2 per annum in constant terms, higher than any of the 10-year averages ever achieved in Oman. This growth rate, however, only reflects the profound changes the country would have to undergo. Shifting resources away from old into new industries would involve new considerable investments and the development of new managerial, organizational and technological capabilities. New skills and professions would need to be created and former ones transformed to meet growing demand. Manufacturing would, without a doubt, play a crucial role in driving this technological and skills transformation process. Beyond manufacturing, the economic infrastructure would need to be

adapted to the rapidly changing communication and information technologies and education and health systems would have to be modernized while training its employees in order to address new learning and medical challenges. Transformational changes would have to take place against the background of rapidly changing technology, i.e. a continuously moving target, which would increase the pressure even further for economic and social change.

The Sultanate of Oman's signing of the SDGs adds two critical dimensions to the emerging challenges: inclusiveness and environmental sustainability. Inclusiveness, in a nutshell, stands for leaving no one behind, i.e. all social groups shall benefit from economic growth. It addresses glaring distributional issues. Whatever their causes, the labour market distortions mentioned above, and their related income disparities would need to be addressed to ensure that economic growth benefits all. Equally important will be the development of a growth trajectory that is environmentally sustainable. A large body of scientific and technical analysis shows that man-made activities have put the long-term survival of the planet in peril. The Omani population will have to also make adjustments, some of which will be difficult, to ensure further economic growth is also environmentally viable. Inclusive and sustainable manufacturing could contribute to addressing these challenges through skilled job creation and new, environmentally friendly products and production processes.

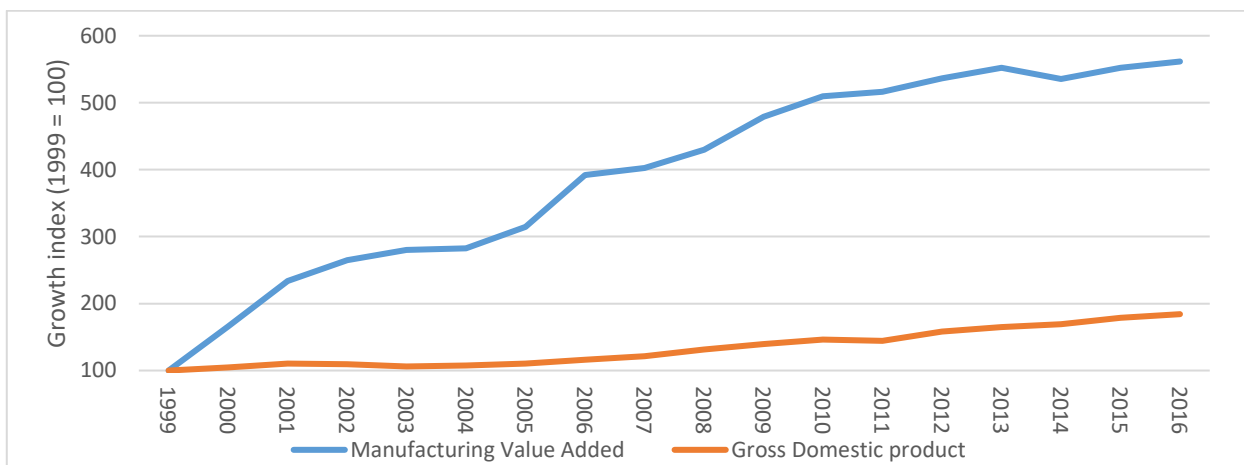
3 Why manufacturing matters

3.1 Economic Growth

Manufacturing is associated with economic growth. Indeed, the Sultanate of Oman's economic growth has been 'pulled' since 1999 by manufacturing's expansion (Figure 3-1). And there is plenty of evidence that this is the case worldwide. It is difficult to find a developed country today that has not industrialized over the last 200 years. Since the 1950s, there is clear correlation between a growing share, or a large share of manufacturing value added and growing income per capita in developing countries. Manufacturing industry has been the 'engine of growth' in countries like China, the Republic of Korea, Singapore and Ireland.

This correlation also holds when examining the components of growth that are necessary to sustain robust increases in living standards. The higher the value of the growth rate (size), the lower the growth rate's volatility or variability (stability), and the longer the growth rate remains stable (durability), the better a country performs in the long run. For example, China kept its growth rate of 10 percent, with deviations of no more than 2 points above or below this figure, for periods of five to ten years. Research suggests that manufacturing is correlated with size and stability, though the jury is still out on variability.

Figure 3-1: MVA and GDP real growth index (Sultanate of Oman)



Source: UNIDO elaboration based on United Nations Statistics Division (2018)

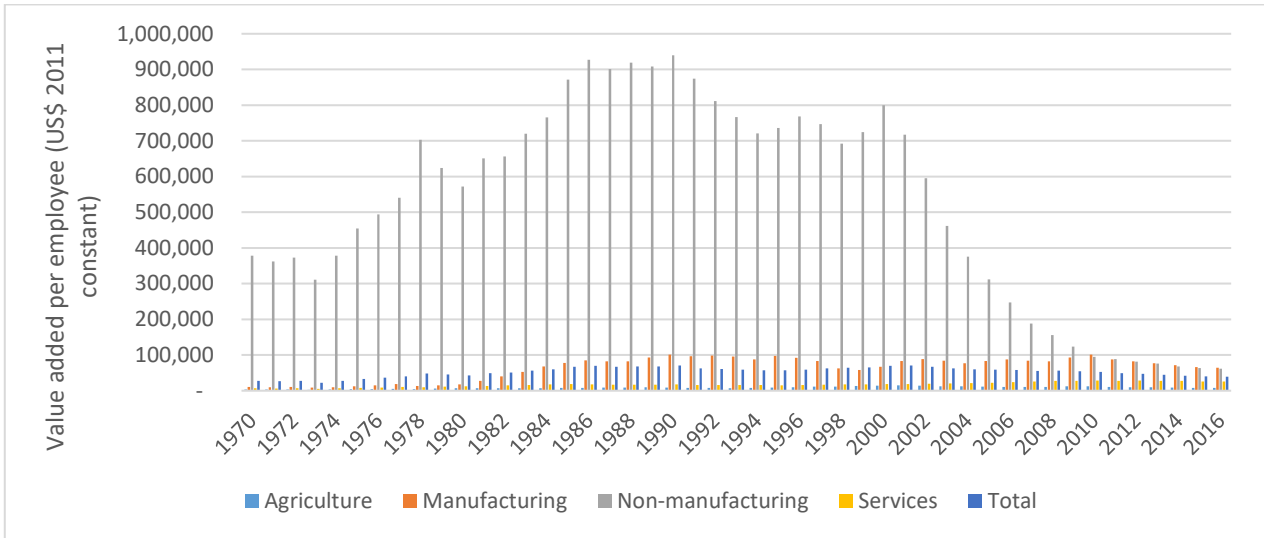
Several mechanisms make manufacturing an 'engine of growth'. Opportunities for division of labour, automation and sub-process integration are much larger in manufacturing than in most economic activities. Capital intensity leads to economies of scale and to fast progress along the experimental learning curve, as much of the knowledge is embodied in the equipment. Further capital intensification leads to more output, thus to a continuous increase in labour productivity, which is generally larger than in other sectors. From an

insignificant level of manufacturing labour productivity in 1970, the Sultanate of Oman has seen its value added per employee increase and eventually surpass the productivity of all other sectors by 2009, including the non-manufacturing sector, which includes the oil industry (Figure 3-2). The only limit to the continuation of this process lies in the creativity of entrepreneurs to improve production processes or to generate new products, whose production can be increased over time. Shifting resources to manufacturing therefore leads

to improved economic performance and higher GDP growth. The benefits of doing so may be even

higher today given the extent of forthcoming automation linked to 4ir.

Figure 3-2: Sultanate of Oman: Trends in Labour Productivity, 1970-2016



Source: UNIDO elaboration based on United Nations Statistics Division (2018), Groningen Growth and Development Centre (2012) and International Labour Organization (2012, 2018)

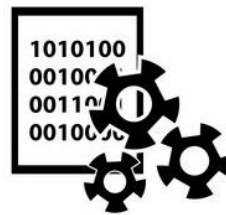
3.2 Linkages and exports

Industrial linkages refer to the contacts and flows of materials and products between two or more industrial sectors or firms. Backward linkages relate to demand from inputs and forward linkages relate to the use of outputs by other sectors. The extent of inter-firm or inter-sectoral linkages is important because it generates interdependencies between firms and sectors and determines the impact of the economic multiplier of specific industries. Industrial linkages are also a key driver of industrial agglomerations and hence influence location decisions.

Manufacturing’s linkages are much stronger than those of mining or agriculture, which generally have weak connections with the rest of the economy. Research on the US economy in 2012 showed that for every US\$ dollar spent in manufacturing, an additional US\$ 1.33 was generated, while transport and warehousing only generated 1 additional US\$ dollar for every US\$ dollar spent. The information technology services industry and the retail sector only generated US\$ 0.8 and US\$ 0.66, respectively, for every US\$ spent. The stronger sectoral linkages generated by manufacturing have been confirmed in multiple input-output studies.

Manufacturing can also help to alleviate balance of payments constraints as the high elasticity of demand of especially high-tech exports can provide sustained growth of foreign exchange. As people’s income rises, they increasingly demand high-tech consumer electronics or health-related products, for example, which the countries that produce and sell them abroad will benefit through higher exports. This will improve their balance of payments results.

3.3 Innovation and change



The strongest argument for the special role of manufacturing in economic development arguably refers to technology and innovation. Insofar as the Sultanate of Oman

emphasizes innovation as a major source of future upgrading, exploring the connections between innovation and manufacturing becomes particularly relevant. Since technology has already been mentioned when referring to the role of capital goods and equipment in economic growth, the focus here will be on innovation.

It is commonly believed that manufacturing is exclusively about producing goods. Due to its success at mass production, manufacturing is often

considered a 'low value' activity compared with other corporate functions, and hence prone to be outsourced to low cost locations. This is far from it. Manufacturing firms are complex organizations that include 'downstream' production activities to 'upstream' activities such as the generation of ideas, designs and drawings for new products, which are often attributed to research and development (R&D) departments as well as marketing activities. While some degree of decoupling of downstream activities and relocation to low-cost sites has been taking place, it is well researched that there are very close interconnections between research and development and production. Product and process knowledge are often interdependent; having a successful product requires a production process that 'understands' the product and can produce it in the most efficient way. The reverse is also true; design and production are often carried out within the same firm and in the same place. This close interaction between ideas and processes also seems to explain the growing relocation of R&D as production has moved around the world.

The connection between production and R&D may be even more closely interlinked in new emerging

industries. Scaling up manufacturing in emerging industries today requires much more investment than in previous stages of the development of a product, and there is less experience in building new factories, so outsourcing is riskier. R&D is difficult to separate, as much of the innovation potential in new industries involves more efficient and cheaper ways of manufacturing emerging new products. A recent well-known example is the solar panels industry, where the most important advances have been made in automation and in wafer manufacturing, which lies at the core of photovoltaic technology.

Perhaps the best evidence of the knowledge intensity of manufacturing is in R&D's sectoral allocation. As presented in (Table 3-1), around 60.3 percent of all R&D takes place in manufacturing, while R&D intensity (R&D as a share of value added) is close to 6 percent in manufacturing and only 0.5 percent in other sectors. Large countries like China, the US, Germany, Japan and the Republic of Korea spend more than 70 percent of their total R&D on manufacturing, but so do smaller countries such as Slovenia, Finland or Sweden.

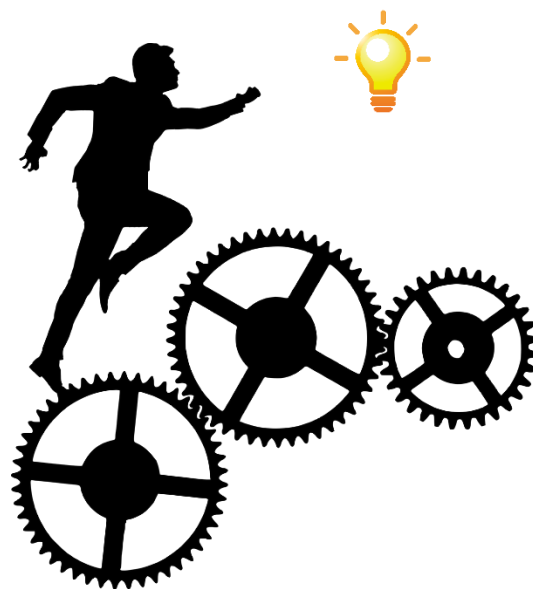


Table 3-1: R&D expenditures, by income group and sector, 2011

	Agriculture			Manufacturing			Mining, Construction and Utilities			Services		
	US \$ Billion (PPP)	Shares of total R&D expenditure (percent)	Sectoral R&D intensity (percent)	US \$ Billion (PPP)	Shares of total R&D expenditure (percent)	Sectoral R&D intensity (percent)	US \$ Billion (PPP)	Shares of total R&D expenditure (percent)	Sectoral R&D intensity (percent)	US \$ Billion (PPP)	Shares of total R&D expenditure (percent)	Sectoral R&D intensity (percent)
Low - and middle - income countries												
China	0.48	0.26	0.04	162.47	86.56	3.78	12.69	6.76	0.64	12.05	6.42	0.21
Poland	0.01	0.77	0.06	0.95	49.15	0.7	0.05	2.76	0.05	0.91	47.32	0.19
Turkey	0.01	0.27	0.01	2.59	53.34	1.23	0.07	1.36	0.06	2.19	45.04	0.3
High - income countries												
Australia	0.13	1.04	0.56	2.98	24.57	4.29	3.51	28.94	1.85	5.51	45.46	0.86
Austria	0	0.03	0.04	4.34	63.69	7.02	0.09	1.29	0.27	2.38	34.98	1.04
Belgium	0.03	0.46	1.09	4.21	62.93	7.13	0.14	2.14	0.4	2.3	34.48	0.75
Canada*	0.11	0.83	0.55	6.03	46.62	4.41	1.05	8.11	0.48	5.75	44.44	0.63
Czech Republic	0.01	0.33	0.13	1.46	56.23	2.19	0.04	1.5	0.11	1.09	41.94	0.66
Denmark	0.01	0.14	0.21	2.48	51.94	9.34	0.05	0.99	0.21	2.24	46.92	1.43
Finland	0.01	0.1	0.11	4.27	76.83	12.06	0.12	2.17	0.64	1.16	20.9	0.9
France	0.18	0.52	0.44	17	49.75	6.82	0.91	2.37	0.44	16.18	47.36	0.94
Germany	0.16	0.25	0.65	55.77	85.62	7.93	0.35	0.53	0.15	8.86	13.6	0.42
Italy	0	0.03	0.01	10.36	73.6	3.43	0.15	1.07	0.09	3.56	25.3	0.25
Japan	0.03	0.02	0.05	100.35	87.87	12.35	1.56	1.37	0.47	12.26	10.74	0.39
Korea, Republic of	0.04	0.09	0.12	39.11	87.54	8.81	1.57	3.51	1.58	3.96	8.85	0.47
Norway	0.08	3.14	1.98	0.98	37.07	4.66	0.35	13.08	0.37	1.23	46.7	0.78
Portugal	0	0.24	0.09	0.7	35.48	2.16	0.05	2.42	0.21	1.21	61.86	0.64
Slovenia	0	0.08	0.07	0.76	72.08	7.07	0.02	1.69	0.35	0.27	26.15	0.81
Spain	0.14	1.32	0.4	5.85	55.7	3.1	0.68	6.44	0.42	38.84	36.54	0.38
Sweden	0.02	0.25	0.38	6.59	71.86	9.91	0.05	0.51	0.13	2.51	27.38	0.98
United Kingdom	0.02	0.07	0.13	9.18	36.9	4.39	0.35	1.4	0.16	15.33	61.63	0.95
United States	-	-	-	201.36	-	10.56	3.79	-	0.3	88.95	-	0.37

Source: Jacob and Sasso (2015)

Manufacturing also contributes to economic development through knowledge spill overs. Knowledge spill overs refer to inter-sectoral flows of knowledge that stimulate innovation in other companies as a result of one's own innovation. Knowledge spill overs derive from the specialization of companies within industries that often require complementary developments to make an initial innovation a success. Technological spill overs have been shown to be one of the major factors through which the manufacturing sector fuels economic growth.

One important point worth stressing with regard to innovation is that country size does not seem to play a role for the capacity to innovate. While large countries may be able to develop a wider range of innovation capabilities and may be involved in several economic activities, by focusing on a few

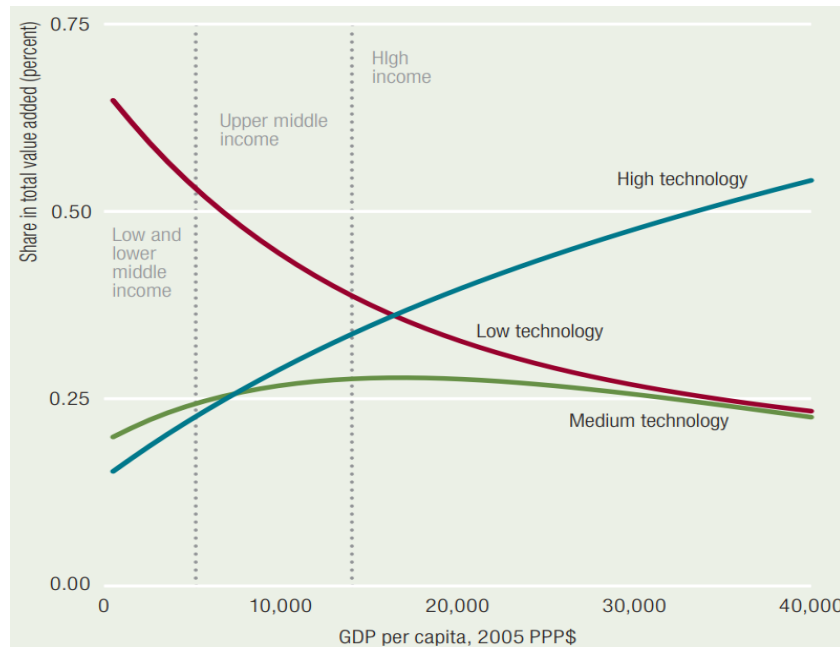
areas of excellence, smaller countries are also able to compete and thrive in the world economy. Of the top ten countries in the Bloomberg 2018 Innovation Index, half of the countries have populations under 10 M: Singapore, Sweden, Switzerland, Denmark and Israel.

Because of the intensity of innovation and technological change, the continuous shifting of resources across industries and the linkages and spill overs that emerge as manufacturing develops, the sector has become a hotbed of change. Change within manufacturing is directional in that it normally shifts away from low-tech, low wage activities, which in certain situations have been associated with 'sweatshop' and exploitative conditions, towards more capital and knowledge intensive activities as incomes rise. The change can be very rapid as a doubling of GDP per capita, say

from US\$ 5,000 to US\$ 10,000, which took place in many countries within 10-20 years between 1990 and 2016, could lead to decreases in the share of low-tech industries of 15 percent to 20 percent and a parallel increase of around 10 percent in high-

tech industries (**Figure 3-3**). This is a significant structural transformation that few other sectors deal with so soon. If there is a feature that characterises manufacturing, that is change.

Figure 3-3: Changes in manufacturing relative share as incomes grow (%)



Source: UNIDO 2013a, pg.61.

While change for the sake of change (and not all changes), are useful, the relentless shift towards more advanced technologies and knowledge-based industries, and the more sophisticated competition that comes with it requires countries and companies to keep abreast of developments in their industries and to continuously adapt their strategies to changing conditions. Efforts from individuals and corporations to continuously upgrade their skills and capabilities need to go hand in hand with global industrial trends in order to sustain economic growth. Growing demand for better education and training accompanies manufacturing growth, helping to improve the overall level of education. Individuals and corporations become more inquisitive, flexible and receptive to new ideas and challenges, all of which contributes to the improvement of the population's living standards as a whole.

3.4 Employment and quality of jobs

Manufacturing directly and indirectly employs about 500 M people around the world. Manufacturing employment in the Sultanate of Oman was around 131,000 people in establishments of 10 or more people in 2016.

Examining direct employment trends around the world shows that while in absolute numbers manufacturing employment is growing, their relative share rarely exceeds 20 percent of total employment and slightly declines in the world as a whole over the long run. Because of the interplay with technology, direct labour absorption in manufacturing will not be a major contributor to addressing employment challenges around the world as well as in Oman.

The employment prospects of manufacturing are far more promising if indirect and induced effects are taken into account. Indirect effects are those created through linkages and induced effects are those arising out of the growth generated through manufacturing. This is because as manufacturing's share in GDP expands, the demand for personal services and social services rapidly increases, also drawing people from the informal into the formal sector, thus increasing formal services jobs. As manufacturing grows, its impact on all types of producer (finance, professional services, cleaning, maintenance and security), distributive (transport, communication, wholesale and retail trade); personal (domestic services, hotels, restaurants, repairs, entertainment) and social

services (public administration, health and education), increases dramatically.

A major beneficiary of a large manufacturing expansion could be the Sultanate of Oman’s software and ICT’s support industries, which has attracted significant interest among young Omanis in recent years. PEIE’s planned industrial cities combining manufacturing, services activities and living spaces may facilitate these complementarities in the future.

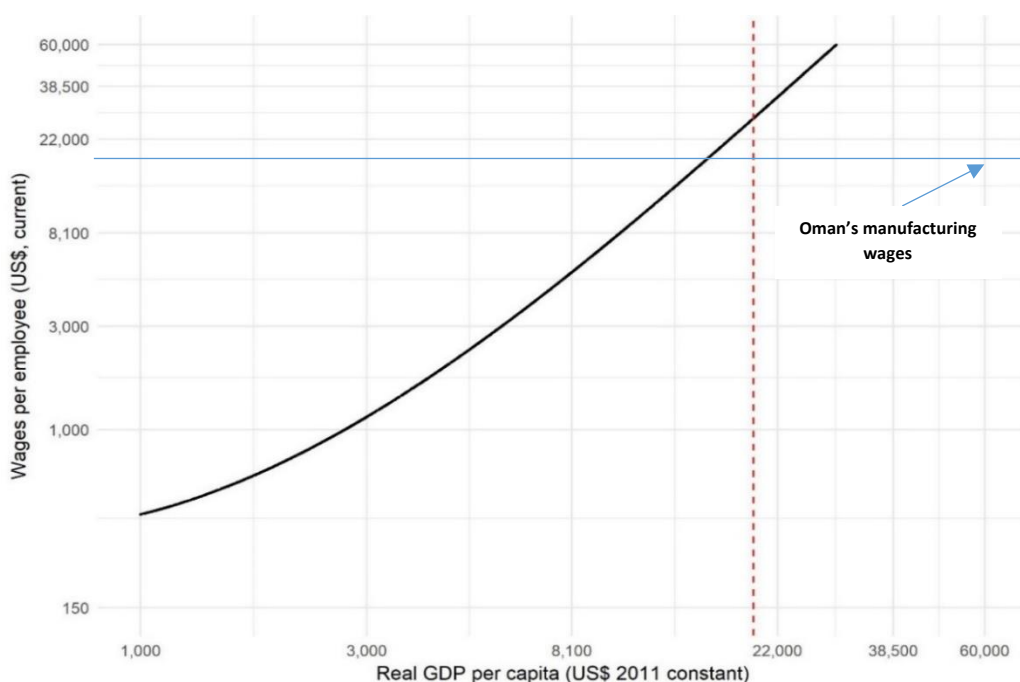
Manufacturing employment multipliers are demonstrably higher than in most other economic activities. Manufacturing creates large numbers of indirect and induced jobs with studies suggesting that for every job created in manufacturing, two to three additional jobs are created elsewhere. When looking into the employment impact of manufacturing, it is critical to consider its indirect impact as well to better gauge the sector’s job generation potential.

Direct manufacturing jobs could benefit the Sultanate of Oman’s development in another respect. Manufacturing jobs tend to be high quality jobs with higher wages and more indirect benefits. In the US, for example, manufacturing wages are higher than non-manufacturing wages, even after taking into account educational

differences. Benefits such as retirement plans, paid holidays and life and health insurance also tend to be higher. Manufacturing jobs fetch higher salaries because of the high costs of downtime, which requires high motivation and skills, and because workers need to act independently most of the time and thus need to be trusted. What was found for the US has been confirmed in other studies all over the world.

Manufacturing wages are not also higher, but continuously grow as industry shifts from lower to higher levels of technology. This is particularly relevant for the Sultanate of Oman since the country already pays relatively high salaries due to the high wages being paid in the oil industry and to Omani staff. Hence, manufacturing may be one of the few sectors that could help the Sultanate of Oman as a whole keep up with the set wages in the oil industry. Also, at Oman’s 2016 GDP per capita of USD 19,560 (constant 2011 prices), current Omani manufacturing salaries of around USD 18,000 (world estimate approximately USD 24,000) were just too high to justify low wage industries, implying that the establishment of medium- and high-tech industries as well as a focus on quality, uniqueness and brand are the only possible future industrial development trajectories for the Sultanate of Oman (Figure 3-4).

Figure 3-4: The wages in manufacturing industries (total manufacturing)



Source: UNIDO elaboration based on INDSTAT2 rev.3 (UNIDO, 2018)

3.5 Social wellbeing



Manufacturing development is not only beneficial to economic growth but also to social development. There are two aspects of social development worth mentioning: education and health. Manufacturing development involves improved education and skills, but the reverse causation is also possible, since enhancing education can lead to manufacturing growth as the new knowledge arising in educational institutions may lead to new goods or product and process improvements. Be that as it may, the evidence suggests that manufacturing measured in different ways tends to be positively correlated with net enrolment rates in primary, secondary

and tertiary education, the ratio of females to males in primary and secondary education, the share of population completing secondary schooling and the youth and adult literacy rate.

Turning to health, like with education, even though the causality can go in both ways, evidence shows that manufacturing is correlated with growing life expectancy at birth, a reduction in infant and under-5 mortality, falls in the maternity mortality rate, reductions in the depth of food deficit, a falling prevalence of child malnutrition and access to improved water sources.

Manufacturing hence seems to be associated with more educated people at all levels of education, and with people living longer and healthier lives.



4 'Manufacturing for Wellbeing'

4.1 *Strategy statement, objectives and rationale*

Strategy is about the long-term positioning of a country with the aim of improving its performance. It is about establishing a unique set of differences that are difficult to imitate, if at all. It rests on identifying and performing activities that differentiate the country from others. It involves establishing priorities and making choices about future directions. These directions in manufacturing are essentially about what types of manufacturing industries should be established, what existing industries should be doing, what types of new products should be manufactured, and which markets should be served.

A strategy needs to be based on the country's strengths and potential opportunities but must at the same time be aspirational and thus entails a degree of ambition. Aside from being ambitious, a strategy must also be realistic, i.e. there must be a clear understanding of the weaknesses and obstacles that the country could face and how to deal with these. A strategy must also include a capacity to adapt to changing conditions. The Sultanate of Oman has three basic strengths on which to build its manufacturing strategy 2040: natural resources, location and people.

The Sultanate of Oman has abundant hydrocarbons and minerals. A 10-20-year strategy needs to focus on the country's resource endowments and build on them as well as diversify away from them. The Sultanate of Oman's manufacturing sector has been building on its natural resources for 20 years by shifting towards oil-based industrial products and diversifying into steel and aluminium. It would be daft to discontinue benefitting from the goods, technology and foreign exchange these industrial commodities bring to the country. In fact, these industries will have to continue providing the

necessary financial resources in the foreseeable future for other industries to flourish. Yet the perils of not creating alternative industries are all too obvious. Dutch disease, instability and inequality are just a few of the economic problems associated with natural resources and industrial commodity dependence. New industries or industry segments need to evolve to complement oil, gas and industrial commodities. These will need to follow a different cycle of accumulation, which depends far less on construction, energy and transport, and more on complex industrial structures and consumer demand both locally and abroad.

Location is another major advantage for the Sultanate of Oman. The country enjoys a unique and privileged position in the Indian Ocean close to the region's major markets. It also has good access to European markets. But more importantly, the Sultanate of Oman is a gateway to the largest and fastest growing present and future markets in the world, namely Asia and Africa. It has a special relationship with Africa due to their historical connections, as well as with India, whose economy based on current growth rates will quadruple in the next 20 years. It can perform a pivotal role in China's Belt and Road Initiative (BRI). The Sultanate of Oman's location is accompanied by a relatively stable social and political situation. While there have been occasional disturbances and upheavals, the country has generally remained peaceful for close to half a century in a region otherwise characterized by conflict. The country's unique location and level of stability does not only mean it has potential for transport and logistics but can also function as an important base for export-oriented manufacturing. Indeed, manufacturing and logistics can be combined in the Sultanate of Oman to establish a strong and competitive position that will be difficult for other countries to contend with and that will allow the Sultanate of Oman to overtake other countries that already enjoy a strong position in logistics.

The Sultanate of Oman's domestic market size will remain small. This is not to say that no import substitution possibilities exist, but that foreign markets will be a key factor of Oman's industrial development strategy. Much like size is not an obstacle to achieving technological progress, it also is not a deterrent to becoming an advanced export location as the cases of Jordan, Ireland or Singapore have demonstrated. Even Norway, which has a very similar economic structure to that of Oman, or Costa Rica and New Zealand, which heavily depend on agricultural commodities, have a much larger share of manufacturing exports.

While natural resources and location are key to the Sultanate of Oman's future industrialization, it will be the Omanis who will be the driving force of manufacturing upgrading. Oman's population is young, self-sufficient and there is general awareness for health and wellbeing as well as family life. Health care is free for Omanis and the standard of care is high for a country at its income level yet demands have been raised to further develop the health care sector. Family, both nuclear and extended, represents an important dimension of Omani life. Although around 78 percent of the population lives in urban areas, people still have strong links with their villages and visit them regularly. Omanis are generally also environmentally conscious and promote friendliness and sustainable lifestyles.

There is an emerging middle and professional class of university graduates, although graduate unemployment remains relatively high. Around 24,000 students graduate every year, with roughly half graduating from public and the other half from private universities. The government supports higher education through the provision of grants and fosters the rapid growth of private universities. It has also been encouraging research and innovation, particularly in the areas of information technology (IT) and industrial technology. Loans and financing have also been made available to potential entrepreneurs. To advance Oman's industrial transformation, the country will need to draw from this large pool of existing and future higher education graduates, both technical and academic. Industrial development will therefore depend on the

inclination and ability of graduates, engineers and technical experts to push manufacturing.

In addition to the opportunities arising from exports to the regional markets and the growing Asian and African markets, the ageing global population also opens new markets for health-related industries. Opportunities related to 4ir are emerging and will require highly paid skilled graduates and technicians in order to materialize. Unemployed graduates may also benefit from more demand for skilled jobs. From a manufacturing perspective, growing environmental considerations open new possibilities in renewable energy and environmental industries. A major threat to implementing a strategy for 2040 may be the high levels of unemployed unskilled workers, but if the manufacturing sector is able to grow rapidly enough and contribute to enhancing national wealth creation, ample employment opportunities will open up in the services and other sectors due to the indirect and induced effects of manufacturing employment.

Given the strengths of the Omani economy, the values and preferences of Omani society and the emerging global opportunities, the strategy is to build a **"manufacturing sector for wellbeing"** by 2040. Wellbeing implies that the condition(s) an individual or a group of people live in make them feel positive. The aspiration for 2040 is for Oman's manufacturing sector to generate material and non-material conditions that will raise society's living standards and its overall wellbeing both locally and abroad. The strategy statement thus reads:

'By 2040, the Sultanate of Oman will have a modern and technologically advanced manufacturing base, fully utilizing the creativity of the Omani population together with the most innovative production techniques and focused on improving the wellbeing of the peoples in the region and the world at large.'

The 2040 manufacturing strategy therefore will pursue the following objectives:

- To diversify the Sultanate of Oman's manufacturing into technology and knowledge-driven activities;

- To develop unique products focused on improving the health and welfare of people;
- To expand Omani industry into regional and new markets;
- To upgrade the Sultanate of Oman's manufacturing to 'state of the art' technologies;
- To create an industrial innovation culture.

The 2040 strategy will be based on three principles: 1) niche markets, 2) speed and flexibility, and 3) leaving no one behind. Oman's economy is small and will remain small regardless of how rapidly it grows. A small economy is not necessarily an obstacle but can actually be a blessing if the country builds on it. Building on a small economy starts with the acceptance that it is not possible to pursue a multiplicity of manufacturing activities, but very few selected ones. The Sultanate of Oman's future manufacturing sector will be concentrated and complex but specialized in activities in which it can become a world leader and achieve world class standards. Niche products do not only refer to specific industries but also—and perhaps specially—to concrete activities *within* those industries. They also target specific market segments, which, however, are usually not the mass market targeted by many large companies and countries. Specific market segments can be more rewarding than larger markets and countries have built successful industrial strategies based primarily on niche markets. Large countries and firms tend to build their industrialization strategies on organization, procedures and rules, which slows down the supply and demand adjustment process. By contrast, smaller countries and firms thrive on their ability to respond rapidly, providing quality and unique characteristics and be more in line with the requirements of demand.

The principle of strategic speed means that the Sultanate of Oman's industrial firms will be encouraged to gain competitive advantage by, inter alia, reaping first mover advantages both in delivery to markets and adoption of new technologies. Only by taking quick actions will Omani firms be able to challenge and gain advantages over the more powerful firms and multinational corporations in neighbouring countries and further afield. Strategic flexibility requires commitment to support Omani

firms in developing capabilities to identify and prepare for major changes in their external environment and to commit resources to respond quickly to those changes. Together with speed, the ability to adjust responses to the given circumstances will be crucial for the competitiveness of Omani firms in gaining access to new local, regional and global markets.

Leaving no one behind is a principle that is not only applicable to individuals and social groups, but also to specific manufacturing activities. In identifying the drivers of strategic diversification, great emphasis has been focused on identifying new activities. This is to be expected as the extent of diversification necessary to break with oil, gas and industrial commodity dependence requires a large number of new industries to be established. Yet there are many existing undertakings among the emerging 'driver industries' that can be as successful as any new ones, requiring relatively little support or nudging. The focus of this strategy will therefore be as much the creation of new activities as it will be the upgrading or improvement of existing ones, particularly in 'driver industries.

4.2 Drivers of 'manufacturing for wellbeing'

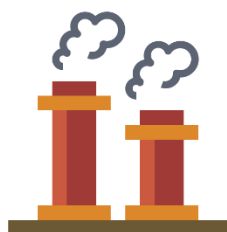


Establishing a modern manufacturing industry by 2040 will require the efforts of all industries, not only the prioritized ones. Consistent with the principle of no industry should be left behind—unless there are activities that can no longer generate value, in which case it is better to replace them with others that can—all manufacturing activities are considered essential. At the same time, it will be necessary to structurally transform the manufacturing sector so new activities emerge in more technologically advanced manufacturing sub-sectors, while already established ones in prioritised sub-sectors enhance their products, quality and efficiency.

The 2040 industrial strategy identifies 30 industries or activities at the Industrial Standard Industrial Classification (ISIC) 4-digit level as those that will provide strategic direction for the development of

the manufacturing sector up to 2040. These are the driver industries and they are grouped into three types of activities based on the nature of their main inputs: natural resources, capital or knowledge. The classification is not perfect as it draws on the majority rather than the totality of industries within each activity type, but it provides a good general overview of industry groups.

4.2.1 Natural resource-based industries



Natural resource-based industries include 15 industries (Table 4-1) whose main input is either agricultural, oil, gas, aluminium, steel or any other mineral. They

accounted for 58 percent of total manufacturing value added in 2015. The industries can be grouped into three clusters: food, oil and gas and other metals and minerals, with furniture remaining as a separate activity. The largest industry group by far among these clusters is oil and gas, accounting for 82 percent of the total, followed by other minerals accounting for 11 percent of the total, and the food industry accounting for 6 percent of the total. With the exception of basic chemicals, a medium high-tech industry, these industries are low-tech or medium low-tech industries according to the OECD classification of technological intensity by industry.

Many of these industries are already performing quite well in terms of levels of production, employment, efficiency of processes and/or exports. The refined petroleum industry will be constructing a new refinery in Duqm soon, with an estimated capacity of 230,000 bd, double the Sultanate of Oman's refining capacity. There are also several plastic projects in the pipeline including the Liwa Plastics Industries Complex, OCTAL's initiative to optimize the production capacity of its polyethylene terephthalate sheets and PET resins plant in Salalah, and the production of 16,000 tonnes of polyethylene triflate sheets and rolls annually, which will substitute imports.

Sohar Aluminium, a key player in the non-ferrous metals industry, already started delivering some of its output in hot liquid form to downstream producers as part of its strategy to develop its industrial ecosystem and to contribute to the

generation of value. The company has also promoted the establishment of downstream users of its product and there are several initiatives to use aluminium in three main products down the value-added chain: wheels, valves and flanges.

In the cement industry, plans to expand capacity to meet the growing demand in construction are already under discussion. Cement consumption in the Sultanate reached 9 million tonnes in 2015, with 54 percent of local consumption being imported from the UAE. Initiatives include establishing two cement plants in Duqm, a white cement plant and two cement grinders.

The major challenges these energy intensive industries face are energy allocation, compliance with increasingly stringent environmental standards and meeting Omanization targets. An immediate task for the strategy 2040 will be to address these challenges and to ensure that these projects come on stream if they have not already. Since it is not clear whether gas production will continue to grow in the future, the approach will be to assume there will be no gas to supply to industry and gradually reduce or phase out gas allocation as an industrial incentive. Indeed, industry may have to prepare itself for a future with no more 'cheap energy' and rather turn their attention to energy conservation and energy efficiency approaches to remain competitive. Energy efficiency schemes do not only save the planet, they can be quite profitable too. Hence, consistent with international agreements and the SDGs, Manufacturing for Wellbeing, will focus on protecting the environment through ensuring limited CO₂ and other dangerous gasses emissions and on less industrial pollution. Industrial recycling will also be heavily encouraged.

The most important among the steel and other minerals industries by far is steel. The global steel industry faces overcapacity, falling prices and growing protectionism. In 2017, global demand for steel was around MT 1.6 BN and could rise to between MT 1.83-2.0 BN by 2040. The Sultanate of Oman's current steel demand is MT 2 M and is expected to rise to MT 4.5-5.0 M by 2040, which will be primarily covered by imports, since the local production of steel is exported. The products sold in the domestic market are mostly long bars and rods for the infrastructure and construction industries.

The key challenge the steel industry faces is product diversification. Long steel products are a distinct necessity for building in Oman. Yet a vast range of the steel market primarily requires flat steel. Ship building, automobile, fabrication, consumer durables, etc. use flat steel as their primary input. Steel products are also experiencing a change in the preferences of

buyers. Demand for special steels is growing at the global level, with similar qualities of iron in terms of toughness but light in weight and rust proof characteristics. Steel alloys are a completely different market segment, one that is usually regarded as a premium segment and requiring large R&D investments.

Table 4-1: Natural resourced-based industries

Industry	Cluster
Processing/preserving of meat	Food
Processing/preserving of fish, crustaceans and molluscs	Food
Vegetable/animal oils and fats	Food
Dairy products	Food
Grain mill products	Food
Bakery products	Food
Basic chemicals; except fertilizers	Oil and gas
Refined petroleum products	Oil and gas
Plastic products	Oil and gas
Glass and glass products	Other metals and minerals
Cement; lime and plaster	Other metals and minerals
Articles of concrete; cement and plaster	Other metals and minerals
Basic iron and steel	Other metals and minerals
Basic precious and non-ferrous metals	Other metals and minerals
Furniture	Various natural resources

Tapping into new types of steel products, certainly starting with flat steel, will be important not only to increase value added and exports, but also for employment. Although the steel industry generates little direct employment, steel plants that produce the full range of products can generate a large number of indirect and induced jobs, which some estimates put at 6.5 workers for every worker employed in basic steel production. Diversification into new steel products, however, should be eventually profitable and not put unduly high costs on consumers during the learning period.

Glass and glass products are another industry that has the potential of growing in the future. The local industry mainly produces glass bottles and containers with a significant share being exported, mainly to neighbouring countries, the Philippines and Kenya. Although the Sultanate of Oman has had difficulty penetrating the high end of the glass and container bottle market, such as perfumes, there are possibilities for further exports, provided some non-tariff barriers and red tape

obstacles are addressed. Entering the high-income segment could depend on the establishment of a local large-scale perfumes industry that would pull the production of sophisticated containers. Attracting foreign capital to the industry is also a possibility, but this may partially depend on the availability of silica raw material. In this context, the possibility of a silica sand processing unit will need to be explored.

The global food industry is facing a major challenge. For the first time in history, non-communicable diseases (NCDs) are killing more people than infectious diseases. Every year, more than 35 million people die from NCDs—nearly two-thirds of the world's annual deaths. NCDs are not just a growing global public health emergency. They are also financially costly because they reduce productivity and increase the load on health care systems worldwide. Cardiovascular diseases (heart attacks and strokes), cancer, diabetes and chronic respiratory diseases are responsible for most NCD-related

illnesses and death. The main behavioural risk factors for these diseases are tobacco use, harmful use of alcohol, physical inactivity and unhealthy diets (diets that are based on a low fruit and vegetable intake and are instead characterized by high saturated fat, salt or sugar intakes).

Due to the improved access to information, consumers around the world are demanding healthier foods and allergen-free products, and an increasing number are changing their habits and choosing healthier diets. As a result, demand for specific foods or types of food has decreased considerably or have even been banned by some governments. This trend has been accompanied by an increasing variety of human taste, the use of exotic flavours, higher consumption of vegetables, less waste and more traceability and transparency in the labels. People are increasingly connecting food consumption patterns to negative environmental impacts, such as in the case of beef consumption.

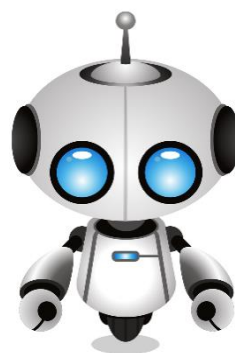
The Sultanate of Oman has also witnessed an increase in NCDs at all age levels in recent years which also in part relates to the change in eating habits towards less healthy foods as people move to cities. Attempts are already being made by the government to increase awareness of this problem, to improve food quality generally and to reduce the content of harmful ingredients, particularly in food targeted at the young. Since the Sultanate of Oman has already introduced a food security strategy, its industrial strategy will complement it—at least as far as food processing is concerned—with an emphasis on healthy foods (see Chapter 5).

4.2.2 Capital-intensive industries

Capital-intensive industries include nine industries (Table 4-2) that are grouped by technological intensity in terms of a high capital labour ratio. These industries accounted for 10.8 percent of manufacturing value added in 2015. Structural metal products and the building and repair of ships industry also tend to be labour intensive. Electric motors, electricity equipment and other electrical equipment include a family of very similar products often produced under the same roof, so they are grouped together as a single industry (they make up a single industry in ISIC rev.4, the most recent

industrial classification). Two industries, structural metal products and insulated wires and cables, account for more than 80 percent of the total of capital-intensive industries.

The structural metal products industry comprises around 60 enterprises of various sizes. It produces bridges and their parts, towers and lattice masts, doors, windows and their frames, equipment for scaffolding and prefabricated buildings for oil refineries, factories and similar buildings as well as their parts. Iron, steel and aluminium are the industry's main inputs. The structural metal products industry is fairly mature, with the majority of its companies being in operation for over 20 years. The industry's turnover was around USD 634 M in 2016, with exports increasing from 6 percent of total output in 2015 to around 23 percent in 2016. It caters mainly to the construction, infrastructure and oil industries.



Given this industry's relatively high labour intensity compared to other metal bashing industries, it is likely to face challenges of automation associated with 4ir. Laser technologies, 3D printing, novel control systems and robotics have already penetrated the industry internationally. These technologies should be arriving in the Sultanate of Oman in the near future, changing the nature of required skills and the demand for labour. The industry could also develop along the product differentiation and product quality axes, since its product range is widening significantly and consistently internationally with a definitive potential for new projects aimed at import substitution and exports to regional markets. A wider range and higher quality products will help to increase value added. The industry, however, is highly cyclical and ways to stabilize demand will have to be found in coming years in order to sustain growth.

The shipbuilding industry for its part consists of small shipyards, and the Sultanate of Oman Drydock Company in Duqm, with two dry docks and a floating

dock, which can accommodate the largest tankers in the world. The docks are mainly used for repair, but they are expected to gradually shift to building larger vessels, moving progressively from smaller fishing and recreational boats to larger trawlers. Building ships and tankers could be contemplated in the long run.



Turning to medium-/high-tech products and specifically to the manufacturing of electric motors, generators, transformers and electricity distribution and control apparatus, sales have proceeded apace in recent years, reaching USD 178 M in 2016, of which around 12 percent was being exported. The main products being produced are transformers, switchgears and electrical panels. The main components of switchgears include switches, breakers, relays and controls, which are all imported. There are about 30 manufacturers for switchgears and electric panels and about 3-4 firms producing

transformers. The technology is fairly well-established but requires local certification, and buyers prefer collaborating with a foreign partner because the likelihood is higher that the technology will be accepted in Oman. Demand is driven by projects from the electricity, construction or manufacturing industries.

The transformer, switchgear and electrical panel industry is undergoing considerable change, mainly at product level. High-tech devices that can send the performance of the product to the customer in real time are being tested in transformers. If this industry is to grow, scale economies will need to be improved and the product range broadened and modernized, something that may require future mergers and acquisitions. There is also some potential for expanding exports, particularly to Africa. As is the case for the structural metal products industry, demand is highly cyclical; for example, the upcoming World Cup in Qatar has significantly boosted current demand, but ways to stabilize demand will also have to be found for these products in the long run.

Table 4-2: Capital-intensive industries

Industry	Cluster
Structural metal products	Medium-/Low-Tech
Building and repairing of ships	Medium-/Low-tech
Electric motors; generators and transformers	Medium-/high-tech
Electricity distribution & control apparatus	Medium-/high-tech
Other electrical equipment	Medium-/high-tech
Pumps; compressors; taps and valves	Medium-/high-tech
Other general-purpose machinery (air conditioning)	Medium-/high-tech
Insulated wire and cable	Medium-/high-tech
Automobile bodies; trailers & semi-trailers	Medium-/high-tech

Pumps, condensers, valves and tips are other locally manufactured medium/high-tech products, although only three firms are engaged in their production. Building, water, oil, sewage and other types of specialised pumps are produced by the industry. Sales amounted to USD 10.7 M in 2016, while imports amounted to USD 750 M in the same year.

This industry has obvious import substitution potential as well as export potential to Iran and

Iraq, and once they stabilize, to Syria and Yemen. Pump demand is growing internationally, which may open opportunities elsewhere as well. Product and process technology is evolving rapidly, with improvements to control and design in the former and automation and 3D printing of hydraulic components in the latter. Pumps, as well as many other similar products, will become sophisticated products with a lot of electronics embedded into them and connected to suppliers or to internal maintenance departments that will monitor them

constantly. It will be unwise to consider these types of products as old technology as the extent of product transformation will be significant. Automation is also making inroads into assembly. Economies of scale will also have to be reached to reduce costs and become price competitive, and hence investments will need to be made, possibly by foreign investors in partnership with local ones, for the industry to be successful in the next 10 to 20 years.

Demand for air conditioning and refrigeration systems is steadily growing around the world as disposable incomes increase, especially in hot and (possibly) humid climates with large and growing populations, such as India, China, Brazil and the Middle East. Presently, the global market for air conditioning equipment reaches close to a USD 100 BN. The International Energy Agency (IEA) projects that air conditioning energy consumption will increase 4.5 times the 2010 level by 2050 for non-OECD as compared to 1.3 times for OECD countries. The Sultanate of Oman's manufacturing capabilities in the air conditioning systems industry are, however, limited to a few firms which mainly assemble air conditioning systems for the residential sector and are almost non-existent in the commercial sector.

Demand for air conditioning systems in the country is likely to grow in the near future. Oman's air conditioning market imports were estimated at USD 426 M in 2017. One of the major reasons for the high import content is the lack of production facilities in flat steel products. With the exception of electronic parts and compressors for air conditioners, all components are manufactured from flat steel products, which range from galvanized sheet vents to assembly housing and fins. In the Sultanate of Oman's air conditioning market, centralized air conditioners have captured the majority share and are further projected to maintain their dominance in the future. Demand for window air conditioners has decreased due to the increasing acceptance of mini-split air conditioners in the residential sector. There is a huge potential for import substitution in this industry, with neighbouring countries also among the largest markets in the world. Competition is, however, tough and entering this industry should avoid long infant industry periods and consumers paying above market prices for too long, if at all.

The Sultanate of Oman's electrical wires and cables industry is dominated by Oman Cables

Industries and Nuhas Oman. A third player, National Cable Factory, has entered the market in 2018. Oman Fiber Optics is the only domestic manufacturer of fibre optic cables in Oman. In addition to supplying the local market, these firms also export their products. The market also, however, relies on imports. There are two market segments: insulated electrical wires and cables and optical fibre cables. Sales in the former are USD 599.2 M and USD 83.3 in the latter, with exports amounting to 25.9 percent and 10.9 percent, respectively. The major export market is the UAE.

Although the industry is small and young, it has matured and is capable of producing goods of international standards. Benchmarked against the GCC competitors, the local producers are equally poised with regard to technology but room for modernization exists when compared with global leaders. The future challenges are to move further up the value chain to offer integrated solutions to end users. There is potential to expand into other products in the longer term, especially into electrical cables and HV cables. Cables for renewable energy applications could be a focus in the immediate term. A further expansion into foreign markets would be necessary going into 2040.

4.2.3 Knowledge-driven industries



Knowledge-driven industries include six industries (Table 4-3) grouped in two activity clusters, namely health and environment. Data is available for medium, medium high- and high-tech industries, but they account for a negligible 0.6 percent of total manufacturing value added. The industry is R&D intensive, employs skilled labour and professionals and pays higher wages. The working environments tend to be clean, except perhaps parts of the recycling industry, involve expensive equipment and are normally connected to laboratories for quality control. There is no data available for the Sultanate of Oman's recycling industry, international data is generally deficient, and part of the industry is being reclassified out of manufacturing into the newly created activity "Waste Management and Remediation Activities". Knowledge-driven industries will need to grow fastest in order to attain significant structural change in Oman's manufacturing sector.

The pharmaceutical industry in the Sultanate of Oman consists of three firms, one of which is in its inception phase. In 2016, sales accounted for around USD 50 M, mainly in generic products. These include anti-cholesterol, cardio-vascular, anti-bacterial, anti-allergic, anti-inflammatory, gastro-intestinal, anti-diabetic, anti-depressant and analgesic-antipyretic drugs. Drugs are supplied in capsules, tablets, solutions and other forms. Despite the small size and wide variety of products, the industry exports around USD 20 M, mainly to GCC countries, but imports a staggering USD 437 M.

Possibilities for developing the Sultanate of Oman's pharmaceutical industry in the near future arise from the fact that several drugs to treat immune mediated diseases (rheumatoid arthritis, psoriasis, Crohn's disease), metabolic disorders (diabetes) and even some oncology disorders, will see their patents expire in the next few years. Treating these diseases has a large impact on the health care costs of governments and individuals. Health expenditures are poised to rise significantly in coming years. Sultan Qaboos University is said to have the capacity to establish the first bio-equivalence centre in Oman. This would allow the

university to test biological treatments and to find way to produce the drugs locally. Biological products have represented the strongest pharmaceutical innovation in the past 15 years.

The Sultanate of Oman has built an international reputation as applying high standards to procedures and compliance by pairing its requirements with those of the European Medicines Agency and is a strong advocate of Intellectual Property Rights (IPRs). This should attract foreign investors to Oman. The country also has privileged access to the GCC and U.S. markets, with the U.S. avid to purchase cheap reliable drugs to reduce its growing health expenditures. Two possible long-term directions emerge for the pharmaceutical industry in Oman. First, focusing on generics and building an own domestic industry following the examples of Jordan and India. Second, concluding manufacturing agreements with pharmaceutical multinational corporations for the local manufacturing of generics or brand name drugs, and gradually building local R&D and manufacturing capacities in the sector. A combination of both is also possible.

Table 4-3: Knowledge-driven industries

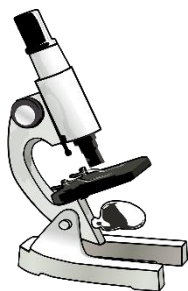
Industry	Cluster
Manufacture of pharmaceuticals, medicinal chemicals and botanical products	Health
Manufacture of medical and surgical equipment and orthopaedic appliances	Health
Manufacture of soap, detergents, cleaning and polishing preparations, perfumes and toilet preparations (fragrances)	Health
Manufacture of electronic valves and tubes and other electronic components (solar panels)	Environment
Recycling of metal waste and scrap	Environment
Recycling of non-metal waste and scrap	Environment

Related to the pharmaceutical industry and as a way to initiate the development of a strong health care cluster is the manufacturing of medical and surgical equipment and orthopaedic appliances. This would be a greenfield activity in the sense that it currently does not exist in the Sultanate of Oman.

Moving into the medical device industry is challenging because products that have the lowest degree of risk and regulation such as disposables and supplies are produced in large volumes and are already being manufactured in China at prices most countries cannot compete with. Nonetheless, some

limited opportunities may emerge here, perhaps linked to local or GCC public procurement. On the other hand, therapeutics is highly regulated and requires medical expertise. Offshoring is uncommon as the high share of U.S. and the EU-15 exports demonstrate. Capital equipment is produced in low volumes with manufacturing ties to countries engaged in electronics manufacturing. Medical instrument manufacturing is comparatively less concentrated (in terms of firms and countries), with some offshore manufacturing in place and relatively lower regulatory hurdles. Instruments also have the highest export value of their product categories. As

such, this product category may offer the biggest potential for entering the medical device industry.



The Sultanate of Oman will be better off if it pursues the development of an export-oriented, globally focused medical instruments industry instead of focusing on domestic and regional demand alone. There is potential in the medical instruments manufacturing for

export activities, for example, in minimal invasive instruments, endoscopes and single-use instruments, where technological learning could begin before progressively moving on to more sophisticated products. High quality products and stringent process controls could be a distinctive competitive advantage of Omani manufacturers. The aim should be a cluster or industrial park-focused development strategy centred on a specific end market or final product category. This could evolve in one of two directions:

- Identify a niche area of medical instruments and target key foreign companies
 - a. Location: Salalah area
 - b. Focus: foreign medical device MNEs as a supply base for global sales or R&D
 - c. Investment funds for JVs could be an incentive for smaller, niche players
 - d. Strategy should align with pharmaceutical industry development
- Target Asian medical companies for sales in Asia
 - a. Location: SEZAD Duqm
 - b. Who: Chinese medical device companies (The Sultanate of Oman included in China's BRI) and possibly companies from other countries such as Iran
 - c. Promote the industry based on proximity to GCC and Asian markets (India and China).

Targeting investors from emerging Asian markets with growing demand for medical devices may provide easier entry than the U.S. or EU markets. China represents a growing market opportunity, especially considering the potential for increased economic cooperation under the Belt and Road Initiative. Other Asian markets like India or Singapore may also offer promising alternatives. These nations are increasing their health care expenditures, expanding insurance coverage and

have growing populations. These markets also tend to have lower regulatory access hurdles, giving smaller firms the chance for entry.

The third industry in the health care cluster is not so much focused on physical health, but more on improvements in quality of life through the use of fragrances. The focus, in particular, is on developing a frankincense perfumes industry. Like the pharmaceutical or medical instruments industries, this industry has high R&D and marketing expenditures, and production processes take place under similar conditions as in the pharmaceutical industry.



The Omani frankincense industry has several large international companies and numerous family businesses that produce cosmetics and perfumes in their homes. Essential oils of frankincense are said to be distilled in private residences and all other raw

materials, packaging materials, bottles, containers and designed boxes are imported from abroad, mainly from France and China. Small Omani family firms producing incenses and perfumes do not seem to export their products but focus instead on the local market. One firm mentioned that it sells its products online, although the amount of sales was unclear. On the other hand, large companies like Amouage have sales points in the most exclusive markets around the world. Perfumery is an extremely profitable industry.

The development of a modern global frankincense industry requires production of the necessary essential oils. The Sultanate of Oman has been producing these for centuries but in an artisanal manner, which creates problems such as lack of standardization and variability in quality, and hence reliance on foreign raw materials. In 2016, USD 4.9 M in essential oils and USD 47.1 M in odoriferous substances and mixtures were imported. Compared to these figures, Oman's frankincense exports are negligible. The challenge is therefore to produce the necessary essential oils at industrial scale so downstream mixers can develop their own fragrances.

The global market of essential oils has a turnover of USD 6.5 BN with a projected increase in the range of 8.4 percent to 11.3 percent to USD 15.8 BN in 2024-2025. Estimates for 2020 are 370.000

tonnes valued at over USD 10 BN. Essential oil cultivation areas cover 600,000 hectares and 1 million farms are producers of essential oil-bearing plants. The market of essential oils does not include only perfumes, but food and beverages (35 percent), fragrances, cosmetics and aromatherapy (29 percent), household products (16 percent) and pharmaceuticals (15 percent). The market price of essential oils depends on quality factors, economic factors such as supply and demand conditions and international certification. The quality of essential oils is determined by geographical aspects such as country of origin and climate. In frankincense, the Sultanate of Oman would have a distinct advantage.

Much is being said about the Sultanate of Oman's potential in the use of solar energy, but the country also has immense potential in the manufacturing of solar energy components and parts. This is another green-field industry that could open a door to a modern technologically advanced industry.

The Sultanate of Oman is a net importer of solar energy manufactured goods, such as photovoltaic cells. Between 2006 and 2016, Oman, on average, imported USD 1.02 M per year worth of photovoltaic cells, mainly from China and India. This can partly be attributed to the early stage of the domestic solar energy industry's development. Photovoltaic (PV) cells are imported by local firms specialized in downstream design, installation and maintenance of PV systems for domestic and industrial use. This value chain segment shows a high concentration of local firms in comparison to upstream manufacturing activities.

Oman's installed solar energy generation capacity has witnessed considerable growth in the last five years. Additional developments suggest this growth might continue in future years. For example, the enhancement of the north-south interconnect project and a wholesale electricity spot market, enabling the potential for future electricity trading from 2020 onwards, which could drive demand for solar energy. Furthermore, leading authorities have issued a renewable energy development plan that includes four independent solar power (IPP) projects, adding a planned 2,000 MW of solar generation capacity to the electricity supply landscape by 2024.

Opportunities for manufacturing will emerge in secondary (low-tech) components for PV and



Concentrated Solar Power (CSP) systems, capital-intensive raw materials for PV (i.e. polysilicon),

manufacturing of core (high-tech) components for PV and CSP and for research on next-generation PV and CSP components and systems. Attracting foreign investors and developing technological capabilities in this field will be key to building Oman's solar energy manufacturing industry.

At present, the Sultanate of Oman's recycling industry is not active, with the exception of the reprocessing of end-of-life car tires and acid lead batteries. Reprocessing is carried out by private entrepreneurs in contact with be'ha and Haya, the public sector waste management companies, for the supply of waste and the recovery of treated sewage and oil well waters. At the same time, the export of a few recyclable materials—Acid Lead Batteries (ALB), tires, plastics, iron scrap—has been ongoing for some time, operated mainly by expats. Be'ha has set an ambitious target to reduce amount of waste going into landfills by diversion rate of 60% moving towards 80% by 2030.

The following selected industries of “recovery from waste”, identified in collaboration with be'ha, could be developed in the Sultanate of Oman in the short-term to obtain inputs for domestic production:

- Construction & demolition waste, usable for road construction
- Refused derived fuel (from undifferentiated municipal waste, tires, plastics), usable in energy recovery in cement plants
- Waste from steel production, usable in road construction
- Source segregated food/agro waste, usable for anaerobic digestion in energy recovery (biogas and bio-methane) and compost
- Fish industry, usable for fish fertilizer
- ALB, usable for lead and plastics.

4.3 Enablers of “manufacturing for wellbeing”

For the industries to achieve their development objectives by 2040, some challenges will have to be addressed. Addressing these key challenges will enable the achievement of the industrial priorities discussed in the previous section. Three types of challenges must be dealt with: people, technology and governance.

4.3.1 People



The Sultanate of Oman’s impending industrial transformation will require people with new and advanced sets of skills, which will have to be developed in parallel to the establishment of new industries. Skills dynamics in the Sultanate of Oman appear to be framed by two interconnected sets of challenges,

one related to the labour market context, the other to the education and TVET system. These two sets of challenges are reminiscent of circles that mutually reinforce each other.

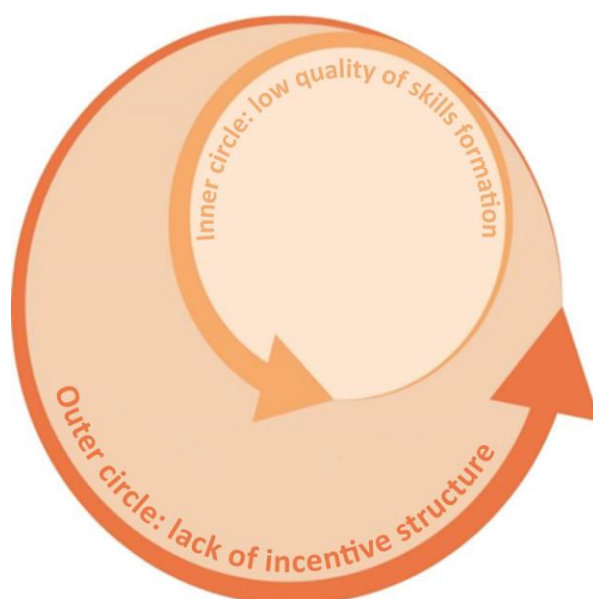
In **Figure 4-1**, the outer circle comprises structural challenges. It sets the general context for the social processes related to the skills-labour nexus and shapes the social imaginary of work and education, which influences study and work behaviour. The inner circle comprises proper educational and skills development

processes as they occur in various institutions and which should be addressed by policy. The key issue here is persisting quality deficiencies that derive from a set of structural (outer) and functional (inner) challenges. The two circles mutually reinforce each other and jointly inhibit the emergence of vibrant national skills development dynamics.

Structural challenges (outer circle) arise from an economic model based on cheap foreign labour. While cheap labour has been at the base of the country’s impressive economic and social development, it seems to have become an obstacle in times of stagnation and increasing demand for Omani employment. Reliance on cheap foreign labour does not stimulate technological and skills upgrading in the private sector, consolidating labour-intensive, low productivity patterns of industrial production.

Even though the number of Omanis working in the private sector has increased over the last few years, Omani youth still view, especially unskilled employment in the private sector as a secondary choice compared with employment in the public sector. This is mainly due to the lower salaries and unfavourable working conditions leading to lack of motivation, weak commitment and Omani youth not finding the private sector jobs stimulating enough. In fact, such jobs are often only considered intermediate jobs while vying for a job in the public sector.

Figure 4-1: Two interconnected circles framing the skills dynamics in the Sultanate of Oman



These employment patterns lead to a lack of an incentive structure in the private sector to replace foreign workers with Omanis. Incentives for employers to hire Omanis instead of cheaper and better skilled expatriates are weak. They are equally weak for Omanis to seek work in the private sector rather than in the better paid public sector. Under these circumstances, support for the emergence of vibrant national skills development dynamics is clearly necessary.

Policy and functional skill-related challenges (inner circle) in the Sultanate of Oman comprise the education and technical and vocational education and training (TVET) system as well as the concrete processes of skills development that take place inside and outside of these systems. There are, in turn, two levels that need to be looked into: challenges to the forthcoming 4ir and those related to the education and TVET system itself.

4.3.1.1 Challenges related to the manufacturing sector and the 4th industrial revolution



There are substantial gaps between the education and skills acquired in schools, colleges and vocational training institutions and the manufacturing sector's skill requirements. The most

common cognitive and technical skill gaps are the lack of knowledge, and the required depth, of the English language, mathematics and science. But there are also deficiencies in critical and analytical thinking and in data handling. In the private sector, skills for operators and technicians are lacking, i.e. mechanical, electronic and instrumental skills. Studies point to relatively good digital preparation in schools, but it does not seem to be carried over to work, where reports suggest weak digital skills among employees and limited interest in ICT-related training. There seems to be a lack of machine operating skills in the pharmaceutical industry, which will be an even greater problem as machines become more sophisticated. At the professional level, biotechnology expertise, in particular, biomedical engineering, is urgently needed.

The lack or limited availability of skills is compounded by several factors. First is the absence

of thorough assessments of digital skills among secondary school and college graduates as well as a lack of assessments of future digital and technological skills needs. Second are the relatively weak quality standards of basic skills in the general education system, an issue that is examined in the next section. Solid basic skills will be of key significance if the future workforce is to adapt quickly to rapidly changing technological skill requirements and to develop analytical and creativity-based skills that complement automation processes. Third is the limited and disjointed supply of technical training. For example, vocational training is not available for machine operators in the pharmaceutical industry and there is no specialized college in metallurgy. TVET delivery is particularly fragmented at low and medium skill levels, a worrying problem since employment in these segments is most at risk of being replaced by automation. Lack of standardization, quality assurance and alignment across the growing private training sector and between the public and the private TVET sector are starker than for other education sub-sectors, and result in particularly weak skills dynamics in the low and medium skill segment.

Company involvement in initial skills formation is fragmented and scarce. Official data indicate very low enrolment in the TVET apprenticeship track (34 apprentices in 2016). Private companies often lack commitment to skills formation and technological upgrading, instead preferring to run labour-intensive businesses based on cheap expatriate labour. Hence, their interest in skills formation is even lower with regard to the expatriate workforce. There are some indications that private firms resisted assessing migrant workers' skills for quite some time out of fear that this would lead to higher salary demands. However, employers' awareness of the importance of skills improvement and skills testing, also among the expatriate workforce, is beginning to change.

A government-private sector dialogue to identify occupational standards and training curricula is incipient and has not yet yielded significant results. Some blame this on low private sector interest to cooperate with government agencies either in terms of the curriculum or at the practical training level. Continuous and intense private

public dialogue will be key to respond to 4ir changes, both because of their speed and the unpredictability of upcoming change.



Manual labour has a low social status among Omanis. Workers point to low wages and poor working conditions

as key reasons for this attitude. Manual work also lacks social recognition as opposed, for example, to clerical jobs. A common problem reported at the workplace, particularly in the private sector, is low work ethics, weak commitment to jobs and poor time management skills.

A major paradox of the supply and demand of skills in the Sultanate of Oman, especially at the professional level, is that many more women than men attend ICT-related training courses. In some cases, female participation accounts for up to 80 percent of the total. This high potential in terms of digital skills, including highly specialized skills, risks to be at least partially lost for the Omani private sector since employment rates among women are low.

4.3.1.2 Challenges at the level of the education and TVET system

Assessment tests and evaluations highlights that quality standards need to be improved in the education system (grades 1-12) leading to low basic skills among secondary school graduates, both at the level of key cognitive skills and transferable skills. This negatively affects any type of subsequent education or training. As a result, secondary school graduates require a foundational year at universities, colleges and vocational colleges and often entail lengthy retraining in companies.

Performance assessments, however, show that like at the graduate level, girls outperform boys in virtually all grades, subjects and regions, irrespective of whether achievement is measured by teachers' grade, national assessments, international assessments or public examinations. Yet as is the case in the professional level, employment rates among women are much lower than among men, and women mostly work in the

public sector, meaning a substantial loss of skills and capabilities for the manufacturing sector.

The low standard of education is attributable to conservative teaching methods that focus on the acquisition of factual knowledge and rote learning rather than on knowledge application, creativity and analytical thinking. The government has undertaken efforts to reform the curriculum and teacher training to make teaching more learner-centred and more relevant for the acquisition of transferable skills, but reforms have not resulted yet in a tangible transformation of teaching methods.

Recent curriculum reforms have focused on introducing new subjects, such as information technology; science and the environment, and life skills; limiting the amount of theoretical content; making learning more meaningful by relating content to the students' practical world; reducing emphasis on memorization; and reducing dependence on textbooks as an information source. However, one major problem is that the curriculum is not always appropriately applied in the schools. In practice, lessons are still mostly restricted to theoretical knowledge and not closely linked to the concept of work. Research suggests that teachers experience difficulties in applying learner-centred approaches as well as being reluctant to adopt modern approaches to delivering knowledge.

The school year is short and instruction times are shorter than in other countries due to school closures for national holidays, religious events, public examinations and some adverse or unusual circumstances. An estimate of total instruction time amounts to approximately 690 hours per year. In sharp contrast, most countries allocate between 700 and 800 hours of instruction time annually for pupils in grades 1 to 4 and between 800 and 900 hours annually in grades 5 to 8. Pupils already start disadvantaged due to the traditionally low participation rates at the pre-school level.

The general education system also lacks vocational preparation and inter-linkages with working environments. This hampers students from acquiring a positive view of work processes as valuable learning opportunities early in life.

Enrolment numbers in the TVET system, albeit growing, remains marginal and is perceived to be second best compared with academic education. Technical colleges are a major provider of vocational skills. In terms of enrolment numbers, they outnumber vocational colleges more than tenfold. High unemployment rates among college graduates indicate that professional qualifications acquired in Omani institutions are not sufficiently competitive to make up for the perceived “advantages” of expatriate employees. The low social status of manual work translates into vocational training also lacking social recognition and, hence, low enrolment.

TVET deals with weak basic skills of newly enrolled students, outdated teaching and learning methods, lack of common standards and not being well connected to industry. There are no nationally standardized skills assessments and skills requirements assessments. The government is working on and has launched “The Sultanate of Oman Qualification Framework”, but the initiative has only just begun. Skills standards among graduates from technological colleges have improved, but instruction at colleges still focuses too much on theory and there is hardly any exposure to the practical workplace. Internships are only mandatory for the last year of college due to the lack of sufficient places in private sector companies, which for some is the result of the reluctance by companies to provide internship places.

Private universities and colleges have a major share of the total student population at the tertiary level accounting for more than 50 percent in the academic year 2015/16. The quality of training provided at private universities and colleges seems to be mixed, is not particularly relevant for subsequent employment and biased towards academic rather than technical careers. The public subsidies received by private universities are not always invested in the improvement of the quality of education and their strategies are often dictated by profit maximization instead of academic quality or social equity.

The quality of private training institutes is also mixed. Some are perceived to provide very low-quality training. Many focus more on administrative rather than on technical fields and

craftsmanship. Although a thorough evaluation of standards is due, there is a widespread belief that the quality standards among private training institutes represent a major problem. Furthermore, there is a lack of standardization and alignment at various levels. The Ministry of Manpower (MoM) is responsible for certification and quality assurance for industry-related skills but due to a lack of institutional capacity, it has thus far not been possible to standardize certifications and quality assurance across the public and private sector of TVET provision. Clearly, MoM needs to improve its administrative and technical capacity to supervise the growing private training sector in terms of quality assurance and standardization.

There has been more progress in developing occupational standards at the national level. To date, the National Training Fund (NTF) and the Occupational Standards and Testing Centre (OSTC) have developed 50 national occupational standards in cooperation with the Oman Society for Petroleum Services (OPAL) in the oil and gas industry. However, many industries need to follow suit, particularly such industries like pharmaceuticals.

Frequent shifts in TVET policymaking with regard to policy transfer from foreign models have led to strategy inconsistencies and a loss of capacities. From following the UK model of National Vocational Qualifications in the 1990s, TVET policymaking shifted to following the German model of defining national occupational standards based on work process analyses in the mid-2000s, and back again to the UK model of a National Qualifications Framework, which is based on a market-led system of private TVET provision and



certification. It is unclear what were the shortcomings that led to the policy reversal.

Social dialogue as a basis for the design and continuous adaptation of the national skills system is only now emerging in Oman. The parties involved are mainly the government and employers, while there is no evident participation of a third partner in this dialogue, namely employee or civil society associations. To date, the dialogue still lacks a systematic scope and its effectiveness and outreach is unclear.

All in all, the challenges described above limit the capacity of the Sultanate of Oman's skills development system to respond to private sector requirements and as a result, limit the private sector's demand for Omani workers, who tend to require timely and costly retraining. Likewise, the private sector's reluctance to get involved in initial skills formation and in an institutionalized dialogue about a national skills formation system reinforces the functional and structural weaknesses of the latter.

As outlined, the outer and inner circle of structural constraints and skills and related policy gaps mutually reinforce each other, resulting in enablers that are too weak to unleash a vibrant national skills dynamics process for increased employment and productivity.

4.3.2 Technology



There is a wide convergence of Omani opinions in terms of the huge challenges associated with low

labour productivity and emerging 4ir and digital technologies. Furthermore, an overall consensus exists on specific shortcomings observed in the national innovation system, which act as barriers to the digitalization of Oman's manufacturing sector. While some companies are making efforts at preparing themselves for the 4ir by and large the Sultanate of Oman still needs to make significant efforts to be ready and reap productivity gains. Three areas, in particular, need to be addressed: generation, diffusion and deployment.

4.3.2.1 Challenges to Knowledge and Technology Generation

Over the last years, research capacity has been improving at universities and some quality research is already taking place, mostly sponsored by the Research Council. Notable examples are the research being conducted at the University of Nizwa on frankincense oils or the newly establish centre on dyes and moulds at the University of Sohar. This research will in due course have an impact on upcoming manufacturing efforts to develop the related industries.

At the same time, it is clear that overall R&D activity remains limited both in terms of funding as well as research outputs. There are only few PhD students in the Sultanate of Oman, and the PhD projects being pursued hardly ever have a commercial impact. This was particularly obvious in ICT-related research, the cornerstone of the forthcoming 4ir. What little state funding is available does not focus on basic and applied research activities that manufacturing firms engaged in digitalization could tap into.

Overall, the Sultanate of Oman's R&D expenditure is just over 0.2 percent of GDP in 2015, among the lowest in GCC countries, with the exception of Bahrain. UAE leads with nearly 1% of GDP while Saudi Arabia spends around 0.8% of GDP. The world average in 2016 was 2.3% of GDP. Low knowledge and technology generation therefore arises partially from a small public R&D budget. But it is also attributable to low private R&D investment. Although some companies, such as Oman Cables, have their own internal R&D budgets and capabilities, the bulk of Omani manufacturing firms are not involved in R&D. Linkages and partnerships between industry and academia are also very sporadic, which is an additional constraint to the development and use of emerging digital technologies in manufacturing.

A number of new promising initiatives have been introduced in support of local R&D capabilities development in the private sector. These are supported by the Research Council, Oman Technology Fund and the Industrial Innovation Centre, and are clear steps in the right direction towards building a local innovation base. There

are growing opportunities to make research projects more business-oriented, which might create or improve communication channels and collaboration mechanisms between industry and academia. The majority of Omani firms, however, still perceive these initiatives as a drop in the ocean and not fully accessible to the bulk of them.

The availability of skills for new 4ir knowledge and technology generation is also lacking. Local universities are not integrating digital manufacturing concepts and themes as part of their syllabus, resulting in graduates without the right expertise in new digital technologies. In particular, a lack of practical experience in 4ir concepts is evident among Omani university graduates. This is seen not only as a challenge for the development of local research capabilities (PhDs) but also for the creation of a skilled workforce capable of bringing and adapting foreign technology into Oman. New machinery is expected to be more digitalized in the future and the Sultanate of Oman will require both the capability to develop their own technology through R&D as well as a skilled workforce to understand foreign technologies.

4.3.2.2 Challenges to Knowledge and Technology Diffusion



One key challenge to the spread of knowledge and 4ir technologies across the Sultanate of Oman's manufacturing sector is the appropriate information and demonstration examples deficit that companies are facing. Local firms, especially SMEs, struggle to fully grasp the extent of the upcoming technological changes and to navigate through the huge amount of information, and misinformation, provided by international technology suppliers, consultancies and the internet. They find it difficult to determine which solutions are best for their organizations, including how new digital technologies and applications can deliver value to their businesses through existing activities or through new data-based business models. They are confused about the strategic priority of 4ir for the government, since strong government leadership in this field by demonstrating the value of emerging digital

technologies to firms or through policies and support mechanisms/ initiatives would have gone a long way to convince them to adopt new technologies. On the whole, although the willingness to learn exists, firms often find it difficult to address information deficits and related uncertainties, which works as a disincentive for the application of new technology.

Omani firms are concerned about the high costs of and lack of accessibility to new technology, particularly SMEs. Automation involves heavy capital expenditures and normally requires increasing scale to amortize investments. This creates additional burden to the adoption of 4ir technologies. Many countries have schemes to provide firms with limited resources and skills access to low-cost digital applications and solutions. These schemes usually support the adoption of new technologies through training, demonstration campaigns and international visits as well as through the provision of finance, sometimes at preferential rates, to pay for their costs.

One rather bothersome barrier to the adoption of new technology is associated with the difficulties manufacturing firms face to import foreign machinery and components. The process for importing new technologies is long and costlier than in competitor countries. As a result, Omani companies adopt preventive measures such as minimizing the variability of equipment and technologies they use in their operations in order to reduce the complexity of maintenance and service requirements (i.e. standardized technology/equipment used across firms to minimize variability in spare parts and components). The same constraints could apply to new industrial machinery equipped with new digital technologies, so companies may avoid introducing them to get around sourcing and maintenance issues. The current regulatory framework for imports represents an area of opportunity, as it could be simplified to facilitate access to new foreign technology and the required maintenance and service expertise.

There are constraints in the digital infrastructure as well. Low internet connection speeds, lack of optical fibre data connections and limited broadband coverage are some of the key issues.

Similarly, despite significant legal and regulatory efforts by the Information Technology Authority business concerns about cyber-security and data sharing confidentiality in the current Omani network infrastructure may have become a disincentive to use digital tools in some firms' operations. A number of initiatives were mentioned as already aiming to address these barriers. For example, wireless and 4G networks have nearly full country coverage, and a broad fibre optic installation across the country is expected to be completed by 2021.

Rapid routes for the diffusion of advance knowledge are industrial networks/ communities/ forums, which bring together stakeholders to discuss and share their experiences, something that is particularly important when great uncertainty exists regarding the performance of new technologies. The Sultanate of Oman, however, lacks many of these industrial networks and even less so, technological partnerships. This is seen as a missed opportunity to develop linkages to other industrial players with similar issues and concerns, as well as to increase visibility of potential technology and solutions providers. Information sharing through specialized industrial forums help firms become aware of emerging digital technologies and applications and to better understand their potential value for their organizations. Governments frequently take the lead by organising forums for companies to network and exchange views on critical 4ir common issues. Knowledge networks help avoid silos and connect the public and private sectors with each other and with other actors of the innovation system.

4.3.2.3 Challenges to Knowledge and Technology Deployment



Knowledge and technology deployment refers to the use of new technologies within a firm. One main factor easing technology deployment is skills availability to which reference was made earlier. Nonetheless, there are a few additional issues from the perspective of technology use. The first one is that the limited flexibility in the supply of training in the Sultanate of Oman, which focuses on outdated skills rather than shifting its

attention towards new skills development programmes, markedly for digital manufacturing technologies such as machine learning, artificial intelligence, cloud computing, robotics and cyber-security. The other challenge is the inability to leverage Oman's education system, and a potentially improved supply of trained personnel in the above-mentioned skills, as a magnet for bringing FDI both to install R&D facilities in the Sultanate of Oman and to initiate green-field activities with advanced technologies.

The third challenge is the incapacity to issue special labour laws and providing privileged treatment and incentives for attracting highly skilled expat workers related to 4ir technologies. Revamped labour laws could also be used to attract investment and to provide legal protection and certainty for companies willing to transfer 4ir technologies into Oman. A fourth challenge relates to the lack of recognition of foreign online learning certificates from reputed international educational institutions by Omani education authorities. Indeed, more international linkages between local and foreign institutions could be used as a mechanism to develop suitable online training programmes for Omani workers. Finally, the ability to identify and distinguish between industry-specific skills and cross-cutting skills is a crucial challenge in the training of workers that will be capable of using the new technologies at their maximum potential.

Beyond skills, there are fundamental challenges on how to integrate digital technology with legacy systems. The required expertise to realize such integration seems to be missing in the country. Furthermore, integration challenges add uncertainty to making a business case in support of digital solutions adoption, as there is huge uncertainty in terms of resources and time required for successful implementation of new technologies. The possibility of new technology add-ons leading to operational disruption needs to be minimized to convince managers about the value of new technology adoption and often, it is not all that obvious how new and old technologies will interact.

Challenges are also evident in the ecosystem of industrial support. The deployment of 4ir in many countries takes place in a context in which firms

have programmes at their disposal that provide advice and guidance on best available technologies, their related costs and implementation requirements, and incentives for technology adoption. Moreover, for digital manufacturing, in particular, governments in many countries provide subsidized consultancy services, soft loans for technology adoption and automation, and a host of other incentives that make it worthwhile to invest and use new technologies. There is great interest among individuals and firms in the Sultanate of Oman, both large and small, to enter the 4ir. However, with the exception of ICT, where some efforts to support deployment have been introduced by the government, there are hardly any support programmes that can be leveraged by manufacturing firms.

4.3.3 Governance



Getting governance ‘right’ is a challenge that many governments face in the delivery of a wide range of essential services – from infrastructure and implementation of industrial strategies to the functioning of the legal system and enforcement of rules and regulations.

One important principle and a lesson for countries like the Sultanate of Oman is that if the manufacturing sector is to become a key driver of their economic growth and transformation, the government should first develop a modern governance system that delivers on developmental outcomes in general and that promotes inter-sectoral linkages and the operation of efficient domestic supply chains.

Four challenges emerge in relation to Oman’s system of governance: policy coordination, clear institutional mandates, efficient lead ministries and effective rules and regulations.

4.3.3.1 Policy and institutional coordination and implementation challenges

In the Sultanate of Oman, like in any other country, regulations, incentives and programmes are designed by different entities that usually work in isolation. Their implementation is, in turn,

undertaken by other institutions which also follow their individual mandates. The Ministerial Council is the authority responsible for ensuring that policy is implemented. The Council also sets out the general goals and policies for economic, social and administrative development and proposes methods and ways for implementing measures to ensure the efficient use of financial, economic and human resources.

As economic development progressed, the executive branch of government has also grown institutionally. It currently has 39 ministerial level posts, 11 governorates with their corresponding provinces, as well as a large number of public institutions and enterprises across all economic sectors, many of them offspring of other government agencies. Increased government functions have also meant more personnel and further managerial complexity with an increasing risk of confusion, duplication and the creation of “gaps” in the coverage of critically interrelated activities, thereby undermining the synergy needed to achieve the national economic objectives.

To deal with the more complex nature of government and to ensure better coordination, the Sultanate of Oman abolished the former Ministry of National Economy in 2012 and instead established the Supreme Council for Planning (SCP). The SCP has a secretariat and serves the Ministerial Council, which prepares periodic reports on economic progress, initiates processes for preparing five-year plans and the national strategy and follows up on the work of the committees established by the Council. Although the secretariat consults with and solicits suggestions and inputs from various ministries and major public institutions and authorities, it is not entirely clear whether this information is routinely used to set the Council’s agenda. While some of these mandates have a strategic dimension, the SCP was not established with a think tank capacity or a coordinating role but operates with its old ministry structure and work culture. In reality, the SCP’s responsibilities would seem to be predominantly centred on planning, follow-up and setting standards for the planning process, which are mainly operational activities.



The other mechanisms introduced to improve coordination and implementation is Tanfeedh. While it is too early to judge the effectiveness of Tanfeedh, it has some elements that have helped coordination and implementation across the government. Key Performance Indicators (KPIs) were introduced to measure progress in the implementation of projects agreed under the Tanfeedh initiative. KPIs are not only used to monitor those directly involved in a specific project, but all those contributing to its implementation. As such, it is a very powerful coordination tool for achieving individual targets which all stakeholders must communicate and coordinate with others. Tanfeedh has also been successful in bringing together public and private sectors. The 'Lab' workshops held between September and October 2016 were unprecedented in the Sultanate of Oman's history and provided an innovative approach for the mobilization of private sector resources, and the financing and implementation of priority areas in the ninth five-year plan. However, Tanfeedh is an ad-hoc and temporary coordination and implementation mechanism, and the Sultanate of Oman will have to face the challenge of institutionalizing it without muting all the advantages this one-off initiative has generated.

4.3.3.2 *The challenge of having clear mandates*

In many countries—the Sultanate of Oman being among them—mandates among ministries, public institutions and specialized public entities are unclear or vaguely defined, creating duplication of roles and responsibilities and in some cases turf wars. For example, practically all developing countries have Investment Promotion Agencies (IPAs) that attract and facilitate inward investment, provide after-care services to investors, and monitor and advise the government on investment-related incentives, rules and regulations. IPAs also coordinate the contributions of foreign investment to skills formation, technology transfer and domestic economic development. Normally, these functions and

responsibilities are performed by a single 'national' IPA, collaborating closely with relevant public institutions and other stakeholders. Having a single agency taking the lead—either as an autonomous entity or linked to a specific ministry—helps avoid competition between different institutions in attracting investment and reduces the possibility of transmitting conflicting or confusing policy signals to foreign investors. Even in a federal government system, where regional investment promotion agencies operate, concerted efforts are made to ensure coordination between a single national investment agency and other regional or sectoral investment offices so that duplication of roles and confusion is prevented.

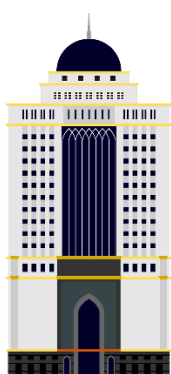
In the Sultanate of Oman, the Public Authority for Investment Promotion and Export Development (Ithraa) plays the role of 'national' investment promotion and facilitation. In addition to promoting Oman's exports, Ithraa's primary goals are to perform the functions and roles of an IPA described above. In effect, therefore, as far as foreign investors are concerned, Ithraa is the official body or the front desk for investment promotion and facilitation in Oman. Yet, a number of other public institutions believe that they also have the mandate to attract investment, in most cases, performing the same functions and providing the same services as Ithraa. These include, among others, Oman Authority for Partnership for Development (OAPFD); the Public Establishment for Industrial Estates (PEIE); and the Duqm Special Economic Zones Authority (SEZAD). There is also an Investment Centre within the Ministry of Commerce and Industry (MOCI), established by Royal Decree, to assist 'strategic' investors—mainly local but also foreign—in establishing their businesses. Although the Centre focuses on manufacturing activities, it also provides services to investors in other industries, particularly priority industries.

While the extent and depth of the duplication of functions and responsibilities vary, the fact that various public institutions believe that they have the mandate to perform the same roles as the country's official investment promotion agency and that they perform these functions to attract investment, in some cases without coordination

with Ithraa, should raise concern as it is likely to create duplications and confusion on the roles and responsibilities of different public agencies, particularly among foreign investors. Moreover, this is not a problem confined to investment. Across ministries and public institutions, the fragmentation and poor coordination of policies and mandates are repeatedly highlighted by public officials who point out that although this is widely known, there is no national level governance framework to enforce coherence in mandate setting and inter-ministerial policy coordination.

Ultimately, good governance requires clarity over who does what, how and when to deliver public services, and that the respective responsibilities are communicated to stakeholders. Clarity about roles helps stakeholders understand how the governance system works and who is accountable for what and to whom. For the Sultanate of Oman, these basic but critical governance issues will become even more important as the economy expands and deepens its level of sophistication and begins to implement the new industrial strategy as an integral part of the 2040 strategy and national development agenda.

4.3.3.3 *The need for a lead ministry*



One important lesson from successful countries is the delegation of strategic leadership to sectoral ministries that are charged with supervising the development of the real economic sectors such as industry, commerce, agriculture, tourism, etc.

In countries that have successfully industrialized, such as South Korea, Japan or Singapore, the lead ministry with authority and the necessary policy tools to become a one-stop centre for initiating and implementing industrial policy and kick-starting the industrialization process has been the Ministry of Trade and Industry. Sectoral level policy design, cross-sectoral coordination, implementation of the industrial strategy and consultation with the relevant business community were the direct responsibilities of the Ministry of Trade and Industry. The Ministry of Trade and Industry—often led by a charismatic

and competent minister—was given full authority to oversee the implementation of industrial strategy, including the rules, regulations and incentives related to trade and industry.

One of the key lessons from the Japanese model that other successful countries found useful and pragmatic is the notion that in order to grow, initiate industrialization and catch-up, governments do not have to improve public sector effectiveness across all sectors at once. There was a deliberate policy in Japan to build a few strategically important ministries and public agencies—by devoting a large amount of resources and the best skills and most committed public servants available—to create role models of excellence and efficiency in policy implementation that other sectoral ministries and public entities could imitate and use as an example.

In the Sultanate of Oman, a good place to start is with priority sector ministries where some experience in international competitiveness and competences in policy design and implementation already exist. The Ministry of Oil and Gas and the Ministry of Commerce and Industry (MOCI) are the two palpable ministries where these basic criteria apply. The formulation and execution of the new industrial development strategy is the mandate and responsibility of the MOCI – an institution with a long history, and one of the dynamic and highly respected public institutions in the country. The key question that both the Ministry and the Government of the Sultanate of Oman have to address is whether, at this particular juncture, the MOCI, as an organization, is ‘fit for the purpose’ and ready to provide the sectoral-level governance needed. The ultimate objective is to see MOCI emerge as a champion of good development governance practices and a role model that other public institutions will replicate.

Over the years, the primary mandates and responsibilities of the MOCI have been reduced to two key economic sectors: commerce (including both domestic and external trade) and industry (mainly manufacturing). Whether these reforms, which were undertaken over a period of three decades, have been sufficient to streamline and refocus MOCI’s mandates and responsibilities is not clear. There are still signs that MOCI is overstretched and that the

boundaries between its policy/regulatory-related roles and operational functions remain blurred. The distinction between its generic objectives and the specific goals that the Ministry is expected to achieve is also unclear. As a result, measuring the performance of the diverse activities performed by the Ministry and their impact on commerce and industry and on the economy as a whole, including the contributions towards the national development strategy, is a challenge. A basic principle of good development governance is that organizations should not only have generic objectives and responsibilities, but also clearly defined specific goals with guidelines on how to implement them and indicators to measure performance.

MOCI remains associated with many public institutions (including offshoots from MOCI such as PEIE), but the precise role or influence of MOCI is unclear. While MOCI's Minister is the chairman of the boards of several public institutions, including RIYADA, the Omani Authority for Partnership for Development (OAPFD) and Oman Tourism Development Company (Omran) and the Undersecretary of MOCI is chairman of the PEIE's board, there is neither a statutorily defined delimitation of roles and functions between MOCI and these organizations nor any organic links that bind them. However, what is clear, even from a scant glance at the organigram of the Ministry, is that MOCI's responsibilities are still overextended, although much less so than in the earlier days of its existence.

Building a dedicated, technically competent and professional staff is an essential prerequisite for creating a lead ministry that excels in its functions and contributes to the attainment of the national development goals. Ultimately, government is only as good as the people in it and the organizational culture and setting in which they work. Thus, policies that allow lead ministries to recruit and retain "the brightest and the best" will help achieve the maximum excellence in policy design and execution. Equally important is the need to adopt a modern and open organizational working culture. This does not mean adopting "alien" values and cultures but working towards common goals, sharing common philosophy and beliefs and the collective determination to achieve the agreed strategy and development goals.

4.3.3.4 Appropriate incentives, rules and regulations



Public sector governance is fundamentally determined by the nature and quality of rules, regulations and incentives that are applied to influence economic relationships and to achieve the desired development outcomes. One important policy tool in the development of the industrial sector is the package of incentives the government offers the private sector to encourage investment in priority sectors and/or activities, and to encourage technology transfer and local capability building through linkages. Three types of incentives are key for Oman's industrial development: incentives to attract foreign investment, location incentives and SME support.

4.3.3.4.1 Attracting investment



The Sultanate of Oman offers an attractive package of incentives to foreign companies to invest in the country (Table 4-4). In addition to location- and geographic-specific advantages, the Sultanate of Oman has a stable political and economic environment. The country has signed free trade agreements with the USA, Singapore, EFTA, Iceland, Norway, Switzerland and Liechtenstein. It is part of the GCC common market, the Greater Arab Free Trade Area (GAFTA) and a signatory to the WTO. The Sultanate of Oman also offers an investor-friendly legislative and legal environment and has a rapidly improving transport and logistics infrastructure.

With a few modifications, the package of incentives has remained largely the same for several years. It was quite successful during the first decade of the millennium when FDI averaged over USD 2 BN per year related to industrial commodities investments. However, since 2010, the inflow of foreign direct investment has decreased to USD 0.5 BN per year, with the net inflow practically drying up. International competition for investment has become fierce in recent years and many countries now offer similar or better incentives than Oman.

Among GCC countries, the Sultanate of Oman also seems to be falling behind. While it scores higher than many GCC countries in the World Bank Doing Business ranking (position 78 in 2018), it is not the most attractive outlet for foreign investors. Bahrain and Kuwait have the lowest corporate income taxes. The UAE is virtually tax-free, except for the oil and gas and financial services industries. In Qatar, a 10 percent flat rate income tax is levied on businesses that are not wholly owned by GCC nationals. More GCC countries now allow companies to operate at 100 percent foreign ownership. Like in Oman, 100 percent foreign ownership is also only allowed in the UAE for companies operating in the free zones. In Bahrain and Saudi Arabia, the limits to 100 percent foreign ownership only apply to companies operating in industries that are specifically listed. In Kuwait, the new FDI law allows companies to have full foreign ownership outside the free zone. The new investment law in Qatar allows 100 percent foreign ownership in all industries (provided the non-Qatari has a Qatari services agent).

Investors are pointing out that former costs advantages of the Sultanate of Oman are eroding. While the local infrastructure is good, except perhaps for internet bandwidth, costs are incurred due to red tape and delays at ports and borders. Energy costs, a former selling point of the Sultanate of Oman are becoming similar to those of competitors and are no longer considered attractive.

Other obstacles to FDI usually raised by foreign investors include availability of skilled personnel, cumbersome administrative and procedural requirements related to the establishment of a new activity or the expansion of an existing one, weak entrepreneurial culture and lack of incentives for investing in the green economy.

The challenge is therefore to create a competitive package of incentives that attracts FDI to the selected industries. A new FDI law is being discussed which entails a more comprehensive and selective set of incentives but has not yet been promulgated. Export processing zones also offer more flexible incentives, but they are limited to the export sector.

Table 4-4: Investment incentives for foreign capital in the Sultanate of Oman

Activity	Income tax	Custom duty and withholding taxes	Ownership	General
Manufacturing Greenfield	5-year exemption	Exemptions on imports of plant, machinery and raw materials for 5 years after starting production (renewable once)	Up to 70% allowed (further under special circumstances)	Free repatriation of capital and profits
	Tax losses during exemption period may be claimed against future profits	No import registration of production accessories, machinery, spare parts, material, transport equipment (upon one-time approval by the relevant authority)		Minimum capital requirements of OMR 150K, 500k or 2000K depending on type of enterprise
	No personal income tax	No withholding of tax on dividends and interests, but 10% on royalties and management fees		Double taxation treaties with several countries
	Corporate tax rate of 15%			Safeguards against expropriation
Manufacturing Expansion	5-year exemption	Exemptions on (5-year renewable): machinery and spare parts raw materials and partially processed goods		MOCI may also provide: incentives, subsidized utilities, preferential land allocation, trade promotion
	No personal income tax			

4.3.3.4.2 Benefitting from location-specific advantages



Turning to location-specific incentives, the government has been very active in issuing policies to establish special economic zones (SEZ) (Table 4-5). The first industrial estate (IE) in Al Rusail, near Muscat, was established in 1983. The Rusail Industrial Estate is managed by the Public Establishment for Industrial Establishments (PEIE), today known as Madayn. Since the creation of the first IE in the Sultanate of Oman, the development of SEZ has undergone several changes to attract investment, support employment and achieve industrial diversification.

Different types of zones have emerged in the Sultanate of Oman and the institutional setting of these structures is evolving. In addition to IEs, these include free trade zones (duty free), export processing zones (focused on exports), comprehensive special economic zones (multifunctional), bonded areas (warehousing), specialized zones (activity-focused) and eco-industrial parks (environmental performance). The management of the different types of zones also varies. In addition to PEIE, which reports to MOCI, the ports and the Salalah and Sohar Free Zones are governed by ASYAD, which reports to the Ministry of Transport, while the Duqm Port and Comprehensive Zone is presided over by a Special Authority, reporting to the Council of Ministers.

There are currently 1,852 firms registered in IEs, of which 1111 are active. Around two-thirds of them are manufacturing firms. Total investment is estimated at OMR 4.9 BN, of which around 17 percent is FDI. In 2017, the two other large locations, the Sohar Port and Free Zone and the Salalah Free Zone had in operation, construction or under consideration, 57 active firms and 35 active firms respectively. In terms of performance, research suggests that IEs have positively impacted the Sultanate of Oman's industrial

development. Indeed, there is a remarkable difference between the economic performance of firms located inside IEs and those located outside, although other factors besides the presence of an IE may be at play as well.

The growth of special economic zones in its different forms and with different authorities has generated a governance dilemma. Varying reporting lines with diverse promotion schemes in different parts of the country have increased the complexity of the SEZ governance system. A number of problems have followed. First, industrial promotion policies have become fragmented and may be diverting investment from industrial estates. Second, there is minimal coordination and cooperation between industrial poles. Third, there is reduced potential for the intra- and inter-area externalities that normally develop in well-connected areas. Finally, there is also lower potential for knowledge spill overs, which are very important for industrial innovation. On the whole, there is no 'system' or coordinated policies for SEZ. 'SEZ systems' and intense collaboration within and across SEZs have historically allowed many countries to move towards more advanced industrial clusters.

A related problem SEZs face, but even more so free and export processing zones, is their lack of integration into the local economy. Due sometimes to over-specialization in export-oriented products, many of the zones' managerial and engineering expertise are not being shared with or disseminated to other firms in the surrounding areas. SEZs are beneficial to industrial development when they attract new investment and the interest of specialist suppliers and the services industry around it. But this is not yet the case in the Sultanate of Oman. Furthermore, a brief examination of the size of firms in industrial estates suggests that they tend to be medium or large, while small enterprises tend to be concentrated in urban areas away from SEZs. A vibrant zone usually attracts large numbers of SMEs into its midst to cater for the various types of demands that arise from the larger companies in the area.

Table 4-5: Special Economic Zone classification

ECONOMIC ZONES IN OMAN	SEZ CLASSIFICATION						
	Free Trade Zone	Export Processing Zone	Comprehensive Economic Zone	Industrial Park	Bonded Area	Specialized Zone	Eco- Industrial Zone or Park
RUSYAL INDUSTRIAL ESTATE				X			
SOHAR INDUSTRIAL ESTATE				X			
SOHAR PORT & FREE ZONE	X	X			X		
RAYSUT INDUSTRIAL ESTATE				X			
NIZWA INDUSTRIAL ESTATE				X			
SUR INDUSTRIAL ESTATE				X			
BURAIMI INDUSTRIAL ESTATE				X			
KOM (TECH. PARK)						X	
MAZUNAH FZ	X						
SUMAIL INDUSTRIAL ESTATE				X			
DUQM PORT		X			X		
DUQM SPECIAL ECONOMIC ZONE		X	X			X	
SALALAH PORT					X		
SALALAH FREE ZONE	X	X	X				
KHAZAEN					X		

4.3.3.4.3 Growing SMEs

As regards SMEs, there are some indications that they play a limited economic role, but even more importantly, they seem to exhibit a continuous decrease in their number, share of output and employment, which if confirmed, would be a very troubling development for the Omani economy.

The Public Authority for Small and Medium Enterprises Development (RIYADA) has currently registered 34,000 business units (data March 2018) which represent about 30 percent of the total number of SMEs in the country. Of these 34,000 SMEs, 72 percent (24,480 units) are micro enterprises (five or less workers); 18 percent

(6,210) are small enterprises (6-25 workers) and 10 percent (3,400) are medium-sized enterprises (26-99 workers).

SMEs face several obstacles in their development. Arguably, the most significant problem is the lack of entrepreneurship. At the cultural level, the predominant mind set is based on security and safety rather than risk, experimentation and innovation. The Sultanate of Oman's entrepreneurial diaspora has not returned in sufficient numbers to make a dent on that mind set and universities, while undertaking some efforts to promote courses that focus on entrepreneurship, have not stimulated enough

'go-getter mentality'. Very few role models exist for those who might be exploring entrepreneurship as a viable career option. And there is also a notable absence of women starting businesses, although they tend to be highly qualified and skilled.

There have been many public and private initiatives to build an SME ecosystem, especially by Riyada, which provides support to Omani SMEs. The package of services includes training, consultancy support in the preparation of business plans and feasibility studies, the provision of land at subsidized rates, access to a variety of funding mechanisms, incubators and accelerators, possibility of hiring foreign workers and the right to enter public tenders. Bank Muscat introduced an initiative called Al Wathbah, which provides non-collateral SME financing while Bank Sohar launched a programme in 2013 to support SMEs in the Sultanate of Oman through workshops and seminars for entrepreneurs. These workshops centre on business planning, cash flow management and marketing. Unfortunately, these

initiatives have yet to build a dynamic entrepreneurial sector.

The Omani ecosystem is also weak on partnerships, networks and associations; both within the Sultanate of Oman and across the region. Hence, there is limited idea exchange and access to resources and markets. While some public and private efforts have been undertaken to improve market access in the Sultanate of Oman itself, these have not extended to enhancing entrepreneurs' access to other markets in the region.

The Sultanate of Oman's investment, and SME incentives and regulation system are sophisticated and comprehensive. It uses most of the instruments that are also applied internationally and seems to be clear and transparent. Yet it fails at the implementation level, as the intended effects do not seem to follow. It also seems to lack monitoring, evaluation and learning mechanisms that would allow it to improve its degree of implementation.



5 Linking the Sultanate of Oman's 2040 strategy with other sectoral strategies and the Sustainable Development Goals (SDGs)

The Royal Directives of His Majesty Sultan Qaboos bin Sa'id stipulate that the strategy "The Sultanate of Oman 2040" should centre on comprehensive and sustainable development while preserving Omani values and identity. The Strategy 2040 identifies three themes: 1) People and Society, 2) Economy and Development and 3) Governance and Institutional Performance.

The Manufacturing 2040 Strategy "Manufacturing for Wellbeing" focuses on human capital as one of the three enablers related to the people and society theme. The objective is to build skills and develop an education system that is compatible with emerging work environments and adequately prepares students for the technological demands of the future, in particular the 4ir. It coincides with the health objectives of the people and society theme insofar as it pursues the building of local productive capacities and a unique food processing approach that can underpin the creation of a society that benefits from sustainable health and fosters a health culture that all assume responsibility for, including industry. This, more importantly, closely connects with the people and society theme since an environmentally sustainable future and the social wellbeing of Omani's population lies at the heart of the manufacturing sector's 2040 strategy.

'Manufacturing for Wellbeing' will also play a major role in achieving the objectives of the economy and development theme. It will represent the backbone of the Sultanate of Oman's diversification, innovation and technological advancement objectives and be the gateway for entering the 4ir. In this regard, manufacturing will be key to providing dynamic economic leadership to other economic

stakeholders and activities. Since attracting investment into manufacturing is particularly challenging, the sector will be the test run for Oman's future investment-promoting environment, SME development and direct and indirect employment generation. Manufacturing will also contribute to an optimal and balanced use of natural resources and sustainable development by shifting resources away from resource-intensive industries, promoting energy efficiency and a 'circular economy' as well as developing productive capacities in renewable energy.

Governance, the third theme of the Strategy 2040, also overlaps substantially with 'Manufacturing for Wellbeing'. Key enablers for upcoming manufacturing development include clear institutional mandates, efficient lead ministries for manufacturing and associated SME ecosystems, and raising the technical competence of manufacturing-related government officials even further, which would greatly contribute to the overall improvement of government performance. An additional contribution in this regard that could perhaps be highlighted more forcefully in Strategy 2040 is the emphasis in 'Manufacturing for Wellbeing' on improving intra- and inter-sectoral policy and implementation coordination. This is crucial for developing an effective state apparatus. Finally, the manufacturing strategy coincides with Strategy 2040 in proposing a clear, transparent, specialized and proactive set of rules, laws and incentives backed by an independent judiciary that while attracting investors, is perceived by all as being fair and straightforward.

'Manufacturing for wellbeing' also has many points in common with specific sectoral strategies.

5.1 Economic sectors' strategies



Strategy 2040 entails two economic sector strategies, namely agriculture and fishing, as well as a strategy for the food processing industry, which

although prepared outside the Strategy 2040 context, provides a good sense of the direction the industry is pursuing. The Omani government has also been working on an innovation strategy, which albeit cross-cutting, will have a significant economic impact.

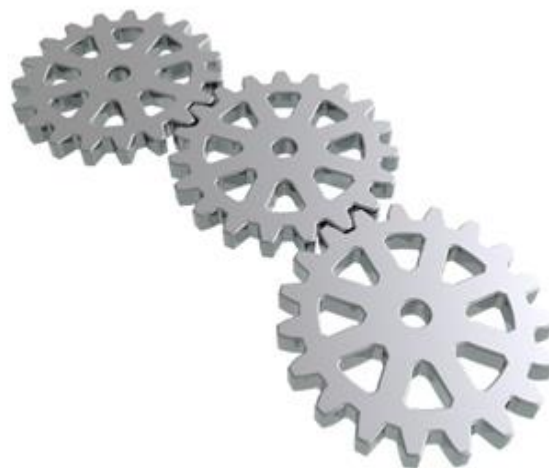
The Sustainable Agriculture and Rural Development Strategy towards 2040 (SARDS 2040) states that agriculture can make a substantive contribution to diversification, food security and sustainable development by increasing agricultural productivity and the value of domestic production, while reducing its environmental footprint (primarily, water and energy). Rural development, which is closely associated either directly or indirectly with agriculture, can help reduce social and economic imbalances in regional development. To achieve its objectives, SARDS 2040 proposes three measures: 1) enhancing the economic efficiency, profitability and competitiveness of crops and livestock, 2) improving environmental sustainability and resilience to natural disasters and crises, and 3) reducing regional imbalances between rural and urban areas and promoting social inclusion.

In the fisheries and aquaculture industry, the main objective is to create a profitable world-class industry that is ecologically sustainable and a net contributor to the Sultanate of Oman's economy by 2040. The approach is to develop a framework and processes in which Omanis will determine how to achieve the aim on a 'fishery-by-fishery' or even 'community-by-community' basis. Given the rich mix of fisheries with differing management demands, the strategy elaborates four approaches during its initial implementation, each representing a distinct type of harvesting: 1) A local shared fishery concentrated on abalone (and nowadays perhaps also shrimps), which is a high value, single stock resource available within a sub-area of the Exclusive Economic Zone of Oman

(EEZ); 2) A national shared fishery focused on cuttlefish, for example, also a high value resource available in the entire EEZ of Oman; 3) A regional shared fishery centred on kingfish, which is available within the EEZs of the Gulf Cooperation Council (GCC) states; 4) An international shared fishery focused on large tuna fished within country waters and on the high seas, and which attracts coastal state fishers as well as fishers from foreign flagged nations.

In its 2018-2027 strategic plan which underpins SARDS 2040, Oman Food Investment Company (OFIC), the government holding for the food processing industry, emphasizes the role of self-sufficiency and food security as key strategic objectives in Oman's economic development. Drawing on the Food and Agriculture Organization's (FAO) definition, food security exists when all people have physical, social and economic access to sufficient, safe and nutritious food at all times, which meets their dietary needs and food preferences for an active and healthy life. Food security is expected to be achieved in the Sultanate of Oman by increasing the availability of sufficient quantities of food of appropriate quality; providing access to individuals to adequate resources for acquiring appropriate foods for a nutritious diet; using food through adequate diet, clean water, sanitation and health care to reach a state of nutritional wellbeing; and access to adequate food at all times.

There are obvious synergies between 'Manufacturing for Wellbeing' and the strategies of the agriculture, fisheries and food industries. Processing agricultural, livestock and fisheries products ensures that harmful bacteria and other



microorganisms are eliminated, making food safer and last longer. Processed food can easily be made available, irrespective of season or location, and can travel far, giving consumers a wider range of products and choice. Processed food together with pre-cut vegetables and meat has become a staple food for busy city dwellers and has triggered a burgeoning packaging industry. Growing urbanization is generally accompanied by a rising food processing industry. Several industries considered a priority in 'Manufacturing for Wellbeing', such as the meat, fish, dairy, grains and animal oils industries, are also a priority in the other sectors' strategies.

It is worth noting that there are some disadvantages to food processing, especially when it involves removing nutrients, vitamins and fibre present in the food. Trans-fats and sugar present in processed items can pose health risks as frequent intake of processed food leads to accelerated aging and kidney damage as they contain phosphates or may affect people's mood. Manufacturing for Wellbeing emphasizes the development of healthy food processing, with lower fat, salt and sugar content and as natural and nutritious as possible. This lies at the core of the food security concept.

Turning to innovation, the Research Council has produced a National Innovation Strategy (NIS) with the vision of joining the top 20 leading innovation countries by 2040. The four pillars of this strategy include improving human capital through the upgrading of education and skills, economic diversification, institutional and community integration, including higher R&D expenditure, and efficient management and protection of intellectual property. Much has already been said in 'Manufacturing for Wellbeing' about the close links between innovation and manufacturing. The only aspect worth reinforcing is the importance of intellectual property protection for the development of this strategy's priority industries, namely high-tech industries such as pharmaceuticals or photovoltaic.

5.2 Social sectors' strategies

Social sectors' strategies comprise the National Strategy for Education 2040 and the Health Strategy 2050. The Education Strategy envisages by

2040 to "equip human resources with the values, knowledge and skills that enable them to be productive in the world of the knowledge economy, keep pace with the continual changes in the world, maintain their national identity and intrinsic values, and contribute to the advancement of human civilization". The strategy is based on five pillars. The first is to improve education management by identifying roles, responsibilities and interrelationships among educational institutions and making them more effective in the fulfilment of their objectives. The second pillar is to ensure a clear path all the way from pre-school, compulsory basic education, secondary and higher and technical education to the labour market based on progress and advancement according to each individual's abilities and qualifications. The third pillar focuses on raising the quality of education in line with international standards. The fourth pillar is to build research capacities in educational institutions so they can better contribute to the knowledge economy. Finally, the last pillar seeks to develop new financing mechanisms to improve educational funding.



The Health Strategy's 2050 vision is for the "Omani people to live healthy and productive lives, through the establishment of a well-organized, equitable, efficient and responsive health system, grounded by societal values of equity and social justice". Achieving these objectives requires a transparent, accountable, customer responsive and universal health care system. It also requires far more funding than is available today, partially generated through efficiency gains and insurance and private health schemes. It includes the rebalancing of roles of primary, secondary and tertiary health care to improve the quality of care. It also entails training and increasing the number of health-related personnel as well as ensuring that they are 'fit-for-purpose' and better distributed regionally. The strategy highlights that the local availability of medicine and consumables as well as the procurement of instruments and equipment that are in line with the actual demands of the Omani population needs to be ensured. More research and information on the diseases that affect the

local population most needs also to be carried out. Finally, significant inter-sectoral collaboration will be necessary as the health sector cannot resolve all health problems of Oman's population on its own.

The potential synergies between the economic and the education and health sectors could be significant. One notable aspect in the education strategy is its emphasis on the quality of education to meet the demands of the labour market. This is clearly a major point of convergence with 'Manufacturing for Wellbeing', although the challenge will most likely not be agreeing on this objective but rather on how to implement it. The pace of the education and manufacturing sectors tends to differ, and it is not always easy to align both of them. The need for more research is also highlighted in both strategies but academic and applied research are likewise driven by very different incentives.

The points of convergence between the manufacturing and health strategies are starkly evident. For the health sector, a thriving local pharmaceutical, instruments and equipment industry is a matter of 'health security'. The rationale behind this is an unreliable supply of medicines and escalating costs. The Health 2050 Strategy goes to the extent of requesting the government to collaborate with pharmaceutical manufacturers exactly in the same way it is envisaged in 'Manufacturing for Wellbeing'. Moreover, health authorities seem to be very aware of the extensive coordination failures of the government and seem to be willing to address them, although as in the case of education and given the different objectives being pursued, this may be easier said than done.

5.3 Services sectors' strategies

In the services sectors, two main strategies for 2040 have been developed: logistics and tourism. The Sultanate of Oman Logistics Strategy (SOLS) 2040 aims to achieve five goals by 2040: 1) to increase their contribution to GDP in real terms by more than 9-fold, 2) to increase its contribution to employment by 10-fold (300,000 workers), 3) to be positioned among the top 5-10 in the relevant trade and logistics rankings, 4) to be perceived as a regional logistics hub (2020), and 5) to be

perceived as a global logistics hub (2030). Achievement of these goals requires a number of changes. Exploring new markets by identifying business opportunities, raising awareness of Oman's logistics potential and leveraging existing and new free trade agreements are expected to significantly increase the size of Oman's logistics sector. Trade facilitation, or the easing of administrative and customs procedures, is anticipated to enhance the flow, speed, reliability and consistency of operations and hence improve the perceptions of Omani logistics. The use of new technologies, which is projected to increase the transparency, visibility and efficiency of communications and facilities, will contribute to the expansion of logistics volume. And, finally, the development of human capital through vocational training, increasing the attraction of logistics jobs and introducing more favourable employment legislation is expected to improve both the size as well as the perceptions of local logistics services.

The tourism industry for its part aims to become "a top-of-mind destination for vacations, discovery and meetings, attracting more than 11 million international and local tourists" by 2040. The elements of competitive advantage that will allow it to reach this aim include a number of tourism 'business models': relaxation, touring and culture, nature and adventure, special interests, festivals, meetings and events, day visitors and visits to relatives and friends. The strategy identifies five target traveller profiles that the Sultanate of Oman could attract: millennials (people under 30), vacationists (middle-class families), sophisticated travellers (high-income families), discerning travellers (mature and educated) and special interest travellers. Travellers will be sourced internationally from Germany, France, India and the United Kingdom and regionally from the UAE and Saudi Arabia. Business models and travellers' profiles will be combined so that an exceptional menu of unique tourism experiences and positive emotions are generated. Three types of experiences are envisaged: top (nature and landmarks), signature (culture and nature) and brand (situations, e.g. frankincense ceremony or coffee drinking). Market positioning will be at the premium level, addressing the affluent and luxury category of

travellers. This positioning attracts fewer tourists than pursuing a mass strategy, but increases per capita tourism revenue.

An ambitious logistics strategy can accompany a growing manufacturing industry quite well, particularly if manufacturers seek to compete in foreign markets such as China, India and Africa. All too often, there are reports of trucks and ships delivering goods in one direction but coming back empty due to the lack of productive capacity in importing countries. SOLS objectives will only be achieved if a local industrial capacity is established that is able to sell goods regionally and internationally, so the trucks and ships do not return empty. It is as much in the interest of the logistics industry as it is in that of manufacturing industries for both strategies to be successful.

As for tourism, a larger number of tourists will require a host of foods, hotels and journey-related products that can be manufactured locally. Frankincense is an obvious example, where production at industrial scale as anticipated in 'Manufacturing for Wellbeing', can generate high income to local producers and through word of mouth and demonstration effects, increase the export potential of this unique Omani fragrance. But more importantly, the emphasis on 'Manufacturing for Wellbeing' together with the type of experiences and premium tourists to be attracted by the tourism industry can easily lead to new types of premium market tourism, such as 'health tourists', and result in the Sultanate of Oman developing a unique type of branding related to health, fragrances, nature and industrial wellbeing.

5.4 SDGs

'Manufacturing for Wellbeing' does not only have connections with local sectoral strategies but also has important links with the SDGs. The SDGs are a global development strategy that, as already mentioned, the Sultanate of Oman is a signatory of. The SDGs consist of 17 goals that the signatory countries have committed to achieve by 2030.



By committing to increase the role and size of Oman's manufacturing industry, the country is on the right path to achieving Goal 9 on "Building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation". Specifically, the Sultanate of Oman would be on track to achieving by 2030 Goal 9's target of significantly raising industry's share of employment and gross domestic product in line with national circumstances. 'Manufacturing for Wellbeing' can also contribute to the achievement of Goal 1, no poverty; Goal 2, zero hunger; Goal 3, good health and wellbeing; Goal 7, affordable clean energy; Goal 8, decent work and economic growth; Goal 10, reduction of inequalities; Goal 11, sustainable cities and communities; Goal 12, sustainable production and consumption; and, Goal 13, climate action. Indirectly, 'Manufacturing for Wellbeing' can contribute to the achievement of all the other SDGs.

6 Achieving Strategy 2040: Key Performance Indicators (KPIs)

6.1 *KPIs in the Sultanate of Oman Strategy 2020 and the Ninth Five-Year Plan (2016-2020)*



The key performance indicators (KPIs) represent and benchmark competitiveness and the performance of the manufacturing sector, defined as the capacity of the Sultanate of Oman to increase its presence in international and domestic markets. The KPIs also indicate the manufacturing activities' progression towards higher value added and higher technological content. It captures Oman's ability to produce and export manufacturing products competitively and reflects the progress of structural transformation to diversify growth sources to participate in reducing the national economy's dependence on oil.

As the 9th Plan (2016-2020) represents the last of the plans of the Sultanate of Oman Strategy 2020 and paves the way for the Sultanate of Oman Strategy 2040, the new KPIs must build on Oman's economic performance in the previous development plans. The previous plans provide a point of reference about which of the objectives formulated in the Strategy (The Sultanate of Oman 2020) were actually accomplished.

Economic diversification was defined as a strategic priority for economic growth in Strategy 2020, given the uncertainties surrounding global oil markets and the resulting necessity of shifting to other sectors as sources of growth. The economic diversification of the Sultanate of Oman was linked to the exploitation of alternative natural resources as well as the development of non-oil producing activities. The Sultanate of Oman has made significant progress in terms of economic diversification, with the share of oil activities decreasing from 66 percent of GDP in 2000 to 42 percent of GDP in 2015. Over the period of the 9th Plan, non-oil activities are anticipated to rise at 4.3 percent pa in constant

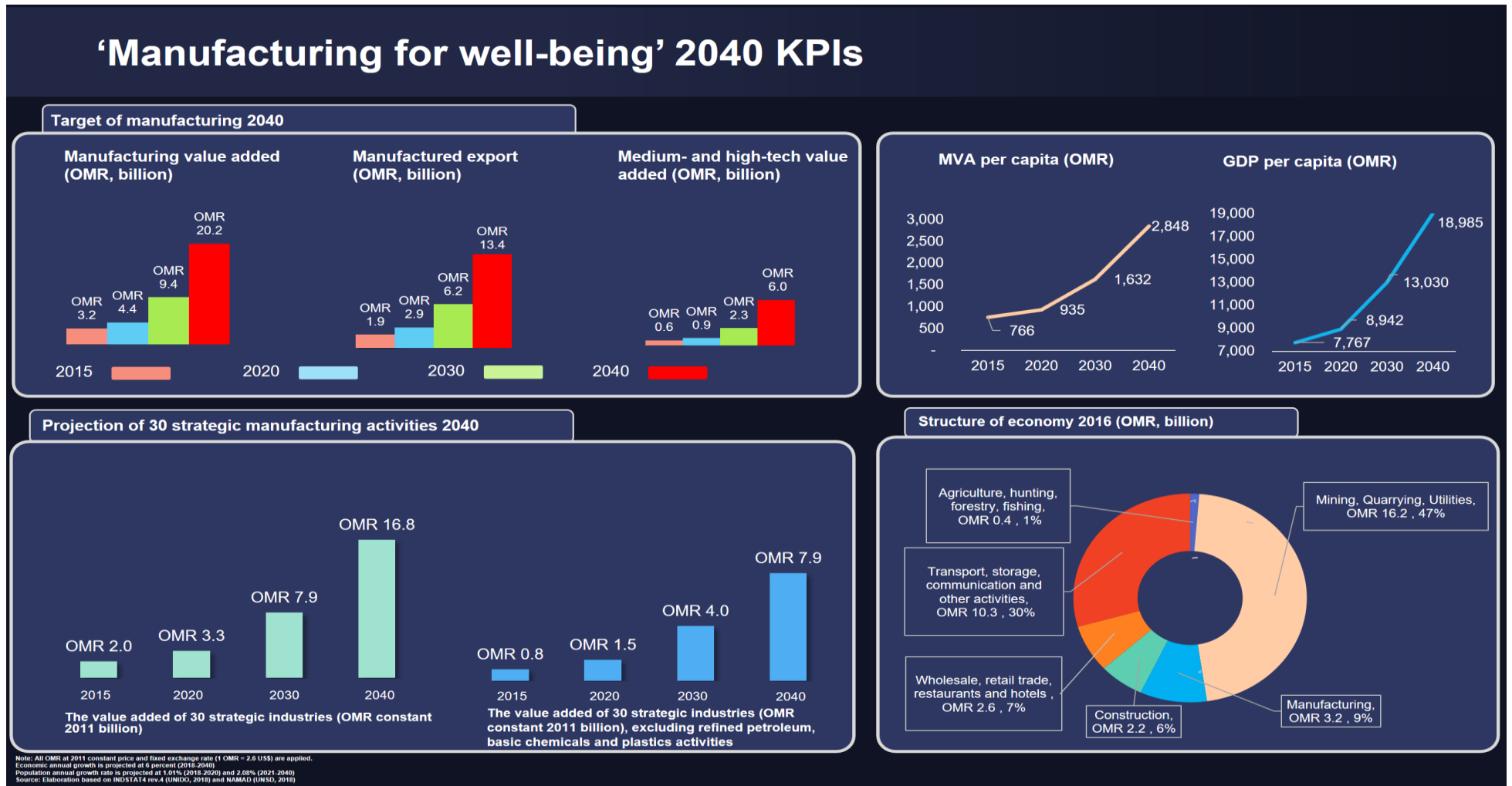
prices between 2016 and 2020, while oil activities are expected to witness a slight increase of 0.2 percent pa on average in real prices.

The 9th Plan also anticipates that the manufacturing sector will experience constant growth at 6 percent pa, which means the sector will reach a share of 10 percent of GDP by the expiry of the Plan. To achieve this figure, the Plan envisaged investments of OMR 2.6 BN during 2016-2010. While the share of GDP target is certainly achievable by 2020, it will not suffice to reduce dependence on oil- and metal-based industrial commodities, which has become the new form of resource dependence of the Omani economy since around the turn of the millennium. From 2014 to 2016, the refined petroleum industry alone accounted for 31 percent of total manufacturing value added, followed by non-metallic mineral products and basic metals jointly contributing another 32 percent. The strategic direction therefore needs to focus on new industries that will further diversify the productive base. More specifically, this implies a gradual shift away from resource-based activities into capital-intensive industries and subsequently into knowledge-driven industries.

6.2 *'Manufacturing for Wellbeing' 2040 KPIs*

Despite the fact that the Sultanate of Oman's economic performance depends on overcoming the obstacles they face, it is expected that the economy will grow annually at 6 percent (2018-2040) based on preliminary estimations by the Supreme Council of Planning. Given this growth rate for the economy as a whole manufacturing is expected to grow in real terms 6.3 times, from MVA 3.2 BN OMR in 2016 to 20.2 BN OMR in 2040, with 30 percent of the manufacturing value added generated by 2040 being contributed by medium- and high-tech industries (**Table 6-1**). Industrial exports, for their part, are targeted to increase by 16 percent of total exports in 2015 to 28 percent of total exports in 2040 (from 1.9 BN OMR to 13.4 BN OMR).

Figure 6-1: Manufacturing for Wellbeing 2040 KPIs



Source: UNIDO elaboration based on United Nations Statistics Division (2018) and INDSTAT2 rev.3 (UNIDO, 2018)

6.2.1 Industrialization intensity (MVA)

The first KPI relates to the degree of industrialization intensity and captures the role and contribution of the Sultanate of Oman's industrial production to economic development. The underlying idea of this target is that the manufacturing industry will increase by 50 percent by 2040 over the anticipated level for 2020. This is expressed by the manufacturing value added (MVA) in OMR term.

Target A: 20.2 BN OMR of manufacturing value added by the end of 2040

Based on the baseline scenario of an annual real economic growth rate of 6 percent (2018-2040), it is expected that GDP will grow from 33 BN OMR to 134.8 BN OMR (2011 constant). With a target of manufacturing value added to GDP at 15 percent in 2040, it is anticipated that 20.2 BN OMR (2011 constant) in manufacturing value added would have to be generated by 2040, for which the manufacturing sector has to maintain an annual growth rate of 7.9 percent over the next 22 years.

6.2.2 Manufacturing exports in total exports (MEXP)

The second indicator is based on the same backdrop as industrialization intensity (MVA). It reflects the competitive status of a country's manufacturing sector in international markets; an increase in the manufacturing export share indicates advancement in relative industrial competitiveness while a decrease indicates deterioration. The country's manufacturing exports are measured by the manufacturing exports (MEXP) in OMR term.

Target B: 13.4 BN OMR of manufacturing exports by the end of 2040

If the target of a 7.9 percent annual growth rate of the manufacturing sector and 6 percent (2018-2040) aggregate economic growth rate is achieved in the next 22 years, manufacturing exports are targeted to contribute to trade in the amount of 13.4 BN OMR (2011 constant) in 2040, which would account for around 28 percent of total exports.

6.2.3 Medium- and high-tech MVA in total MVA (MHT MVA)

The third KPI, which represents the medium- and high-tech MVA (MHT MVA), is aimed at reflecting a more complex production structure. It signals industrial maturity, a research and knowledge-based manufacturing industry and the ability to compete internationally through innovation. The KPI captures the technological complexity of the manufacturing activities in Oman.

Target C: 6 BN OMR of medium- and high-tech MVA in 2040

Countries at the income level and with the resource endowment of the Sultanate of Oman typically have comparative advantages in certain resource-based and a few capital-intensive industries. However, to achieve successful diversification, it is necessary for other capital-intensive and knowledge-based industries to emerge. Hence, the underlying idea behind this KPI is that these advanced industries increase their MVA considerably over the next 22 years. This will require these industries to grow at 9.4 percent annually in constant prices.

6.2.4 Linking KPIs to the performance of strategic sectors

To link Strategy 2040 KPIs to the performance of strategic sectors, it must be reiterated that in order to achieve 20.2 BN OMR of manufacturing value added by 2040 (Target A), the manufacturing sector has to grow at 7.9 percent annually in constant prices. Using this average growth rate and because strategic sectors are expected to be supported during the implementation of Strategy 2040, it is expected that the strategic sectors would expand at a higher growth rate than non-priority industries. On the assumption that non-priority industries will continue to grow at average rate of economic growth at 6 percent, the strategic sectors should expand at 8.4 percent annually until 2040.

The classification of industries by technological intensity (technology classification) is a widely applied method for grouping industries for the purpose of policy-relevant analysis. The technology classification is based on research and

development (R&D) expenditure incurred in the production of manufactured goods. Manufacturing industries with a higher R&D intensity are considered high-technology industries. R&D intensity refers to the ratio of R&D expenditure to an output measure, usually gross value added. Data for R&D intensity in 2016 is provided by the OECD, which also proposes a taxonomy for industry groups with different ranges of R&D expenditure relative to their gross value added.

The taxonomy used for Strategy 2040 KPIs differs slightly from the OECD classification which entails four categories with a separate group for high- and medium high-technology industries. This KPI uses three groups (low-tech, medium low-tech, medium high- and high-tech) for the practical consideration that high-tech manufacturing industries accounted for less than 1 percent of manufacturing value added in Oman. Thus, the

MHT target is based on the aggregated figures combining medium high-tech and high-tech industries into a single group “medium and high-tech industries” (Table 6-1).

The selected 30 strategic industries have their equivalences in terms of technological intensity (except recycling, for which there is no equivalence due to a change in the statistical classification). Among the 30 strategic industries, it is expected that 30 percent of manufacturing value added will be contributed by the medium- and high-tech industries in 2040, that is, 4.6 BN OMR. This requires a constant annual growth rate of 11.4 percent by medium- and high-tech industries among the 30 strategic industries. By 2040, these would generate about 22.5 percent of total manufacturing value added, with 7 percent being contributed by others.

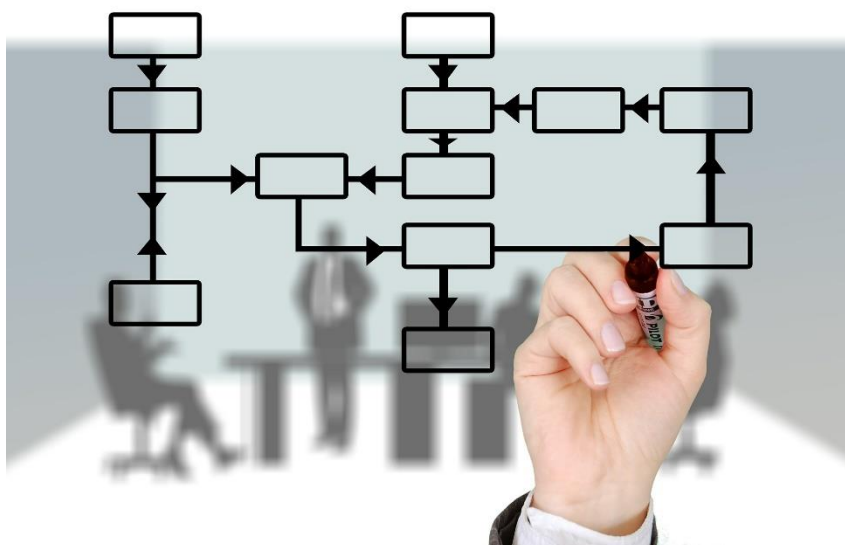


Table 6-1: Industry conversion

Industry	ISIC4 rev.4	Industries by cluster	Technological classification
Processing/preserving of meat	1010	Resource-based industries	Low-tech
Processing/preserving of fish, crustaceans and molluscs	1020	Resource-based industries	Low-tech
Vegetable/animal oils and fats	1040	Resource-based industries	Low-tech
Dairy products	1050	Resource-based industries	Low-tech
Grain mill products	1061	Resource-based industries	Low-tech
Bakery products	1071	Resource-based industries	Low-tech
Furniture	3100	Resource-based industries	Low-tech
Refined petroleum products	1920	Resource-based industries	Medium low-tech
Basic chemicals; except fertilizers	2011	Resource-based industries	Medium high-tech
Plastic products	2220	Resource-based industries	Medium low-tech
Glass and glass products	2310	Resource-based industries	Medium low-tech
Cement; lime and plaster	2394	Resource-based industries	Medium low-tech
Articles of concrete; cement and plaster	2395	Resource-based industries	Medium low-tech
Basic iron and steel	2410	Resource-based industries	Medium low-tech
Basic precious and non-ferrous metals	2420	Resource-based industries	Medium low-tech
Structural metal products	2511	Capital-intensive industries	Medium low-tech
Building and repairing of ships	3011	Capital-intensive industries	Medium low-tech
Electric motors; generators and transformers	2710	Capital-intensive industries	Medium high-tech
Electricity distribution & control apparatus	2710	Capital-intensive industries	Medium high-tech
Insulated wire and cable	2732	Capital-intensive industries	Medium high-tech
Other electrical equipment n.e.c.	2790	Capital-intensive industries	Medium high-tech
Pumps; compressors; taps and valves	2813	Capital-intensive industries	Medium high-tech
Manufacture of electronic valves and tubes and other electronic components (solar panels)	2813	Knowledge-driven industries	Medium high-tech
Other general-purpose machinery	2819	Capital-intensive industries	Medium high-tech
Automobile bodies; trailers & semi-trailers	2920	Capital-intensive industries	Medium high-tech
Manufacture of soap, detergents, cleaning and polishing preparations, perfumes and toilet preparations	2023	Knowledge-driven industries	Medium high-tech
Manufacture of pharmaceuticals, medicinal chemicals and botanical products	2100	Knowledge-driven industries	High-tech
Manufacture of medical and surgical equipment and orthopaedic appliances	3250	Knowledge-driven industries	High-tech
Recycling of metal waste and scrap	3710*	Knowledge-driven industries	Related to specific industry
Recycling of non-metal waste and scrap	3720*	Knowledge-driven industries	Related to specific industry

* ISIC4 Revision 3. The recycling industry has been partially reclassified into a newly created Waste Management and the Wholesale sections in ISIC4 Revision 4. Waste collection and treatment, including material recovery, and wholesaling of waste and scrap are now part of these sections. The transformation of secondary recovered material that is used in the production of new products is now classified in Revision 4 in its corresponding industry (textiles, glass, steel, paper and so on). To avoid naming all corresponding industries and given that many countries still use Revision 3 in their industrial statistics, for these two industries we use the ISIC4 Revision 3 classification.

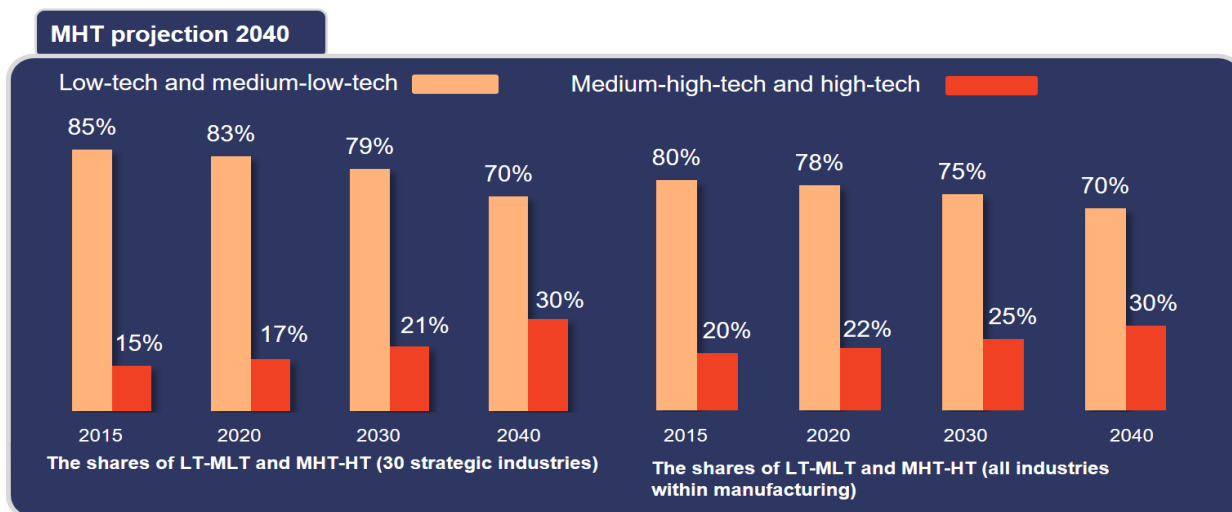
The rationale for targeting a 6 BN OMR share of medium- and high-tech industries is based on the experience of comparator countries (Figure 6-2). In 2014 alone, medium- and high-tech industries in comparators (Costa Rica, Jordan) and neighbouring countries (Saudi Arabia) contributed about 30 percent of total manufacturing value added. In more technologically advanced countries like Ireland and Singapore, it is estimated that medium- and high-tech industries contributed between 50 percent and 80 percent of total manufacturing value added.

Furthermore, pharmaceutical, medicinal chemical and botanical products and the medical and dental instruments and supplies industries (both belong to the cluster of knowledge-based industries among the 30 strategic sectors) jointly contributed about 45 percent of total manufacturing value added in Ireland and 18 percent in Singapore. Since the Sultanate of Oman's medium- and high-tech industries already account for 20 percent of manufacturing value added, an additional 10 percent was considered feasible, particularly in the light of expected greenfield investments.

Since non-priority industries are expected to grow at 6 percent annually, a 9.4 percent annual growth rate of medium- and high-tech industries (of both the 30 strategic industries and traditional

industries) would have to be achieved if medium- and high-tech manufacturing value added is to reach a 30 percent share in total manufacturing value added by 2040.

Figure 6-2: Medium- and high-tech projection 2040



Source: UNIDO elaboration based on United Nations Statistics Division (2018) and INDSTAT2 rev.3 (UNIDO, 2018)

6.2.5 Characteristics of KPIs

The three key manufacturing performance indicators are performance (or “outcome”) indicators consisting of output sub-indicators that describe to what extent the Sultanate of Oman is performing as expected. Such indicators reflect the status of manufacturing development; indicate whether industrial policies have produced results or not, and in turn how to make the manufacturing sector more efficient and effective. This lies in contrast to so-called “process” indicators, which are based on research-based evidence and can only be used to validate or identify the processes that contributed to the observed outcomes. They contrast too ‘perception’ indicators, which are subjective.

Because manufacturing development is a cumulative process that takes place over time, economic activities tend to remain relatively stable in the short run. Only in the medium to long term will industrial statistics and structural economic variables reveal the effect of such developments. This demonstrates that structural transformation,

be it at industry level or economy level, is a long, path-dependent process. When leaps do occur, they signal responses to major improvements or deterioration in the basic conditions of industrial activity.

The downside of industrialization intensity (MVA) is that it does not capture the technological upgrading within manufacturing activities and tells us little about the technological structure of production: a high value of the manufacturing sector’s share to GDP could cover both a very large output with low value added per unit, or vice versa. To account for these important aspects of industrial competitiveness, the medium high-tech MVA (MHT MVA) is used as the level of technological deepening and upgrading.

It is worth mentioning that both industrialization intensity (MVA) and the medium high-tech manufacturing value added (MHT MVA) focus on domestic production only and does not look at a country’s international presence through exports. In this way, the three indicators may serve to complement one another.

7 The making of the Sultanate of Oman's 'Manufacturing for Wellbeing'

7.1 Strategy and policy phases



Industrial development is a complex process, involving several phases that take decades, sometimes even longer, to materialize. Industrial policymaking, although it takes less time, is

no less complicated and also involves a number of phases. A solid diagnosis of the Sultanate of Oman's industrialization experience and identification of its industrial potential constituted the first phase of the preparation of this strategy. The main objective of this phase was to prepare a strategy, objectives and priorities for industrialization in the Sultanate of Oman (Figure 7-1). It addressed two key questions: what needs to be changed, if anything, and why should it be changed. This phase did not address the way change will take place.

The process involved, first, undertaking extensive capacity building efforts aimed at those involved in the preparation of the strategy as well as potential public sector partners to be called upon at a later stage. Three seminars were part of this effort and their approach was hands-on, in that they aimed at initiating the development of data and reports that would be necessary to elaborate the strategy.

With the strategy team being trained in the first stage of this first phase, the long-term patterns of industrial development in the Sultanate of Oman and the status of Omani manufacturing today were examined. This stage also involved understanding why such trends had taken place.

The next stage involved evaluating the potential of industries in the Sultanate of Oman. The productive and trade capacity of all industries in the Sultanate of Oman were evaluated on the basis of a range of methodologies described in the next section. This stage also involved interviewing and consulting a broad range of public and private stakeholders. More than 50 stakeholders were consulted during this stage through individual interviews and several

focused groups. The output of this stage was the list of strategic industries discussed above.

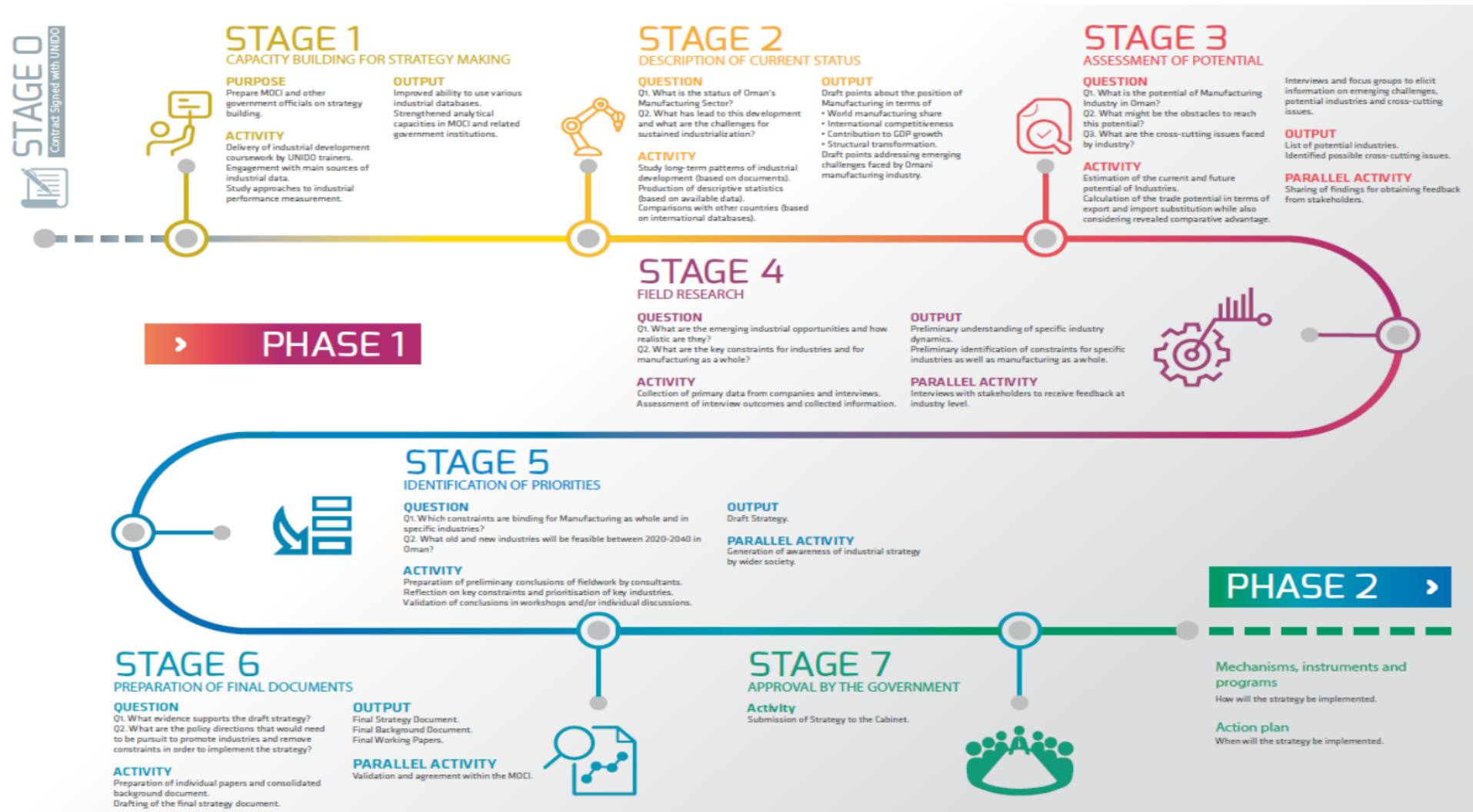
The field research stage brought a number of international consultants to the Sultanate of Oman and drew on local consultants and the expertise available within MOCI to collect primary data and further interview stakeholders to ascertain whether the list of priorities and strategic industries was reasonable. Twelve international consultants, three local consultants and the MOCI strategy team were involved in preparing 19 industry and cross-cutting studies. Recent industry studies prepared for MOCI were also drawn upon. During this stage some 100 firms were interviewed or involved in workshops, 30 government ministries and regulatory agencies were queried, 27 government support and operational agencies were visited, 14 universities and research centres were quizzed, 12 financial institutions and funds were sounded, and eight chambers and private sector representative organizations were talked to. More than 250 individuals were contacted during this stage.

The fifth stage involved the final identification of priorities on the basis of the accumulated work carried out. It involved the preparation of the draft strategy and its discussion and validation with different stakeholders. A key input to this stage was the strategy workshop, held on December 12th, 2018 at the Crowne Plaza Convention Centre Hotel, which brought together 150-200 stakeholders from the public and private sector to discuss different aspects of the draft report. The final draft was an outcome of this stage.

The next stage involved preparing all the documentation for the strategy, including finalizing consultant reports and preparing the final version of the draft strategy. It will involve the final approval and validation of the documents within MOCI.

The final stage of Phase One will be government approval of the final version of the strategy.

Figure 7-1: Stages for building the Sultanate of Oman's Industrial Development Strategy 2020-2040



Phase Two will move on to address the question of how to implement the strategy and when to do so. The first part involves preparing detailed policy instruments, regulations and incentives that will be used to implement the strategy. It will include investment requirements and possible sources of finance for implementation. It will be the ink in the pen or the bullets in the gun of Omani's industrial policy. Without them, the strategy will remain only a list of potentials. The second part of Phase Two will focus on the corresponding action plans, that is, sequencing the application of the instruments and mechanisms chosen over time.

Phase Two will be followed by the third implementation phase, which will involve organizing and managing the application of the instruments and action plans. This will be accompanied by proper monitoring mechanisms and followed by evaluation and learning procedures to complete the policy process.

7.2 A brief description of the methodology

The potential of the Sultanate of Oman's manufacturing industries was assessed across four thematic areas (Table 7-1). The first thematic area was the country's production capacity or its ability to create value added, generate employment and improve labour productivity. Second was the Sultanate of Oman's export potential, namely the basket of manufactured products that the Sultanate of Oman has potential to export. Third was the dynamism or possibility of sustaining high growth and a set of dynamics industries, particularly in connection with rising global demand at current and future stages of development. Fourth was the potential for import substitution, meaning emerging opportunities for the Sultanate of Oman to develop promising yet nascent industries by producing locally.

Table 7-1: List of variables and thematic areas

Thematic areas	Indicators
Production capacity	Real value added per capita (constant 2011 US\$), 38,500
Production capacity	Employment to population (%), 38,500
Production capacity	Real output per worker (constant 2011 US\$), 38,500
Export potential	Gross export per capita (US\$), 38,500
Export potential	The Sultanate of Oman gross export share (%), 2016
Export potential	The Sultanate of Oman revealed comparative advantages, 2016
Export potential	World gross export share (%), 2016
Dynamism	Real value added per capita (constant 2011 US\$), 38,500 - 57,000
Dynamism	Employment to population (%), 38,500 - 57,000
Dynamism	Real output per worker (constant 2011 US\$), 38,500 - 57,000
Dynamism	Gross export per capita (US\$), 38,500 - 57,000
Dynamism	The Sultanate of Oman gross export growth (%), 2007-2016
Dynamism	World gross export growth (%), 2007-2016
Dynamism	Intrinsic attractiveness, 2016
Dynamism	The Sultanate of Oman gross import growth (%), 2007-2016
Import substitution	The Sultanate of Oman gross import share (%), 2016

7.2.1 Production capacity

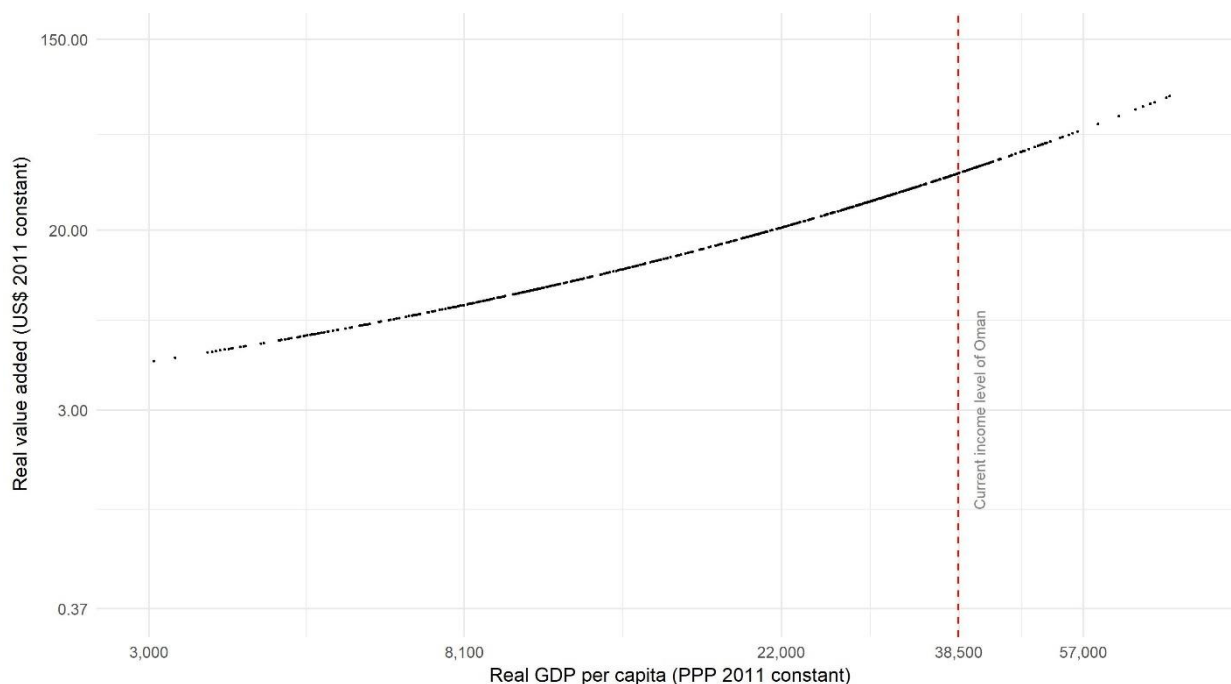
Production capacity included three indicators. The first one was each industry's real value added per capita (constant 2011 US\$). The indicator is meant to determine the value added by each member of the Omani population. By including population rather than employment in the denominator, the indicator

captures differences in population structures across countries. The values of the variable were estimated at all levels of income for all countries from 1990 to 2016. Each estimate represents the expected performance for a given level of income, with USD 38,500 (PPP 2011) being the income per capita of the Sultanate of Oman in 2016 (Figure 7-2).

The second indicator is each industry's share of employment to population. The underlying idea of this indicator is to determine how many people are employed by a specific industry. It aims at capturing employment potential, taking into account the population structure. The values of the variable were

estimated at all levels of income for all countries from 1990 to 2016. Each estimate represents the expected performance for a given level of income, with USD 38,500 (PPP 2011) being the income per capita of the Sultanate of Oman in 2016.

Figure 7-2: The performance of manufacturing industries (38,500 income per capita, PPP 2011): Pharmaceuticals, medicinal chemicals and botanical products industry



Source: UNIDO elaboration based on INDSTAT2 rev.3 (UNIDO, 2018)

The third indicator is each industry's real output per worker (constant 2011 US\$). This is an indicator of productivity since it measures the contribution of each worker in a particular industry to the economy as a whole. The values of the variable were estimated at all levels of income for all countries from 1990 to 2016. Each estimate represents the expected performance for a given level of income, with USD 38,500 (PPP 2011) being the income per capita of the Sultanate of Oman in 2016.

7.2.2 Export potential

Export potential entails four indicators. The first is each industry's gross export per capita (US\$) of the Sultanate of Oman in 2016. This indicator denotes the export performance and competitive advantage of the Sultanate of Oman relative to other countries.

The second indicator is each industry's gross export share to total exports (%) of the Sultanate of Oman in 2016. This complements the indicator of export

performance and further describes the country's export structure.

The third indicator is revealed comparative advantages. This indicator allows us to assess in which industries the Sultanate of Oman has a comparative advantage based on its export performance relative to the industry's global performance.

The fourth indicator is world export share (%) in 2016, which reflects the export share of a particular industry in the world export basket.

7.2.3 Import substitution

Import substitution is represented by the import share of industries in the Sultanate of Oman in 2016. By assessing Oman's import structure, it allows us to assess the domestic demand of certain goods/industries and identify import substitution opportunities to foster domestic value-added generation.

7.2.4 Dynamism

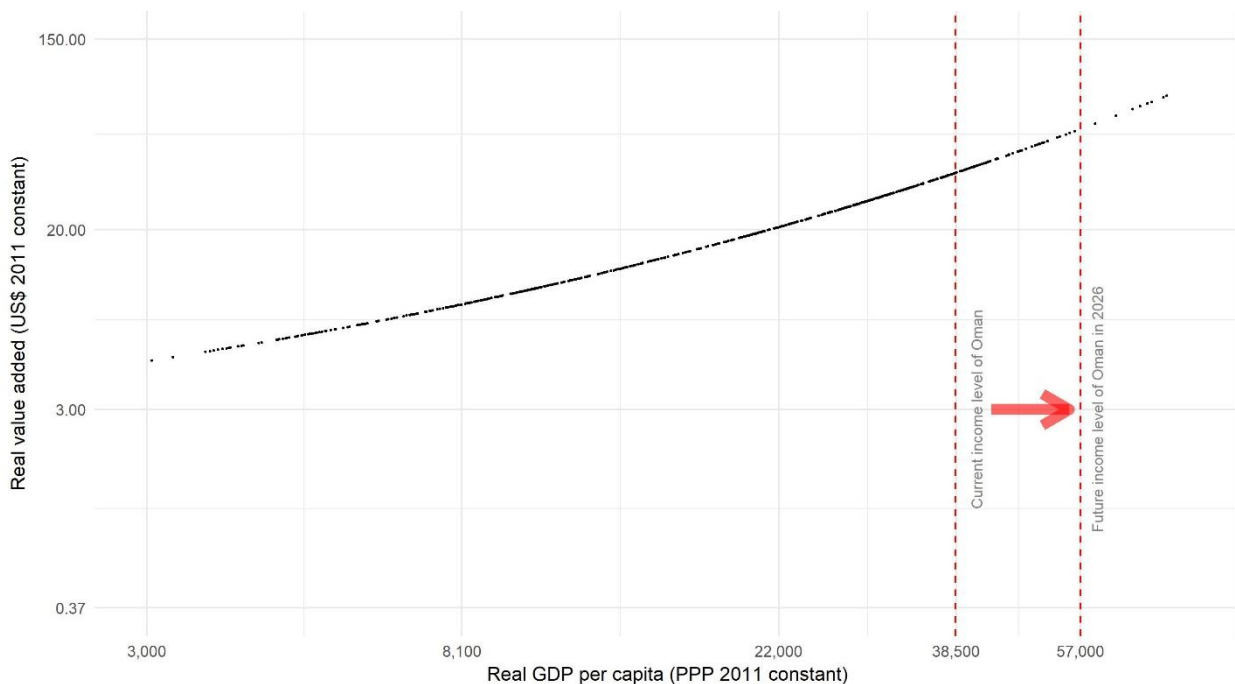
Apart from the intrinsic attractiveness index, the other seven indicators of dynamism capture the dynamic aspects of those indicators in production capacity, export potential and import substitution. For real value added per capita (constant 2011 US\$), employment to population (%), real output per worker (constant 2011 US\$), and gross export per capita (US\$), the dynamic aspects of these four indicators can be gauged as how the performance of the Sultanate of Oman in a particular industry evolves from the current to the next stage of development, with USD 38,500 (PPP Int\$ 2011) being the current income per capita of the Sultanate of Oman adjusted for purchasing power parity, and USD 57,000 (PPP Int\$ 2011) being the projected income level of the Sultanate of Oman in 10 years with a 4 percent annual constant growth rate. The income per capita term can be expressed in constant prices for the purpose of delineating growth patterns or

adjusted for purchasing power parity for cross-country comparisons, as in this case (Figure 7-3).

The dynamic aspects for gross export growth (%) 2007-2016, world gross export growth (%) 2007-2016, gross import growth (%) 2007-2016 can be expressed as the emerging trends over the past 10 years. These allow the Sultanate of Oman to identify industries that experienced the most rapid growth in terms of export and import in the country and export in the world at large over the past decade.

The intrinsic attractiveness index presents the normalized average of the share and growth rate of each industry (2007-2016) of the high-income OECD countries, the share and growth rate of each industry (2007-2016) of the world and the sophistication of industries based on the PRODY measurement (2016). It is used to assess the dynamism and complexity of industries by examining their development trends in advanced countries.

Figure 7-3: The performance of manufacturing industries (38,500-57,000 income per capita, PPP 2011): Pharmaceuticals, medicinal chemicals and botanical products industry



Source: UNIDO elaboration based on INDSTAT2 rev.3 (UNIDO, 2018)

7.2.5 *The ranking of industries*

The 16 variables in the four thematic areas were used to assess each of the 119 manufacturing industries. Of these, eight were estimated (real value added per capita, employment to population, real output per worker, gross export per capita) for the current (USD 38,500 Int\$ PPP 2011) and future (USD 57,000 Int\$ PPP 2011) levels of income of Oman. Industries were then ranked according to the 16 criteria. A common weight point system was

used to shortlist industries that appear to be in the top-30 list of each indicator. Each industry's potential was then further examined individually to validate their feasibility on the basis of global and domestic trends, availability of technological capabilities and former Omani policy decisions. Expert judgment was sought where there was doubt and some industries ended up being eliminated. Likewise, some industries whose potential may have been overlooked by the methodology were included.

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