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Turkey Resilience Project in
Response to the Syria Crisis (TRP)

NEW APPROACHES TO MANUFACTURING INDUSTRY

UNDP

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Designer: Arzu Çelik

Turkey Resilience Project in Response to the Syria Crisis (TRP)

JOB CREATION COMPONENT

2020

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INTRODUCTION

1.1 Executive Summary

Due to globalisation, competition is growing in the world. The factors that determine competitive advantage include the use of advanced production technologies, R&D and innovation. Countries with a high level of economic complexity usually dominate global markets. The factors which determine the economic complexity of a country, ranging from the development of human capital to infrastructure and innovation, are related to economic growth. The increasing complexity level of an economic base is thus related to economic growth. Between 2000 and 2012, Turkey displayed an upward trend in global competitiveness and continued its economic growth in spite of serious domestic and regional challenges. The civil war in Syria which started in 2011 has affected Turkish economy, especially foreign trade but the downward trend. Due to the combined effects of these issues, Turkey has been losing its position in global competition since 2013.

This downward trend cannot be attributed solely to the war in Syria and its impact on Turkey. Manufacturing industry has one of the biggest multiplier effects on any economy and is the main driver of knowledge and job creation. However, manufacturing industry in Turkey has failed to keep up sufficiently with advanced production methodologies and technologies. Advanced production requires the implementation of technological, organizational, social and environmental strategies that enhance production, meet the needs of businesses, society and governments, and are able to keep abreast of change.

Production is a highly complex activity that is affected by many important factors including government policies, trade deals, infrastructure, Foreign Direct Investment (FDI), labour and talent development, wage levels, energy supply, access to resources, innovation, the ecosystem and foreign exchange rates. However the factors production interacts with are not confined to these. This baseline report analyses Turkey's manufacturing industry with respect to its readiness for future production and competition. The many factors that have a direct effect on the performance of manufacturing industry are reviewed and outstanding gaps are identified.

1.2 Methodology

Both quantitative and qualitative data were collected for the preparation of this report. The quantitative data consist of statistical information while the qualitative data are derived from articles, online discussions and findings from studies previously carried out by various organizations.

The data sources include the following:

- International databases, analysis tools and sector reports (WEF, OECD, World Bank, IMF, ITC, WTO, WITS, WEF, UN Comtrade, UN Stats, Trade Map, Market Access Map, EuroMed TIFM, Export Potential Map, Sustainability Map, Investment Map and Market Price Information, Harvard University - The Atlas of Economic Complexity)
- International sector, cluster and labour organizations and their data / reports (CECIMO, UN ILO, ECCP)
- Related national plans and reports (Development Plans, Development Plan Special Commission Reports, strategic plans of ministries)
- National databases and data sources (TurkStat, ISKUR, Union of Chambers-TOBB industry database)
- National associations and organizations and their databases/reports (TOBB, chambers of industry and commerce, Organized Industrial Zones)
- National and international legislation databases (Turkey's Legislation Information System, EUR Lex)
  Data sources of national and international standards organizations (Turkish Standards Institute-TSE, ISO)
  Scientific articles
- Data and reports from other national and international sources (stock exchanges, external audit companies, R&D organizations and technology transfer interfaces and forums).

NEW APPROACHES TO MANUFACTURING INDUSTRY

2

BASELINE ANALYSIS

2.1 Baseline in the World and in Turkey

Rapidly developing technology has increased the speed with which economic gains are achieved and economic losses incurred. Even small companies can increase their turnover rapidly by tracking market conditions closely, while global companies that fail in international competition can be wiped off the market within a very short space of time. Developments in the transport sector and changes in production technologies have made it possible for products to reach consumers swiftly. The increased pace of production and consumption results in many companies entering and exiting the market. This situation makes it possible for companies achieving fast, economical, affordable, tailor-made, high-quality production to grow rapidly. It also leads companies that cannot satisfy these requirements to collapse quickly. The accelerating pace of technological development has intensified both economic and political competition all over the world.

One of the most important results of the globalization process is the need for interdependence. With the development of industry and the rise of technology, innovation and international competitiveness have gained in importance. Competitiveness refers to the ability to meet the total demand and needs in free market economies. If the world is considered a single economy, international competitiveness is the ability to respond quickly and adapt to international demand. This understanding of competitiveness embraces the concepts of innovation, technological innovation and total factor productivity. In competitive countries, value added and productivity are very high.. Innovation, in all areas from human capital to production methods, leads to gains in these respects and strengthens international competitiveness. Another definition of global competitiveness is the ability to take economic decisions freely while trading goods and services.

In the light of these considerations, the global production and competitiveness baseline will be analysed using following international indices:

- Global Competitiveness Index
- Global Innovation Index
- Readiness for the Future of Production
- ICT Development Index
- Product Complexity Index
- Economic Complexity Index
- Human Capital Index

2.1.1 Global Competitiveness

The World Economic Forum (WEF) has been publishing its Global Competitiveness report, which covers approximately 140 countries, for more than 30 years. The report contains 119 indicators of the competitiveness of countries, grouped under 12 main pillars. The term competitiveness is defined as the set of institutions, policies and factors that determine the level of productivity in a country. The level of productivity determines the level of prosperity that can be attained and the rate of return on investments, which is the main driver of a country's economic growth.

While the twelve pillars of the Global Competitiveness Index (GCI) (Table 1) are defined separately, it is well-known that they tend to strengthen each other, and that a weakness in one area affects the others negatively as well. Recently, the WEF reviewed these pillars and introduced the Global Competitiveness Index 4.0 (GCI 4.0), which was designed and defined in line with the requirements of the Fourth Industrial Revolution (4IR). The GCI 4.0 adopts 12 new pillars to measure competitiveness vis-à-vis the 4IR (Table 2).[1] The new version of the Index integrates long-established elements with new and emerging levers that drive productivity and growth. The new version emphasizes the role of human capital, innovation, resilience and agility, not only as drivers but also as defining features of economic success in the 4IR.

Table 1: The pillars used to measure the competitiveness of an economy (GCI 2017-2018)

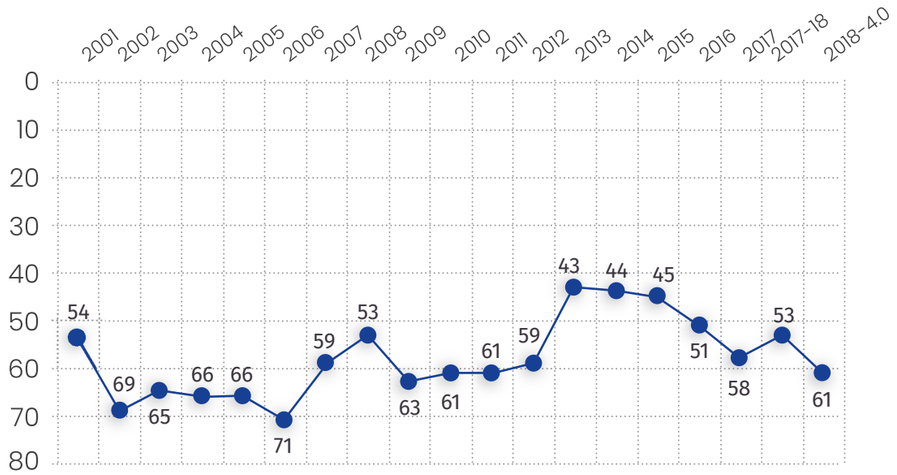
CATEGORY	#	Pillars	Level of development
Basic Requirements	1	Institutions	1. Factor-driven
	2	Infrastructure	
	3	Macroeconomic environment	
	4	Health and primary education	
Efficiency Enhancers	5	Higher education and training	2. Efficiency-driven
	6	Goods market efficiency	
	7	Labour market efficiency	
	8	Financial market development	
	9	Technological readiness	
	10	Market size	
Innovation and Sophistication Factors	11	Business sophistication	3. Innovation-driven
	12	Innovation	

Table 2: The pillars used to measure the competitiveness of an economy (GCI 4.0 -2018 revised for 4IR)

CATEGORY	#	Pillars
Enabling Environment	1	Institutions
	2	Infrastructure
	3	ICT adoption
	4	Macroeconomic stability
Human Capital	5	Health
	6	Skills
Markets	7	Product market
	8	Labour market
	9	Financial system
	10	Market size
Innovation Ecosystem	11	Business dynamism
	12	Innovation capability

[1] Global Competitiveness Index 2018, World Economic Forum, Fourth Industrial Revolution revamped version

Figure 1: Turkey's global competitiveness ranking



Turkey was ranked 54th in the world before the 2001 crisis, but dropped to 69th in 2002 crisis. After the effects of the crisis started to disappear, Turkey started to rise in the competitiveness league, reaching 53rd in 2007. However, with the global crisis of 2008 it declined to 63rd. . After the end of the crisis, Turkey recovered to record its best-ever performance in 2012, when it ranked 43rd among 140 countries. After 2013, due to both global and national political and economic shocks, Turkey's international competitiveness ranking declined again. The revised version of the index, which takes into consideration where Turkey stands in terms of the Fourth Industrial Revolution, ranks Turkey 61st, - i..e, eight ranks lower than it ranks under the traditional methodology.

According to the 2017-2018 GCI World Economic Forum assessments, Turkey is one of 19 countries, as of 2018, that is at the stage of transition from an efficiency-driven economy to an innovation-driven one. In recent years, the growth rate has performed quite well compared to the world average. However, this has not been reflected sufficiently in Turkey's global competitiveness standings. In comparison to its overall ranking in 2018 (53rd), Turkey ranks rather lowly (60th) in terms of innovation and sophistication factors.

The GCI 2017 – 2018[2] ranks Turkey 53rd among 137 countries. Figure 1 shows how Turkey's competitiveness ranking has changed over the years.

According to GCI 2018 data, the components that Turkey needs to develop in order to strengthen its competitiveness performance are as follows:

- **Institutions –** Social capital, judicial independence, efficiency of legal framework in challenging regulations, efficiency of legal framework in settling disputes, property rights, intellectual property protection, strength of auditing and reporting standards.
- **Infrastructure –** Electricity infrastructure, water infrastructure.
- **ICT adoption -** Mobile-cellular telephone subscriptions, internet users.
- **Macroeconomic stability -** Inflation, debt dynamics.
- **Human capital -** Mean years of schooling, skillset of existing labour force.
- **Skills -** Critical thinking in teaching, pupil-to-teacher ratio in primary education.
- **Product market -** Distortive effect of taxes and subsidies on competition, extent of market dominance, trade tariffs, complexity of tariffs.
- **Labour market-** Redundancy costs, hiring and firing practices, cooperation in labour-employer relations, workers' rights, ease of hiring foreign labour, reliance on professional management, pay and productivity, female participation in labour force, labour tax rate.
- **Financial system -** Financing of SMEs, venture capital availability, market capitalization, insurance premium, soundness of banks, banks' regulatory capital ratio.
- **Market size -** Imports.
- **Business dynamism -** Cost of starting a business, insolvency recovery rate, Willingness to delegate authority, companies embracing disruptive ideas.
- **Innovation capability -** Diversity of workforce, the state of cluster development, multi-stakeholder collaboration.

[2]Global Competitiveness Index 2017-2018, World Economic Forum

2.1.2 Innovation Ecosystem

As result of the growing world population, rapid urbanization, and industrialization, energy demand has reached unprecedented levels. Higher levels of technological and non-technological innovation are required to meet this demand, both on the production side of the energy equation (alternative sources, smart grids, and new advanced energy storage technologies) and on the consumption side (smart cities, homes, and buildings; energy-efficient industries; and transport and future mobility). Innovation plays key roles in addressing both sides of this equation and the World Economic Forum's Global Innovation Index[3] analyses the innovation outlook of national economies.

The Global Innovation Index (GII), in which Turkey ranks 62nd in terms of innovation input, 43rd in terms of innovation output and 50th in overall innovation (among 126 countries as of 2018), sets seven criteria to measure innovation fields (Table 4). These criteria consist of two main components, namely innovation inputs and innovation outputs. The analysis is composed of 80 indicators as overall innovation components.

[3] Global Innovation Index 2018, World Economic Forum

Table 3: The criteria used to measure the innovativeness of an economy

Component		#		Pillars
Innovation efficiency	Innovation input	1	Institutions	Political environment Regulatory environment Business environment
		2	Human capital and research	Education Higher education R&D
		3	Infrastructure	Information and communication technologies General infrastructure Ecological sustainability
		4	Market sophistication	Credit Investment Trade, competition and market scale
		5	Business sophistication	Knowledge workers Innovation linkages Knowledge absorption
	Innovation output	6	Knowledge and technology outputs	Creation of knowledge Knowledge impact Knowledge diffusion
		7	Creative outputs	Intangible assets Creative goods and services Online creativity

According to the findings of GII 2018, Turkey needs to develop the following pillars in order to improve its innovation performance:

Institutions - Political environment - political stability and absence of violence / terrorism, Regulatory environment - cost of redundancy dismissal, Business environment - ease of resolving insolvency.

Human capital and research – Education – government funding per student in secondary education.

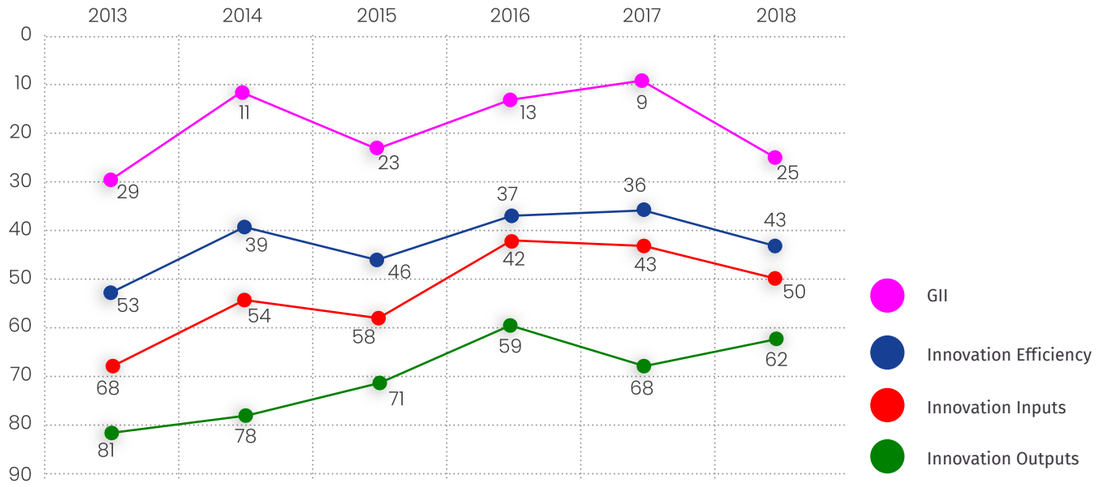
Market sophistication – Credit - microfinance institutions' gross loan portfolio, Investment - venture capital deals (opportunities).

Business sophistication - Innovation linkages – Gross Expenditure on Research and Development (GERD) financed by abroad, Knowledge absorption - ICT services imports.

Knowledge and technology outputs - Knowledge diffusion – ICT services exports.

Creative outputs - Creative goods and services - Cultural and creative services exports.

Figure 2: Turkey's ranking in the Global Innovation Index between 2013 and 2016



2.1.3 Readiness for the Future of Production

The Fourth Industrial Revolution and emerging technologies (such as the Internet of Things, artificial intelligence, robotics and additive manufacturing) are encouraging the development of new production techniques and business models that will revolutionise production. Together with the emergence of other trends, both the speed and scope of technological change add a layer of complexity to the already challenging task of implementing industrial strategies that promote development, productivity and inclusive growth.

The term Readiness for the Future of Production is defined as how well positioned a country currently is to be able to shape and benefit from the changing nature of production in the future. The term Production involves a broad spectrum of economic activity related to manufacturing products and goods. A full end-to-end appraisal of what the term entails reveals the following sequence: Design – Source –

Manufacture – Assemble – Distribute – Service - End of use - Recycle. Advanced manufacturing requires the use of innovative technology to improve processes and products, while traditional manufacturing relies more on the use of manual or mechanized techniques. Readiness is generally regarded as the ability to capitalize on future production opportunities, mitigate risks and challenges, and be resilient and agile while responding to unknown future shocks. The assessment is forward-looking in the sense that it measures readiness for the future, rather than performance today. Moreover, it measures average national readiness, which means that it assesses the entire country on average, not just the highest-performing areas within a country.

The Readiness for the Future of Production Index[4], in which Turkey ranks 32nd in terms of structure of production, and 57th in terms of components of production (among 100 countries as of 2018), defines eight criteria to measure readiness for the future of production (Table 4). These criteria are composed of two main components: Structure of Production, or a country's current baseline of production, and Drivers of Production, or the key enablers that position a country to capitalize on the Fourth Industrial Revolution to transform production systems. The analysis comprises 59 indicators encompassing both the drivers of production and the structure of production.

The Readiness for the Future of Production Index generates a graphic illustration of index scores where drivers of production are represented in the vertical axis and structure of production in the horizontal axis. The intersection of the four quadrants represents the average performance of the top 75 countries (weighted average driver score, weighted average structure score). Thus, countries are assigned to one of the following four quadrants: Nascent, High-potential, Legacy and Leading

[4] Preparation Report for the Future of Production 2018, World Economic Forum

Table 4: The criteria used to measure a country's readiness for the future of production

Component	#	Criteria	Weight (%)	Sub-criteria	
Structure of production	1	Complexity	60	Economic complexity	
	2	Scale	40	Manufacturing Value Added	
Drivers of production	3	Technology and innovation	20	Technology platform	• Availability of ICT • Use of ICT • Digital security & data privacy
				Ability to innovate	• Industry activity • Research intensity • Available financing
	4	Human capital	20	Current labour force	• Labour force capabilities
				Future labour force	• Migration • Education outcomes • Agility & Adaptability
	5	Global trade and investment	20	Trade	• Trade openness • Trade facilitation & Market access
				Investment	• Investment and financing
				Infrastructure	• Transportation & Electricity
	6	Institutional framework	20	Government	• Efficiency & Effectiveness • Rule of law
	7	Sustainable resources	5	Sustainability	• Energy & Emissions • Water
	8	Demand environment	15	Demand	• Market size
				Consumer base	• Consumer sophistication

The models (archetypes) provide a unique perspective for benchmarking against countries with a similar outlook for the future of production.

Leading: Countries with a strong production base today that exhibit a high level of readiness for the future through strong performance across the drivers of production component. These countries also have the most current economic value at stake in future disruptions,

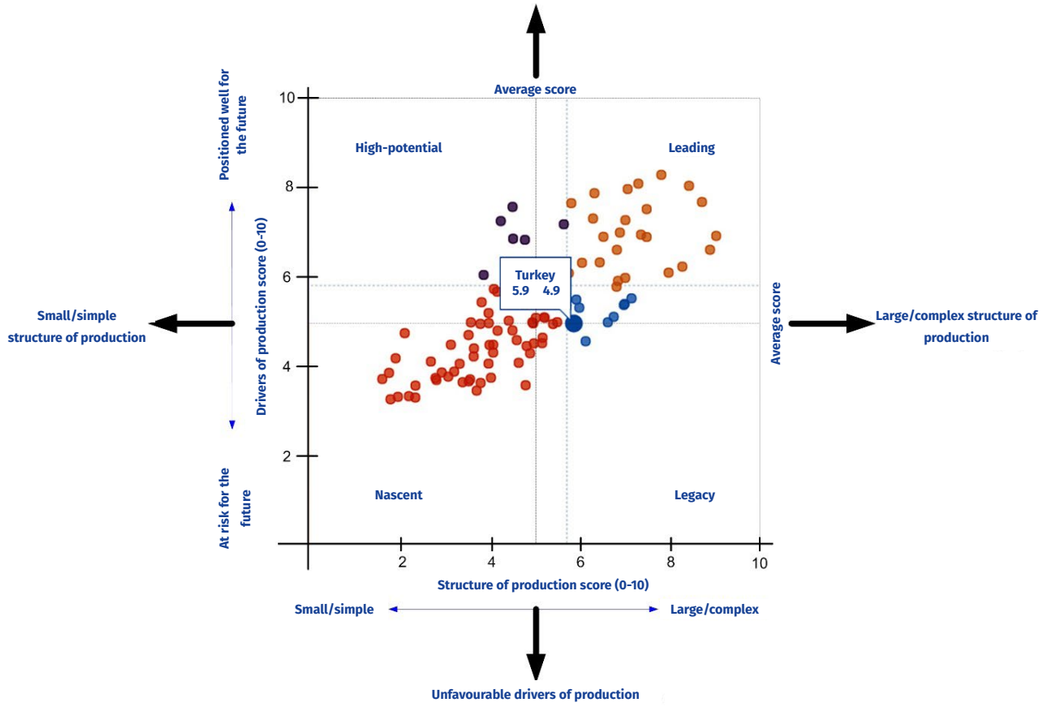
Legacy: Countries with a strong production base today that are at risk for the future due to weaker performance across the drivers of production component,

High-potential: Countries with a limited production base today that score well across the drivers of production component, indicating that capacity exists to increase production in the future depending on priorities within the national economy,

Nascent: Countries with a limited production base today that exhibit a low level of readiness for the future through weak performance across the drivers of production component,

Among the 100 countries and economies included in the assessment, 25 belong to the Leading archetype, 10 to Legacy, 7 to High-Potential and 58 to Nascent (Figure 3). Turkey is classified as a Legacy country.

Figure 3: Countries' readiness map



To improve its state of readiness as determined by the Readiness for the Future of Production Index – 2018, Turkey needs to develop/improve the following (sub-)components;

Structure of Production - Complexity - Economic complexity.

Drivers of Production – Technology and Innovation - Mobile-cellular telephone subscriptions, internet users, companies embracing disruptive ideas, multi-stakeholder collaboration, venture capital deal volume per size of economy.

Drivers of Production – Human Capital - Knowledge-intensive employment, female participation in labour force, mean years of schooling, Quality of math and science education, quality of vocational training, pupil-to-teacher ratio in primary education, critical thinking in teaching, on-the-job training, hiring and firing practices.

Drivers of Production – Global trade and investment - Trade, trade tariffs.

Drivers of Production – Institutional framework – Rule of law.

2.1.4 Information and Communication Technologies (ICT) Development

Published by the International Telecommunication Union (ITU) on an annual basis since 2009, the ICT Development Index (IDI) is a composite index that combines 11 indicators into one benchmark measure that can be used to monitor and compare developments in information and communication technologies between countries and over time. IDI measurement criteria include the following:

the level and evolution over time of ICT developments in countries and the experience of those countries relative to other countries,

progress in ICT development in both developed and developing countries,

the digital divide, i.e. differences between countries in terms of their levels of ICT development

the development potential of ICTs and the extent to which countries can make use of them to enhance growth and development.

The Information and Communication Technologies development process, and a country's transformation to becoming an information society, can be depicted using the three-stage model that includes the following steps:

Stage 1: ICT Readiness – reflecting the level of networked infrastructure and access to ICT;

Stage 2: ICT Intensity – reflecting the level of use of ICTs in the society; and

Stage 3: ICT impact – reflecting the results/ outcomes of more efficient and effective ICT use.

Access sub-index: This sub-index captures ICT readiness, and includes five infrastructure and access indicators (fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, households with a computer, and households with Internet access).

Use sub-index: This sub-index captures ICT intensity, and includes three intensity and usage indicators (individuals using the Internet, fixed-broadband subscriptions and mobile broadband subscriptions).

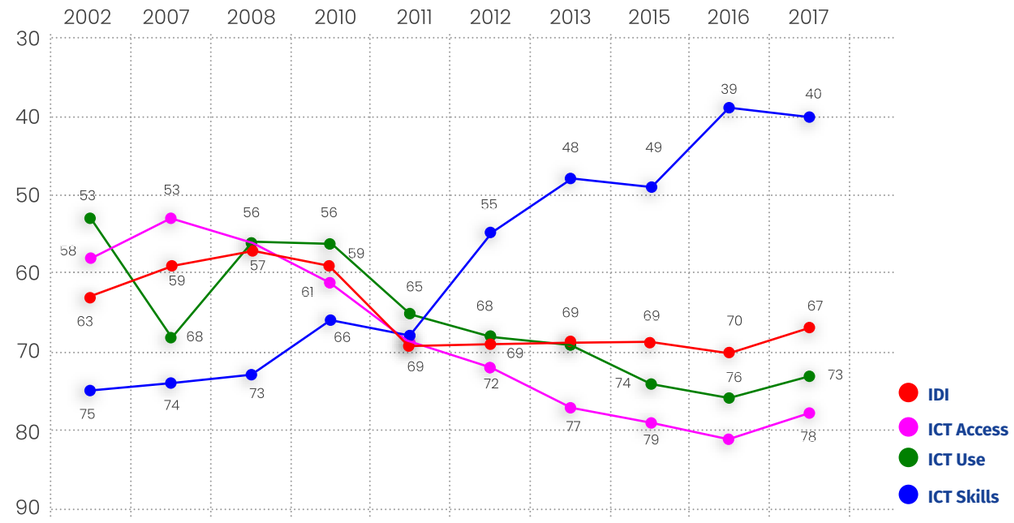
Skills sub-index: This sub-index seeks to capture capabilities or skills that are important for ICTs. It includes three proxy indicators (mean years of schooling, gross secondary enrolment, and gross

tertiary enrolment). As these are proxy indicators, rather than directly measuring ICT-related skills, the skills sub-index is given less weight in the computation of the IDI than the other two sub-indices.

Table 5: ICT Development Index; indicators and weights

Index	Weight	#	Indicator
ICT access	40%	1	Fixed-telephone subscriptions per 100 inhabitants
		2	Mobile-cellular telephone subscriptions per 100 inhabitants
		3	International Internet bandwidth (bit/s) per internet user
		4	Percentage of households with a computer
		5	Percentage of households with Internet access
ICT Use	40%	6	Percentage of individuals using the Internet
		7	Fixed-broadband subscriptions per 100 inhabitants
		8	Active mobile-broadband subscriptions per 100 inhabitants
ICT Skills	20%	9	Mean years of schooling
		10	Secondary gross enrolment ratio
		11	Tertiary gross enrolment ratio

Figure 4: Turkey's ranking in the ICT development index between 2002 and 2017



Turkey has a relatively large telecommunications market that has a potential for further growth. Mobile and fixed-line subscriptions rates are below the European average but increasing rapidly. Three mobile operators serve the Turkish market and offer relatively well-priced options.

Mobile services: Turkey's mobile market is one of the most intensive markets in the Europe region. Mobile phone services were provided by Turkcell and Telsim from 1994 onwards. During the duopoly, Turkcell maintained the larger market share. In 2001, competition increased with the entry into the market of Aria and Aycell. These two operators merged under the name Avea in 2004 and continue to provide services today as a subsidiary of Turk Telekom. Telsim was acquired by Vodafone in 2005. In 2016, Turkcell remained the largest mobile network operator followed by Vodafone and Avea (ITCA, 2016). The country has a rapidly growing mobile broadband market that is supported by a young population who are open to new approaches in technology. In 2009, 3G services were initiated and networks expanded swiftly to cover almost the entire population. LTE was started as late as 2016 and its reception and coverage area has grown since then.

Fixed services: The fixed market has a relatively small subscription rate compared to European countries. On the other hand, operators continue to invest in and develop the network market. These investments are accompanied by a growing number of subscriptions. Most of the fixed broadband connections are established through xDSL with a gradually growing number of fibre-optic and cable-based subscriptions. Leading the market in the fixed segment, Turk Telekom possesses the largest fibre-optic infrastructure in the country, and continues to make upgrade and extension investments. Fixed telephone subscriptions have decreased in line with the global trend by which fixed telephones are replaced by mobile devices.

Government policies: The privatization of the Turkish telecommunications sector started relatively late compared to other countries in Europe, with the sale of a majority of Turk Telekom's shares in a tender in 2005. The Information Technologies and Communication Authority (ITCA), an independent telecommunications regulator, had been established in 2000, under the original name of the Telecommunications Authority. Mobile services had been provided by the private sector from the start. The Government of Turkey seeks to harmonize its policies with those of the European Union as the country has applied for the EU membership.

Telecommunication policies aim to ensure effective competition and spread the use of ICT, particularly broadband. In 2016, the ITCA started a series of working meetings to develop a national broadband strategy, raise awareness about the importance of broadband development and determine the steps to be taken to launch broadband as soon as possible(465). As a result of these efforts, the National Broadband Strategy and Action Plan was adopted and became effective in December 2017.

Table 6: ICT development indicators for Turkey, Europe and the World (2018)

Key indicators	Turkey	Europe	World
Fixed-telephone subscriptions per 100 inhabitants	14.0	35.8	13.0
Mobile-cellular subscriptions per 100 inhabitants	96.4	120.4	103.6
Active mobile-broadband subscriptions per 100 inhabitants	70.5	85.9	61.9
3G coverage (% population)	97.4	98.3	87.9
LTE/WiMAX coverage (% population)	86.5	89.6	76.3
Individuals using the internet (%)	64.7	77.2	48.6
Percentage of households with a computer	57.3	78.6	47.1
Percentage of households with internet access	80.7	80.6	54.7
International Internet bandwidth (bit/s) per internet user	84.4	117.5	76.6
Fixed-broadband subscriptions per 100 inhabitants	14.8	30.4	13.6
Fixed-broadband subscriptions by speed (% distribution)			
• 256 Kbit/s to 2 Mbit/s	1.3	0.6	4.2
• 2 to 10 Mbit/s	21.7	12.4	13.2
• 100 Mbit/s and above	77.0	87.0	82.6

Source: ICT Development Index 2018[5]

[5] ICT Development Index 2018, International Telecommunications Union (ITU)

Turkey's telecommunication sector has seen great changes over the last 10 years in line with technological developments and growing customer demand. The fact that more than 60% of the population is on-line and the rest still off-line demonstrates the huge potential of this emerging market. In 2017 Turkey was included in the list of the most dynamic ten economies in the ICT Development Index and the country.

Parallel to the growth in access to ICT services and the increased use of these services, ICT prices decreased globally between 2008 and 2017. In the period in question, fixed-broadband services recorded the biggest decrease in prices among all ICT services, while the global figure for fixed-broadband subscriptions per 100 inhabitants doubled. Mobile telephone prices followed a stable downward trend over the same period. Emerging markets including Turkey were equally affected by these developments. In 2018, Turkey's ICT development indicators remained below the average for Europe but outperformed the global average (Table 6).

There is a two-way relationship between ICT prices and access to and use of ICT services. Lower prices make ICT services more affordable for larger segments of society and hence contribute to the adoption of ICT. Between 2002 and 2017, the ICT skills of the population in Turkey developed greatly (Figure 4). Access to and use of ICT in Turkey has been growing rapidly, particularly since 2015. On the other hand, the growing level of access to and use of ICT in Turkey has created favourable conditions for operators to achieve efficiency gains. This situation may give rise to a virtuous circle in which lower prices lead to stronger adoption of ICT while stronger adoption of ICT makes lower prices possible.

2.1.5 Economic Complexity and Product Complexity

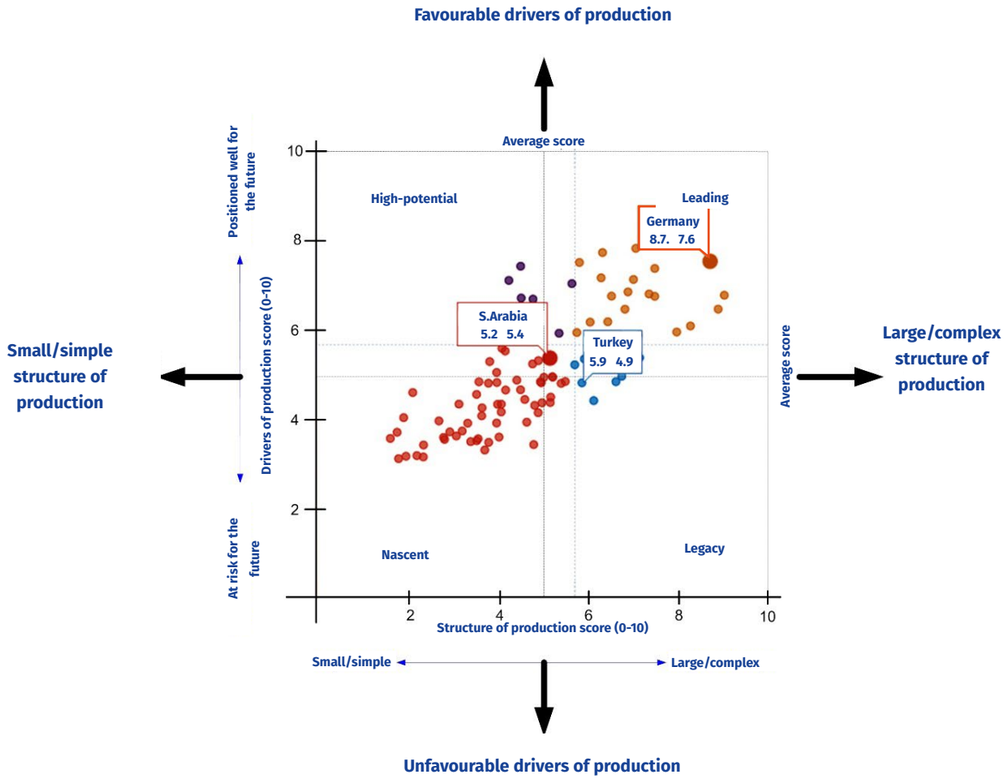
Economic complexity is a measurement of the knowledge that is required for the production of the products produced by a country. A country's economy is considered "complex" if it exports not only very complex products but also many different products. The more complex a country's economy is, the stronger its infrastructure and its adaptability to market changes are. Economic complexity is an indicator of competencies, development and competitiveness, and therefore of the dimensions of countries' production structures. It also counts how many different products of knowledge and competencies are included in a country's production portfolio, and measures the knowledge and competencies required for these products.

The Economic Complexity Index (ECI) and the Product Complexity Index (PCI) are, respectively, measures of the relative knowledge intensity of an economy or a product. The ECI measures the knowledge intensity of an economy by considering the knowledge intensity of the products it exports. The PCI measures the knowledge intensity of a product by considering the knowledge intensity of its exporters. "Product complexity" is the features of products that give them competitive advantage in international markets and reflect advanced technological level, technical labour force, skills, supply chains and innovation systems. The level of product complexity indicates the products and sectors in which a country has a foreign trade surplus or deficit. Products with a high level of complexity are produced using developed skills, intensive labour and advanced technologies. It is possible to differentiate oneself through products with a high level of complexity and in this way to acquire international competitive edge and generate higher revenues.

The product space is a network connecting pairs of products that are significantly likely to be co-exported and that can be used to foresee the evolution of a country's export structure. It is a visualization showing the connection between products based on similarities in the technical

know-how required to produce them. The product space visualizes the paths that countries can use for diversification.

Figure 5: Readiness of Germany, Saudi Arabia and Turkey for the future of production



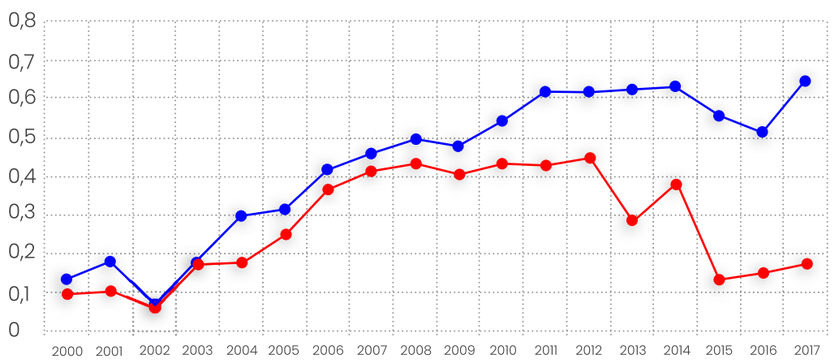


Figure 6: Evolution of the economic complexity of Turkey from 2000 to 2017 (Economic complexity index value)

As of 2017, the economy of Turkey has an Economic Complexity Index (ECI) of 0.176 making it the 52nd most complex country. Turkey exports 389 products with revealed comparative advantage (meaning that its share of global exports is greater than would be expected given the size of its export economy and the product's global market). Between 2000 and 2013, the level of complexity of products produced in Turkey showed an upward trend. From 2014 onwards, there appears to have been a decrease in the use of advanced production technologies and methods in manufacturing industry. Even so, Turkey's global ECI ranking showed an upward trend between 2000 and 2017.

The following product groups (with their product complexity index values in brackets) offer opportunities in the short-term for Turkey to diversify and head towards more complex products making use of the know-how of SMEs:

- Apparatus (optical, medical etc.) (1.040)
- Industrial machinery (0.993)
- Metallic tools (0.824)
- Electrical machinery and equipment (0.803)
- Pharmaceutical products (0.752)
- Trains (0.740)
- Glass and Glassware (0.736)
  Plastics (0.665)
- Chemical products (0.648)
- Vehicles (0.662)
- Textile fabrics (0.630)
- Clocks (0.554)
- Arms and ammunition (0.536)
- Base metal products (0.508)
- Soaps, candles and dyes (0.488)
- Enzymes (0.471)
- Paper and paperboard (0.418)
- Printing industry products (0.409)
- Aircraft parts (0.369)
- Iron and steel (0.391)
- Iron and steel goods (0.282)
- Toys (0.271)
- Stone, cement products (0.265)
- Furniture (0.257)
- Paints, dyes, inks (0.253)
- Padding, felt and non-woollen products (0.227)
- Rubber (0.176)
- Aluminium (0.140).

2.1.6 Human Capital

The Global Human Capital Index aims to provide a holistic assessment of a country's human capital, both current and expected, across its population. The index defines human capital as the knowledge and skills people possess that enable them to create value in their country's economic systems. The Global Human Capital Index is composed of 21 unique indicators grouped under the four elements of capacity, deployment, development and know-how (Table 7).

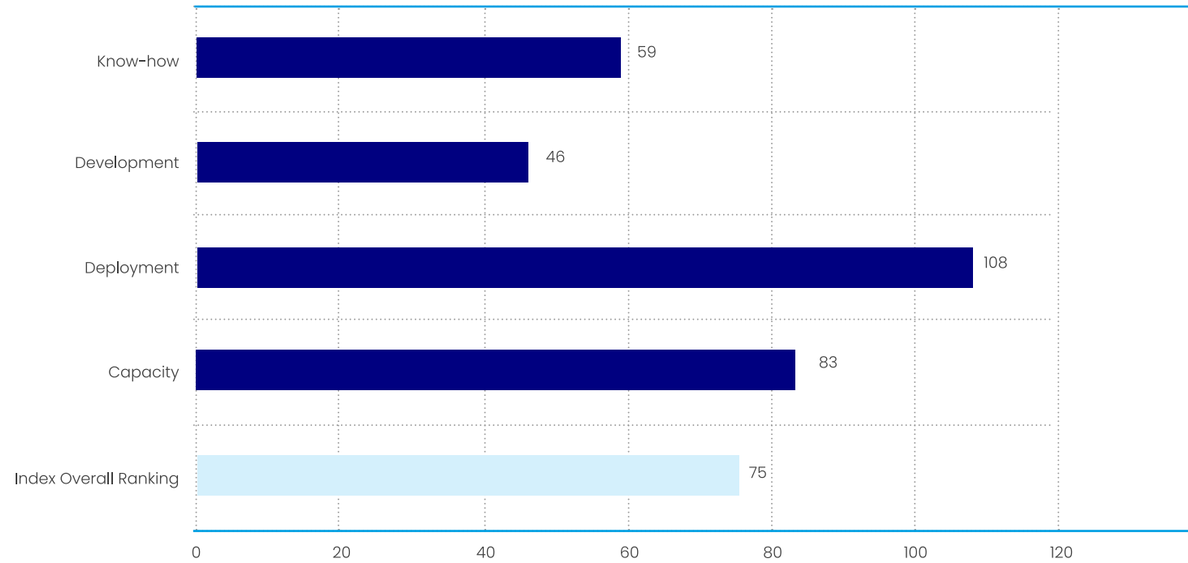
Table 7: Elements and indicators of the Global Human Capital Index

Elements	Weight	#	Indicator	Age group Share of total population				
				0-14	15-24	25-54	55-64	65+
Capacity	25%	1	Literacy and numeracy	N/A				
		2	Primary education attainment rate	N/A				
		3	Secondary education attainment rate	N/A				
		4	Tertiary education attainment rate	N/A				
		5	Labour force participation rate	N/A	N/A			
Deployment	25%	6	Employment gender gap	N/A				
		7	Unemployment rate	N/A				
		8	Underemployment rate	N/A				
Development	25%	9	Primary education enrolment rate		N/A	N/A	N/A	N/A
		10	Quality of primary schools		N/A	N/A	N/A	N/A
		11	Secondary education enrolment rate		N/A	N/A	N/A	N/A
		12	Secondary enrolment gender gap		N/A	N/A	N/A	N/A
		13	Vocational education enrolment rate	N/A		N/A	N/A	N/A
		14	Tertiary education enrolment rate	N/A		N/A	N/A	N/A
		15	Skill diversity of graduates	N/A		N/A	N/A	N/A
		16	Quality of education system	N/A		N/A	N/A	N/A
		17	Extent of staff training	N/A	N/A			N/A
Know-how	25%	18	High-skilled employment share	N/A	N/A			N/A
		19	Medium-skilled employment share	N/A	N/A			N/A
		20	Economic complexity	N/A	N/A			N/A
		21	Availability of skilled employees	N/A	N/A			N/A

Global Human Capital Index data are available only for the years 2015 and 2017. In 2017, 130 countries were included in the study. The 2017 study found that the world has developed only 62% of its human capital as measured by the Index. Conversely, nations are neglecting or wasting, on average, 38% of their talent. The regions with the smallest gaps in human capital development are North America (26%) and Western Europe (29%), while those with the biggest gaps are South Asia (46%) and Sub-Saharan Africa (47%). Turkey was included in the Middle East and North Africa region, where the average gap is 44%.

The gap in human capital development in Turkey is 40%, which is above the global average. In other words, Turkey has developed only 60% of its human capital. The gap in human capital development in Turkey is greater than in Northern America and Europe - regions which include the countries with the highest levels of readiness for the future of production, competitiveness and innovative power. In 2017, Turkey ranked 75th among 130 countries. Turkey's ranking in the Global Human Capital Index is shown in Figure 7. The top ten countries are Norway, Finland, Switzerland, the USA, Denmark, Germany, New Zealand, Sweden, Slovenia and Austria. There are wide gaps between the various aspects of human capital and human capital outputs within each region. The Global Human Capital Index shows that all countries can do more to feed and fully develop their human capital. Only 25 countries score above 70% in terms of the development of their human capital. Another 50 countries, including Turkey, have index scores of 60-70%.

Figure 7: Turkey's sub-index rankings in the Global Human Capital Index 2017



Based on the findings of the Global Human Capital Index 2017, Turkey needs to develop / improve its human capital in the following fields:

Capacity - Literacy and numeracy, primary education attainment rate, secondary education attainment rate, tertiary education attainment rate.

Deployment – Labour force participation rate, employment gender gap, unemployment rate

Development - Primary education enrolment rate, quality of primary schools, secondary education enrolment rate, skill diversity of graduates, quality of education system, extent of staff training.

Know-how - High-skilled employment share, medium-skilled employment share, availability of skilled employees.

2.2 Benchmarking

Turkey is classified as a country that is in transition from an efficiency-driven economy to an innovation-driven economy (an SoTEI country). There are a total of 20 countries in the same category that are considered emerging economies, and only eight of them have a better competitiveness performance than Turkey. These countries are Malaysia, Saudi Arabia, Chile, Poland, Lithuania, Mauritius, Costa Rica and Panama. This section of the report will benchmark Turkey against these countries which are similar to Turkey in economic structure, but display greater global competitiveness.

Table 8 shows the basic economic indicators of the countries in question. The global competitiveness indicators of these countries are given in Table 9. Table 10 compares the key innovation, ICT development and human capital indicators of these countries. Table 11 summarizes these countries' levels of readiness for the future of production along with their economic complexity and product complexity rankings.

Table 8: Basic economic indicators of countries in transition to an innovation-driven economy

Basic economic indicator	Malaysia	Saudi Arabia	Chile	Poland	Lithuania	Mauritius	Costa Rica	Panama	Turkey
Population (1000)	31,624.26	32,938.21	18,054.73	38,170.71	2,890.30	1,265.14	4,905.77	4,098.59	80,745.02
Gross Domestic Product [3] - USD billion	926.08	1,789.26	452.10	1,110.74	90.63	27.44	85.20	99.43	2,132.72
Gross Domestic Product Per Capita[3] - USD billion	29,040.84	54,777.38	24,537.11	29,521.25	32,298.86	21,640.31	16,877.20	25,351.30	26,892.87
Unemployment Rate[3] - %	3.4	5.5	7.0	4.9	7.1	7.1	8.1	4.5	11.3
Mean years of education[2] (years)	10.3	8.1	10.5	11.9	11.8	8.8	8.4	9.7	7.0
Median age of population[2] (years)	27.7	29.8	33.7	39.7	42.7	35.6	31.4	28.4	29.9
Healthy life expectancy[2] (years)	66.5	64.4	70.5	68.7	66.1	66.8	69.8	68.1	66.2
Working age population[2] (1,000)	21,613	23,013	12,305	26,378	1,993	892	3,345	2,607	53,062
Labour force participation rate[2] (%)	67.7	54.0	59.6	56.2	60.3	59.4	58.0	63.7	52
Youth not in employment, education or training rate[2] (%)	1.2	16.1	12.3	11.0	9.2	-	20.7	32.6	23.9
Output per worker[2] (USD, PPP)	54,652	136,180	47,627	54,672	58,114	40,406	33,764	46,008	56,451
Mean monthly earnings[2] (USD, PPP)	1,633	3,483	-	2,336	-	1,251	1,255	1,129	2,021
Mean monthly earnings for high-skilled workers [2] (USD, PPP)	3,117	5,995	-	3,022	-	2,351	2,417	1,029	4,255
Mean monthly earnings for medium-skilled workers [2] (USD, PPP)	1,156	-	-	1,697	-	922	953	1,556	1,484
Mean monthly earnings for low-skilled workers2 (USD, PPP)	841	-	-	1,364	-	632	669	587	1,238
Public spending on education [2] (% of GDP)	5.0	5.1	4.9	4.9	4.6	4.9	7.2	3.2	4.8
Public spending on social security, working age[2] ((% of GDP)	-	-	1.3	3.6	-	-	3.4	-	0.2
Public spending on social security, retired[2] ((% of GDP)	-	-	3.3	11.8	-	-	2.8	-	7.0
Pension scheme coverage share [2] (% of working age population)	28.1	26.2	40.4	59.1	65.48.8	39.7	40.6	46.5	27.9

1Source: The Global Competitiveness Report 2017-2018

2Source: The Global Human Capital Report 2017

3 Source: The Readiness for the Future of Production Report 2018

Table 9: Comparison of countries in transition from an efficiency-driven economy to an innovation-driven economy in terms of global competitiveness

Development level	#	Criteria	Malaysia	Saudi Arabia	Chile	Poland	Lithuania	Mauritius	Costa Rica	Panama	Turkey
Overall global competitiveness ranking			23	30	33	39	41	45	47	50	53
		Basic requirements ranking	24	32	36	45	34	44	53	37	60
1. Factor-driven level	1	Institutions	27	26	35	72	53	37	48	74	71
	2	Infrastructure	22	29	41	44	47	40	65	37	53
	3	ICT adoption	32	54	49	68	18	47	55	81	71
	4	Macroeconomic environment	1	1	1	1	1	90	85	50	116
		Efficiency enhancers ranking	24	33	31	34	40	59	48	57	51
2. Efficiency-driven level	5	Higher education and training	45	43	26	40	29	52	31	88	48
	6	Goods market efficiency	20	42	39	45	44	27	63	41	53
	7	Labour market efficiency	26	80	49	78	61	52	69	76	127
	8	Financial market development	16	56	17	53	59	41	39	14	80
	9	Technological readiness	46	44	38	47	30	58	45	63	62
	10	Market size	24	15	44	21	78	113	80	79	14
		Innovation and sophistication ranking	21	40	50	59	44	46	42	48	66
3. Innovation-driven level	11	Business sophistication	20	34	50	57	46	38	35	44	67
	12	Innovation	22	40	52	59	41	63	43	55	69

Table 10: Comparison of countries in transition from an efficiency-driven economy to an innovation-driven economy in terms of global innovation and ICT development

Development level	#	Criteria	Malaysia	Saudi Arabia	Chile	Poland	Lithuania	Mauritius	Costa Rica	Panama	Turkey
Overall global competitiveness ranking			35	61	47	39	40	75	54	70	50
Innovation efficiency			48	104	68	42	58	105	43	64	25
Innovation inputs			34	46	45	38	36	61	64	78	62
Input	1	Institutions	43	94	37	36	38	59	57	58	96
	2	Human capital and research	31	24	61	44	46	75	73	99	49
	3	Infrastructure	43	51	53	41	32	65	60	39	52
	4	Market sophistication	22	41	54	57	50	45	96	74	55
	5	Business sophistication	39	52	48	41	35	62	54	113	72
Innovation inputs			39	78	53	40	44	89	51	66	43
Output	6	Information and technology	33	73	48	44	58	115	56	118	52
	7	Creativity	47	83	58	42	33	68	49	40	39
Overall ICT Development ranking			63	54	56	49	41	72	60	94	67
ICT access			62	52	66	40	57	58	74	84	78
ICT use			48	59	65	64	38	82	47	112	73
ICT skills			101	48	19	25	22	78	63	92	40
Overall Human Capital ranking			33	82	53	31	25	74	61	56	75
Capacity			32	60	23	25	14	78	56	40	83
Deployment			70	124	97	65	37	93	110	59	108
Development			41	71	51	34	31	63	43	76	46
Know-how			28	58	65	24	67	68	55	62	59

Table11: Comparison of countries in transition from an efficiency-driven economy to an innovation-driven economy in terms of readiness for the future of production and economic complexity

Criteria		Malaysia	Saudi Arabia	Chile	Poland	Lithuania	Mauritius	Costa Rica	Panama	Turkey
Readiness for the future of production[1]	Structure of production	20	44	63	19	31	73	47	75	32
	Drivers of production	22	36	34	31	37	39	56	58	57
Economic complexity[2]	Overall economic complexity	0.97	0.75	0.04	1.09	0.68	-0.58	0.24	0.12	0.18
	Average product complexity	0.952	0.125	-0.110	1.190	0.853	-0.091	0.296	0.211	0.645
	Economic development projected by 2027 (%)	5.47	1.91	3.02	3.14	4.06	-	3.37	3.72	4.64
Manufacturing, value added (% of GDP)[3]		21.947	12.809	10.647	18.054	16.994	11.364	11.887	5.78	19.058

[1]Economic Complexity Index 2017, Economic Complexity Atlas 2017

[2]Production added value,% of GDP, World Bank Database, 2018

[1] Source: The Readiness for the Future of Production Report - 2018

[2] Source: The Economic Complexity Index- 2018

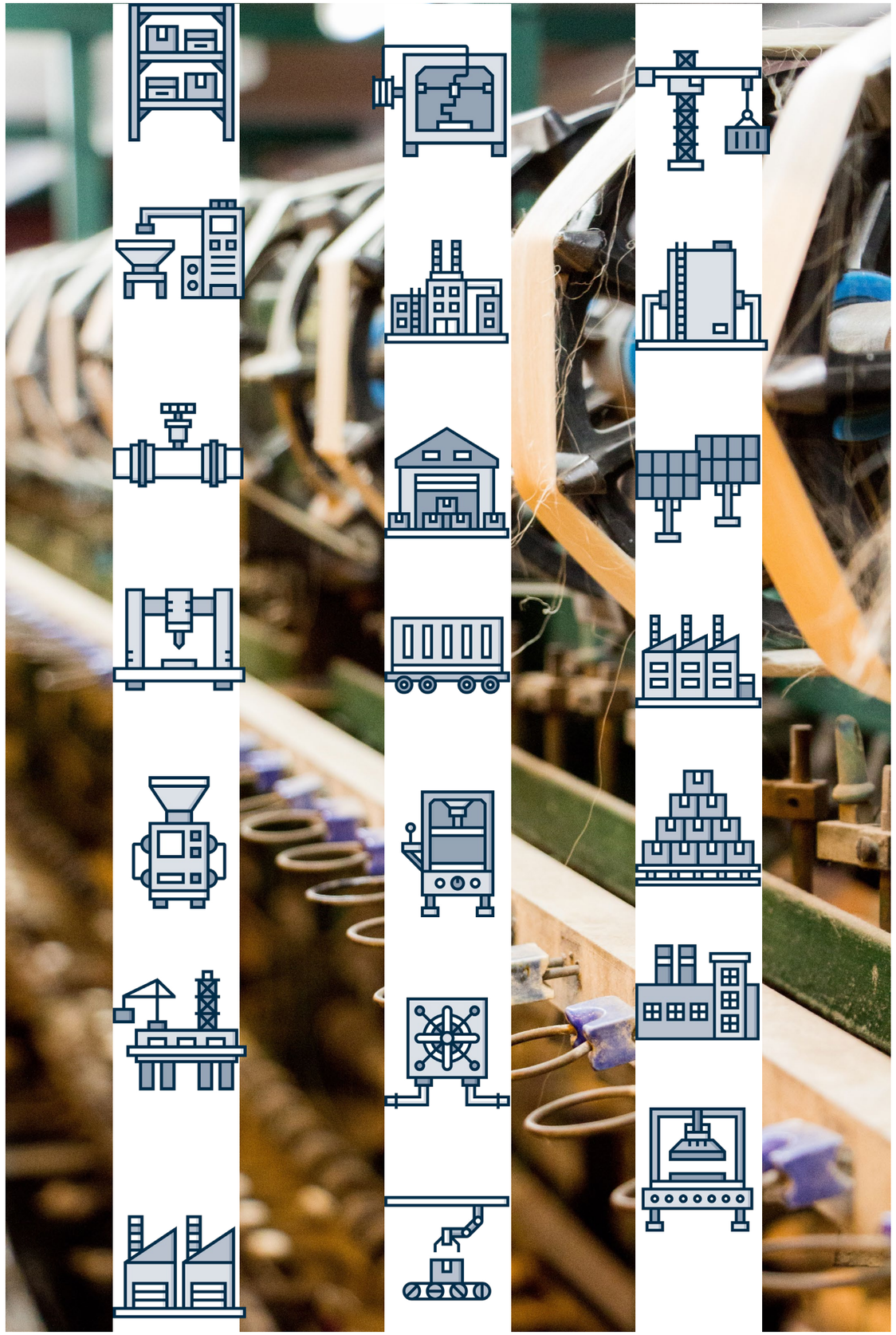
[3] Source: The World Bank, Manufacturing Value Added Databank - 2018

2.3 New Tendencies in Manufacturing Industry

New trends are under way in manufacturing industry that point the way to the future on a global scale. These trends include the following:

- Use of green technologies,
  - Green technology focuses on protecting the environment and supporting the use of energy through sustainable goods.
  - Consumer protection leans towards green technology products (e.g.: electric vehicles)
- Environmental-friendly production,
  - Reducing air emissions
  - Reducing water consumption
  - Energy saving
- Use of renewable energy,
  - Price and competitive advantage derived from use of cheap energy
- Waste-free production,
  - Working to prevent hazardous waste and pollution at every stage of the product life-cycle starting from the design stage (the circular system)

    In circular systems,
    - Processes are designed to minimize waste
    - Goods and waste are re-used if possible
    - Goods that are not re-used are recycled
- Value creation through design,
  - Developing products with multiple perspectives in mind by comprehensively analysing the value to be offered to consumers, their expectations, factors affecting competition and the costs.
    - What do consumers want?
    - What do competitors offer?
    - What is the cost of launching a new good or service?
- Marketing and branding strategies,
  - Digital marketing: Marketing products by using digital technologies and electronic media, mainly through the internet, including mobile telephones, video advertising and other digital media
- Industry 4.0 and digitization.



3

RECOMMENDATIONS

3.1 Development Axes

Seven development axes were identified based on the findings of the analysis of Turkey's needs in the field of upgrading Turkey's current manufacturing industry to the future state of competition. The axes are, as shown below: institutions, infrastructure, human base, financial system, complexity, production and innovation. In addition, each development area has its own development needs. When brought together, the axes, areas and needs make up a matrix.

Figure 8: Development axes

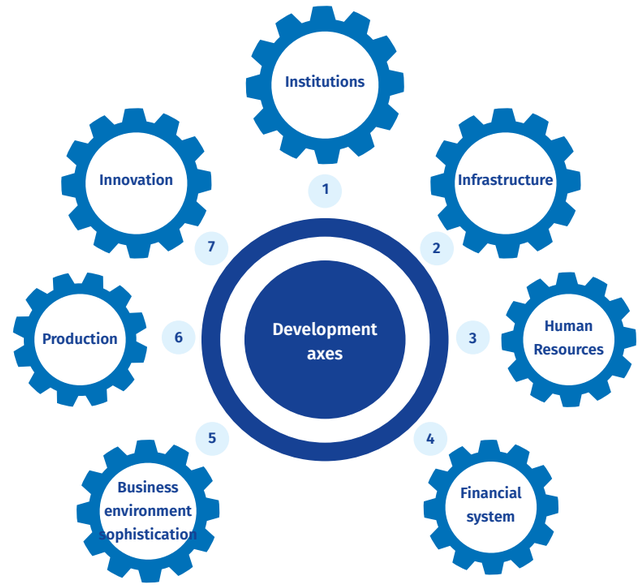


Table12: Development axes and needs for the future of manufacturing industry in Turkey

	Development axis	Development area
1	Institutions	1.1 Public sector
2	Infrastructure	2.1 Logistics and transportation 2.2 Public services
3	Human base	3.1 Human capital 3.2 Labour market
4	Financial system	4.1 Financial instruments
5	Sophistication	5.1 Business dynamism and sophistication 5.2 Market sophistication
6	Production	6.1 Goods market 6.2 Technology and sophisticated production 6.3 Economic and product complexity
7	Innovation	7.1 Innovation capability 7.2 Creation of knowledge 7.3 Knowledge impact 7.4 Knowledge diffusion 7.5 Creative outputs

3.2 Development Needs for the Future of Manufacturing Industry

Institutions-Public Sector
Macroeconomic stability and Turkey's political environment both impact the readiness of manufacturing industry for the future of production and competition. The annual changes in the consumer prices index (inflation) and the public debt stock (debt dynamics) need to be limited more effectively. This will create a more refined environment for private sector investments both in technology and in new industries.

Measures need to be taken to boost the confidence of domestic and international investors in terms of respect for societal rules, particularly with regard to contract practices, property rights, the quality of policing and the courts, and the probability of crime and violence. This will have a direct supportive impact on business owners and investors.

The business environment must be improved and supported, including matters related to the ease with which the private sector is able to contest government acts and/or regulations through the legal system (efficiency of the legal framework in challenging regulations and in settling disputes); intellectual property protection; financial assets, financial auditing and reporting standards; the cost of redundancies, and the ease of resolving insolvency.

Infrastructure
The main infrastructure inputs that support productivity and productive activities are transport capabilities and utility services such as electricity and water. Turkey needs to improve its railway infrastructure to provide cheaper transportation and reduce the logistics costs of small and medium-scale enterprises (SMEs). In addition, electricity losses need to be tackled more effectively, as they have a negative impact on energy prices.

Goods Market
The effects of business taxes and subsidies on the competitiveness of SMEs should be reviewed and/or improved so that fiscal measures (subsidies, tax relief etc.) do not distort competition. Fine-tuning fiscal measures could be a driving force for improving the sophistication of the goods market.

The quality of corporate activity in those sectors where the goods market is dominated by a few business groups should be developed by supporting new businesses that wish to operate in these sectors. Through the inclusion of multiple SMEs in these sectors, the diversity of local players will be enhanced while competition will be increased. This is particularly important for the future competitiveness of technology-intensive sectors.

Trade tariffs in product groups / industries dependent on imported inputs that are currently competitive or have the potential to gain a competitive advantage in the future should be regulated in such a way as to reinforce competitive advantage.

Complexity of tariffs (tariff dispersion, the prevalence of tariff peaks, the prevalence of specific tariffs and the number of distinct tariffs) is another performance criterion for the manufacturing industry.

Complexity of tariffs should be ensured for innovation and/or technology-intensive goods. Clarity and complexity in trade tariffs will develop the transparency of trade in Turkey as an indicator of the competitiveness of the goods market.

Financial system
SMEs in Turkey can access financing via public sector incentives. However, these incentives are not sufficient to meet all the needs of their operations. The financial sector should also be improved to enable access to **financing via financial sector**, to facilitate such access and to raise awareness.

Venture capital is a modern means of finance that enables businesses to use resources in an effective and efficient way. Venture capital has been operating successfully in developed countries for many years. It enables entrepreneurs without sufficient financial resources to realize their dynamic, creative and innovative investment ideas. It provides business administration and management support when needed in addition to supplying capital in return for shares. Venture capital is particularly useful for supporting entrepreneurs and/or investments that are not supported by banks. However, manufacturing industry is not sufficiently acquainted with venture capital and there are insufficient instruments for it. There is a need to create financing opportunities through private equity funds in order to prepare the ground for entrepreneurs that intend to start a

business with innovative but risky projects.

Market capitalization refers to the share price of a listed company multiplied by the number of its outstanding shares. A high market capitalization usually indicates that a company is well adopted, that it is of high quality and that its shares are frequently traded. The number of listed companies and the total value of their shares are indicators of financial system performance. In Turkey, these indicators are considered low by the standards of the developed countries. Public trading in the shares of industrial companies engaged in technology-intensive or innovation-driven manufacturing needs to be encouraged. This would support and/or develop these companies in terms of business efficiency and output competition and contribute to the sophistication of the financial system in Turkey as well. The share price would be an indicator of companies' competitiveness and would be determined by the adoption and implementation of new production technologies and innovations.

National insurance and reinsurance markets are characteristic features of economic growth. Insurance is not only an economic unit that insures sectors against risks; it is also a practice that helps to create jobs and foreign exchange inflows. Life and non-life **insurance premium** volumes have not reached the desired level in Turkey. There are various reasons for this. One reason is that manufacturing industry tends to perceive insurance primarily as an additional cost. The attempts of SMEs to adopt and implement new technologies and/or innovations are risky by nature and should be covered by insurance. It would be wrong to think that the manufacturing industry of the future will be successful in an environment where insurance coverage is insufficient.

The main factor behind economic growth is the accumulation of capital through increased investment. This effectively depends on savings, given due to the allocation of functions between investments and savings. Financial markets have the greatest role to play in increasing and distributing savings. Banks are the main basis of the financial system, and the **soundness of banks** is key to the proper collection and distribution of savings and to the financing of industries for economic growth. The future of production in Turkey, which is expected to be more competitive than today, requires improvements aimed at making the banking system more robust.

The ratio of the banks' total regulatory capital to their total risk-weighted assets is an important indicator for the banking system. For a banking institution, an increase in risk raises the target capital ratio because it increases the probability of bankruptcy and the costs of bankruptcy for any given capital ratio. The regulatory capital ratio of banks (ratio of banks' total regulatory capital to their assets) needs to be improved.

Business Environment Sophistication and Business Dynamism

Start-up costs are the costs incurred while starting a business. As all businesses are different, they require different start-up costs. The careful planning of costs is significant for the survival of the business in the short run. One of the issues that new businesses face is the statutory fees include in their start-up costs. The ratio of total start-up costs to Turkey's GDP per capita is relatively high by comparison with the leading countries in advanced production. Statutory fees and costs should be considered more carefully and reduced.

The World Bank's 'Doing Business' index examines the time, cost and result of insolvency proceedings relating to local entities. These variables are used by secured creditors to calculate the recovery rate, which is the amount recovered through judicial restructuring, liquidation or debt enforcement proceedings. Keeping businesses alive is one of the most important aims of insolvency recovery systems. In Turkey, the insolvency recovery rate is below the desired level. A good insolvency resolution system should prevent the premature liquidation of sustainable businesses. Furthermore, lenders should be deterred from granting high-risk credits, and managers and shareholders from borrowing credits imprudently and making careless financial decisions. A company suffering from mismanagement or a temporary economic crisis can still recover, and is recovery will benefit all stakeholders: creditors may recover a greater part of their investments, more employees will retain their jobs, and the networks of suppliers and clients will be protected.

Willingness to delegate authority is an indicator of entrepreneurship culture and has direct effects on business dynamism. In Turkish manufacturing industry, senior management still delegates insufficient authority to subordinates. The management performance of SMEs also affects their competitiveness. Delegation of authority is a process in which authority and powers are distributed and shared along the superior-subordinate chain. The managers of SMEs should establish a system to share tasks when they exceed their capacity to handle them.

The capacity of SMEs in manufacturing to embrace **disruptive business ideas** needs to be developed further in Turkey. In today's market conditions, companies should be able to think in a disruptive way in order to maintain their competitiveness, investing both in innovations that will enable them to sustain their businesses and in new revenue flows that will defend them against potential competitors. SMEs need to transform their main fields of operation to prevent deterioration due to the effects of new technologies. In addition, SMEs should minimize production costs by adopting lean production techniques, enabling quick testing and repetition, or using open innovation to enhance crowdsourcing.

The percentage of gross expenditure on R&D financed by abroad is an important indicator of the commercial competitiveness of SMEs. The establishment of innovation networks at international level leads to multi-dimensional improvements in many elements of business sophistication, including workforce skills, know-how, financial stability, sustainability and enhanced R&D performance. The benefits and costs associated with the internationalization of R&D can be shared among SMEs and industries. As companies in the same sector (usually) work with similar databases, and have to cope with similar challenges in the innovation process, external R&D finance will act as a catalyst for these manufacturers to perform better at the international level.

The adoption and regular updating of the latest technologies in telecommunications, computer and information services supports SMEs' information absorption capacity of SMEs. However, the adoption of ICT is one of the weaknesses of Turkish manufacturing industry. The adoption of the latest ICT is an indicator of business sophistication, particularly with regard to the quality of the SMEs' operations and strategies. More sophisticated business strategies will provide producers with better guidance in developing their sustainability.

Innovation capability

The diversity of the workforce with respect to ethnic origin, religion, gender, etc. is one of the factors that favourably impact the innovative capacities of SMEs. A workforce with different perspectives has a positive impact on business, R&D and innovation performance. This is also a way for SMEs to present themselves more effectively vis-a-vis their customers and competitors. It is very well-known that the diversity of the workforce in manufacturing industry is low and needs to be improved.

One of the most important factors that affect SMEs' innovation capability is **multi-stakeholder cooperation** in the field of R&D. The degree of cooperation in the Turkish manufacturing industry is lower than one would desire (much below the EU average, for example). Cooperation has a multiplier

effect on the potential success of R&D activities. Cooperation is multi-dimensional and encompasses individuals sharing their ideas and cooperating within the company, companies cooperating with one another in the field of innovation and the exchange of ideas, and cooperation between businesses and universities for research and development. In Turkey, substantial funds are available to support multi-stakeholder cooperation in R&D and innovation, and businesses making use of these funds are known to have written considerable success stories.

Cluster development is one of the strongest driving forces of innovation capability, and constitutes another important indicator. SMEs in Turkey perceive the clustering approach as increasing the risk of disclosure of their commercial secrets. However, clustering is a tool that creates an atmosphere of solidarity and cooperation among the participants. There are many examples of competitive and successful clusters in the world. Some funds are available in Turkey to support clustering in manufacturing industry. Clustering can be a convenient way for producers that complement one another to gain competitive advantage.

The development of the skills of the SME workforce will increase enterprises' capacities for internal innovation and for the adoption of knowledge obtained through cooperation with external partners.

SMEs require assistance as they adopt ICT and adapt to the digital revolution. It is important not only to support SMEs in adopting and making effective use of ICT hardware and software that will professionalise the management of their businesses but also to introduce them to the new opportunities created by the ongoing digital revolution

It is important to ensure that R&D policies extend to SMEs. As R&D grants usually target small businesses, or activities in which small businesses are highly likely to be engaged (e.g.: cooperative innovation), directly, they are more effective in reaching SMEs than tax credits. Governments can also amend existing R&D tax credit programmes to make them respond to the needs of SMEs better by introducing higher investment-related tax credit rates and simpler operational rules for SMEs.

SMEs need to be encouraged and supported in their use of intellectual property rights (IPR). Their awareness of different types of IPR needs to be enhanced, and their IPR-related skills need to be developed, through education and training. To make the IPR system more accessible to SMEs, it is important to structure fees and costs in an affordable way and to improve procedures and related litigation and foreclosure mechanisms.

National innovation systems must be both effective and inclusive. National governments play important roles in the establishment of national innovation systems which are effective in terms of the exchange of knowledge and include SMEs of different sizes and from different sectors.

Outputs

The production and exports of **telecommunications, computer and information services (ICT services)** are indicators of the diffusion of knowledge among the SMEs that are active in these sectors. Exporters of these products have the advantage of bringing high levels of revenues. The more SMEs focus on R&D and innovation in ICT services, the greater the competitive advantage they will acquire. Producers in these sectors should carry out more R&D and make maximum use of external sources of finance.

Economic complexity

Product complexity is a measurement of the knowledge intensity of the product which is produced. An SME that produces more complex products will contribute to economic complexity and profitability. This is a strong way to generate new business opportunities. More complex products require more knowledge, and the possession of this knowledge is a result of the availability of resources such as finance, time and skills. In the short term, the Turkish manufacturing industry can produce more complex products by capitalizing on its existing know-how in certain sectors. This is also the best way to grow a business with limited resources. The following sectors/ product groups offer opportunities for the production of more complex products in the short term:

- **Textiles:** products for technical use, yarn spun from silk waste, textile hose piping and similar textile tubing, sticks, lamps and lighting fittings, yarn of combed wool, synthetic monofilament, woven fabrics, garneted stock of wool, carpets, hemp fibre, flax, linoleum, artificial discontinuous fibres, conveyor or transmission belts or belting.
- **Agriculture:** potato flour, wool grease and fatty substances, sulphate or soda, hop cones, pork, children's picture, drawing or colouring books, paper pulp, filter blocks of paper and paper board, animal fats, mushrooms, skins and other parts of birds, pig fat and poultry fat, live pig, rye, wallpaper and similar wall coverings, maps, whey, rapeseed, colza or mustard oil, newspapers, journals and periodicals, plans and drawings for engineering purposes, cigarette paper, barley.
- **Stone:** metal clad with gold, synthetic precious stones, friction material and articles thereof, ceramic household articles, ceramic pipes, mica, glass mirrors, metals clad with silver, glass envelopes and paving blocks, emery, mineral wools and insulating materials, glass fibres, asbestos–cement, panels of vegetable fibre, architectural ceramic ornaments, articles of cement, asphalt.
- **Minerals:** granulated iron or steel.
- **Metals:** hand tools, stainless steel wire, nickel tubes and pipes, alloy steel, stainless steel bars and rods, handsaws, interchangeable tools for hand tools, paper clips and similar articles, pipes or fittings of iron or steel, copper tubes or pipes, tin waste and scrap, pipes and seamless iron pipes, aluminium powders, zinc bars and rods, nickel waste and scrap, zinc plates and foil, copper powders.
- **Chemicals:** pharmaceuticals, plastics, paints and varnishes, polymers of propylene, insecticides, fungicides, polymers of ethylene, acyclic hydrocarbons, mixtures of odoriferous substances, polymers of styrene, polycarboxyilic acids, catalytic preparations, amino-resins.
- **Vehicles:** railway service vehicles, motorcycles, chassis fitted with engines for the motor vehicles, work trucks, railway coaches, electric trains, self-propelled railway coaches, gliders, parachutes, baby carriages, aircraft parts, parts of railway locomotives, bicycles.
- **Machinery:** thermostatically controlled valves, transmission shafts, compression-ignition internal

combustion engines, machinery for working rubber or plastics, spark-ignition reciprocating or rotary internal combustion piston engines, medical apparatus, bulldozers, toys, automatic regulating or controlling instruments, pumps for liquids, compressors and fans, ball or roller bearings, air conditioning machines, harvesting machinery, lifting machinery, centrifuges, machinery parts, sports equipment, hydraulic turbines.

- **Electronics:** magnetic tape recorders, electric condensers, shavers, electromagnets, soldering machinery, industrial or laboratory electric furnaces, electro-mechanical domestic appliances, radar, insulating fittings for electrical machines, electrical resistors, electric sound or visual signalling apparatus, transmission apparatus for radio broadcasting, carbon articles for electronics, electrical insulators of any material, electrical apparatus for switching or protecting electrical circuits, electrical ignition equipment, batteries, electrical transformers, electric motors and generators, electrical signalling or traffic control equipment, electricity distribution boards.

Human capital

One of the most important factors in manufacturing industry is human capital. The constant trend towards the use of higher technology requires an increasingly talented and highly-skilled workforce. Human capital needs to be improved and developed in many areas to support the transformation of today's manufacturing industry and make it more sophisticated and competitive in the future. Enhancing the quality and skills of human capital is a challenging task and requires multi-stakeholder participation. Some initiatives may take years to produce good results. While some measures can be taken by SMEs themselves, other actions have to be taken at policy level. The various aspects of human capital can be addressed under the following headings: the labour market, deployment, capacity, development, skills and know-how, and employment.

The main issues that need to be solved at policy level for the development of human capital are listed below:

- **Primary education attainment rate:** the percentage of the population of Turkey that has completed primary education at least.
- **Secondary education attainment rate:** the percentage of the population of Turkey that has completed secondary education at least.
- **Primary education enrolment rate:** the percentage of children of the age of primary education in Turkey that are enrolled in primary or secondary education.
- **Tertiary education attainment rate:** the percentage of the population of Turkey with a tertiary education.
- **Quality of education system:** how far the education system in Turkey meets the requirements of a competitive economy.
- **Secondary enrolment gender gap:** the ratio of the female enrolment rate in secondary education in Turkey to the male enrolment rate. Turkey is expected to have equal female outputs to male outputs.
- **Skill diversity of graduates:** the diversity of working areas among fresh graduates in Turkey. The desired result would be an equal distribution of graduates among disciplines.
- **Mean years of schooling:** the average number of years of education completed by members of the population aged 25 years and older in Turkey, excluding years spent repeating individual grades.
- **Quality of math and science education:** the quality of math and science education.
- **Quality of vocational training:** the quality of vocational training.
- **Pupil-to-teacher ratio in primary education:** the average number of pupils per teacher, based on headcounts of pupils and teachers.
- **Critical thinking in teaching:** style of teaching – teacher-based, frontal and focused on memorizing versus focus on encouraging creative and critical individual thinking.
  Education – government funding per secondary student: Government funding per secondary student as a percentage of GDP per capita.
- **Unemployment rate:** the number of unemployed persons as a percentage of the total number of individuals in the workforce.
- **Workforce participation rate:** the percentage of the population in Turkey that engages actively in the labour market, either by working or looking for work.
- **Hiring and firing practices:** the extent to which regulations enable the hiring and firing of employees in a flexible manner.
- **Redundancy costs:** costs such as severance payments and notice payments incurred when laying off redundant staff.
- **Ease of hiring foreign labour:** restrictiveness of the regulations related to the employment of foreign labour.
- **Labour tax rate:** taxes and contributions on labour paid by SMEs.
- **Literacy and numeracy:** the percentage of the population in Turkey with the ability to read and write and make simple arithmetic calculations.
- **Availability of skilled employees:** the ease of finding employees with the necessary skills for the needs of businesses in Turkey.
- **Mobile-cellular telephone subscriptions:** the number of mobile-cellular subscriptions of all kinds including prepaid subscriptions, mobile telephone lines, active prepaid accounts (active for the last three months) and other subscriptions enabling voice communication.

- **Internet users:** the percentage of individuals that use the internet from any point and for any purpose, regardless of the device and network used to connect.

The main issues that need to be solved by SMEs in order to improve/develop human capital are as follows:

- **Cooperation in labour-employer relations:** the nature of labour-employer relations – conflictual or cooperative.
- **Workers' rights:** the extent to which internationally accepted core labour standards are protected.
- **Reliance on professional management:** the structure of senior management positions in SMEs - usually relatives or friends versus usually professional managers.
- **Pay and productivity:** the measurement of payments related to the productivity of employees.
- **Female participation in the labour force:** the ratio of women participating in the labour force to men participating in the labour force.
- **Staff training:** the numbers/ proportion of companies in Turkey that invest in staff training and development.
- **Share of high-skilled employment:** the percentage of those who are employed in Turkey who work in high-skilled roles.
- **Share of medium-skilled employment:** the percentage of those who are employed in Turkey, of both sexes, who work in roles requiring at least a secondary education.
- **On-the-job training:** the availability and provision of high-quality, professional training services and the number/proportion of companies that invest in staff training and development.

Green Energy, Environmental-Friendly Production

The private sector should be encouraged and supported by the government to produce vehicles that utilise green technology.

Incentives aimed at the use of green technologies and other incentives should be strengthened.

Charging station networks should be expanded for electric vehicles, and special arrangements should be made with electricity distributors and petrol stations.

Efforts should be made to raise the awareness of consumers in order to increase the demand for/ production of products using green technology.

The transition to environment-friendly production in manufacturing industry should be accelerated. The use of alternative materials and the development of the necessary design processes should be promoted so that goods produced can be re-produced, re-used and re-cycled.

The manufacture of products that respond to the growing consumer preference for environment-friendly products will provide manufacturing industry with a competitive advantage.

Compared to Europe, Turkey is in a very advantageous position with respect to solar power. The return on investment from solar power plants is much greater in Turkey. Moreover, substantial incentives are available to manufacturing industry in Turkey for solar power generation. Producers that obtain their electricity from solar energy can reduce their energy costs and obtain a competitive advantage. Manufacturing industry should be aware of this future trend and invest in this area.

Lean production is a method of preventing waste and eliminating existing waste. It is a new trend among highly-competitive manufacturing industries. The Government of Turkey has introduced striking policies for waste prevention and supports SMEs in this area. Manufacturing industry should adopt lean production techniques for better production and competitiveness.

Creating Value through Design

- Creating Value through Design is typically a fact-based, multi-dimensional approach that enables companies to reduce their packaging and raw materials costs while increasing their profits through developments in product preferences. Manufacturing industry in Turkey needs to grasp the benefits of this approach very well. Improvements in product design processes will result in considerable gains for SMEs.

Digital Marketing

- Digital marketing is a rapidly developing, innovative marketing approach. Moreover, it is sometimes less costly than conventional marketing methods. Due to its use of radical methods, digital marketing is a process that needs to be managed carefully. However, provided it is well-managed, digital marketing has the potential to provide great marketing advantages to SMEs. Manufacturing industry in Turkey should adopt this new approach, factor it into its marketing budgets, and put it into practice effectively.

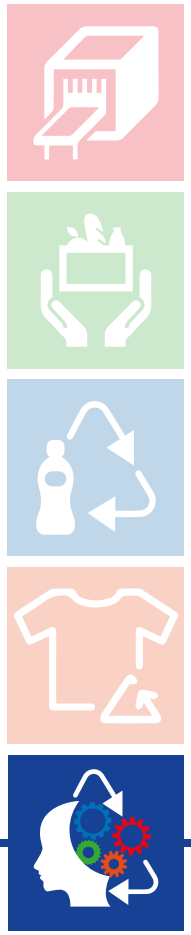
Industry 4.0

- Turkish manufacturing industry is currently situated between Industry 2.0 and Industry 3.0. In order to make quicker progress in the Internet of Things (IoT), manufacturing industry must first be mechanized/digitized.
- Bearing in mind the benefits of Industry 4.0, Turkey should take faster and more determined steps. The regulatory and legislative environments should be strengthened to increase resilience against uncertainties stemming from social, economic and technological changes.
- The use of the 3D printing facilities established in Gaziantep under the GETHAM and Kalyon Garaj projects will reduce costs and accelerate production for the SMEs in the region.

Turkey Resilience Project in Response to the Syria Crisis (TRP)

JOB CREATION COMPONENT

2020



NEW APPROACHES TO MANUFACTURING INDUSTRY