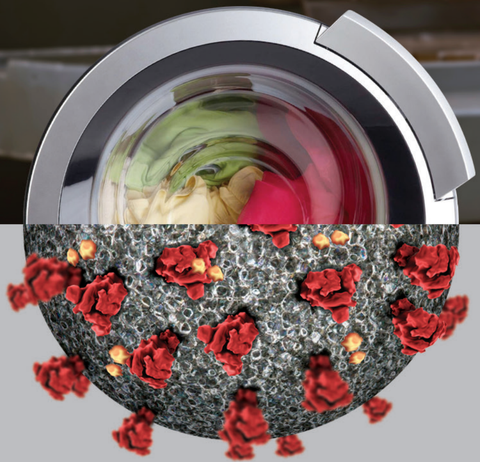

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REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY
AND TECHNOLOGY

UNDP

## COVID-19 Crisis Response and Resilience Project

# MACHINERY SECTOR ANALYSIS REPORT and GUIDELINES

## TR51 REGION

(Ankara)

# MACHINERY SECTOR ANALYSIS REPORT AND GUIDE

## TR51 Region (Ankara)

ISBN:


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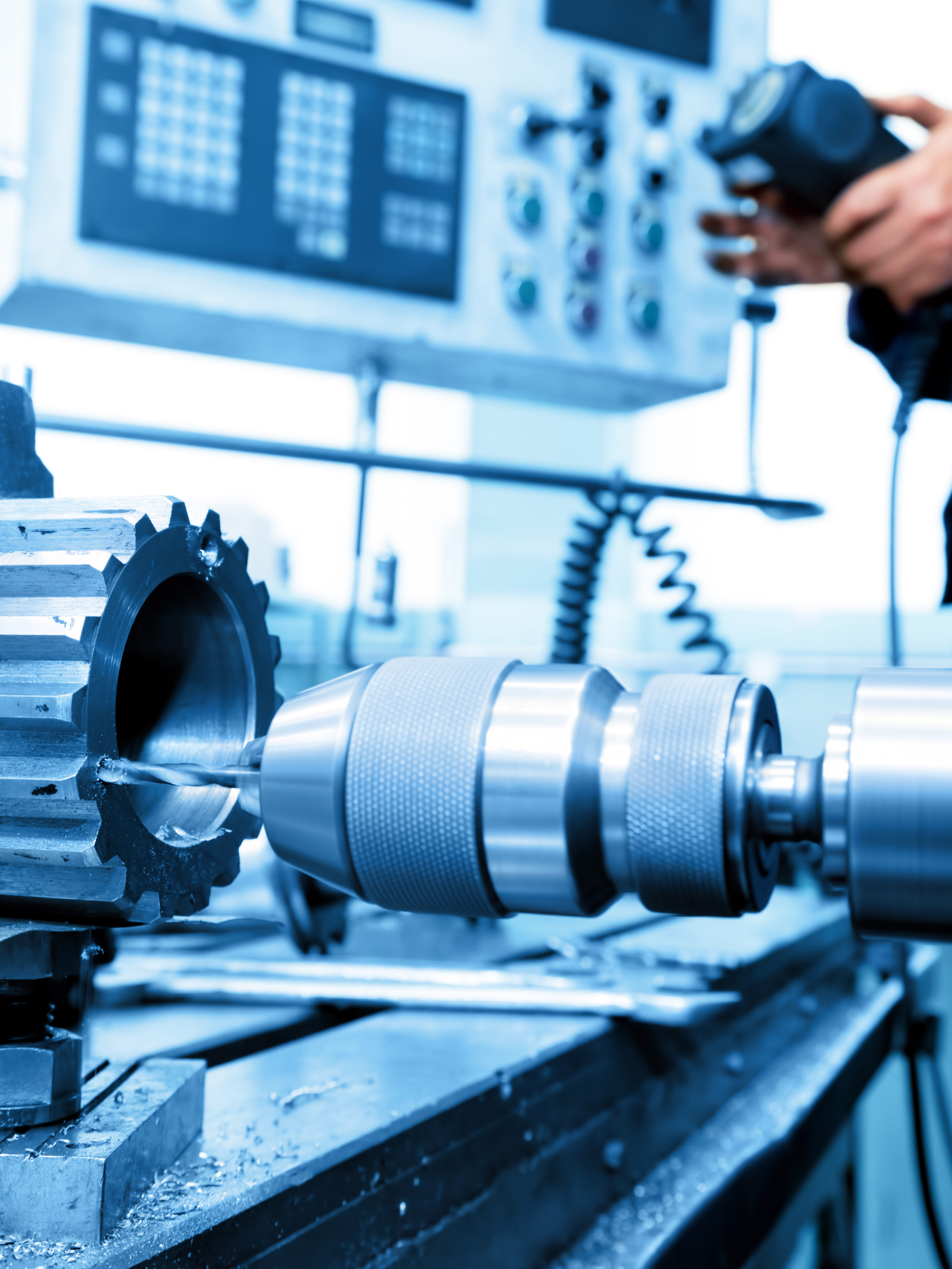
COVID-19 Crisis Response
and Resilience Project

# MACHINERY SECTOR ANALYSIS REPORT and GUIDELINES

## TR51 REGION
(Ankara)



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# ABBREVIATIONS

| | |
|---|---|
| EU | European Union |
| USA | United States of America |
| ABİGEM | European Union Turkey Business Development Centers |
| AR/VR | Augmented Reality / Virtual Reality |
| R&D | Research & Development |
| BDDK | Banking Regulation and Supervision Agency |
| UN | United Nations |
| CAGR | Compound Annual Growth Rate |
| CE | Compliance with Europe |
| CRM | Customer Relations Management |
| SSO | State Supply Office |
| ERP | Enterprise Resource Planning |
| EEC | Energy Efficiency Consultancy |
| EURO | European Union Member States Common Currency |
| FSR | Fragile Sectors |
| SWOT | Strengths, Weaknesses, Opportunities and Threats |
| HS84 | Harmonized System Machinery Sector Code |
| IE | Electric Motor Energy Efficiency Class |
| IoT | Internet of Things |
| IPA | Instrument for Pre-Accession Assistance |
| ISO | International Standards Organization |
| IT | Information Technologies |
| ITC | International Trade Center |
| HR | Human Resources |
| CCM | Cluster of Construction Machinery |
| DA | Development Agency |
| VAT | Value Added Tax |
| CGF | Credit Guarantee Fund |
| SME | Small and Medium Enterprises |
| KOSGEB | Small and Medium Enterprises Development Organization |
| GSC | Global Supply Chain |
| NACE | Statistical Classification of Economic Activities in the European Community |
| OECD | Organization for Economic Co-operation and Development |
| OKA | Central Black Sea Development Agency |
| OIZ | Organized Industrial Zone |
| PESTLE | Political, Economic, Social, Technological, Legal and Environmental |
| PwC | PricewaterhouseCoopers |
| RCEP | Regional Comprehensive Economic Partnership |
| SSI | Social Security Institution |
| U.S.S.R. | Soviet Union |
| MoIT | Ministry of Industry and Technology |
| NGO | Non-Governmental Organization |
| SICDP | Supporting International Competitiveness Development Program |
| SSO | State Supply Office |
| TAYSAD | Vehicle Sub-Industrialists Association |
| TCMB | Central Bank of the Republic of Turkey |

| | |
|---|---|
| TİM | Turkish Exporters Assembly |
| TOBB | Union of Chambers and Commodity Exchanges of Turkey |
| CCI | Chamber of Commerce and Industry |
| TTO | Technology Transfer Office |
| TÜBİTAK | Scientific and Technological Research Council of Turkey |
| TURKSTAT | Turkish Statistical Institute |
| TÜRSAB | Turkish Travel Agencies Association |
| TÜSİAD | Turkish Industrialists and Business People Association |
| UNCTAD | United Nations Conference on Trade and Development |
| UNDP | United Nations Development Program |
| UNEP | United Nations Environment Program |
| UR-GE | Supporting the Enhancement of International Competitiveness |
| WEF | World Economic Forum |
| World Bank | World Bank |
| WTO | World Trade Organization |
| 3D | 3 Dimensional |

# FOREWORD

The COVID-19 pandemic has gone beyond a health crisis and turned into a global problem, due to its impacts felt in all areas of life and all over the world. It is obvious that the problems caused by the pandemic, which has turned into a serious threat to all humanity, can be solved with a sustainable and fair understanding that requires international solidarity, cooperation, and common solution ideas.

The restrictions applied as a necessity of the pandemic led to slowdown in production, decrease in labor supply, delay in the supply of intermediate goods and raw materials, and increased logistics costs in our country as well as all over the world. Therefore, it is essential for sustainable development that policies should focus on the fragile sectors most affected by the pandemic in order to ensure the continuity of economic activities and accelerate the recovery.

By closely following the changes observed in the global system, Turkey carries out a comprehensive transformation in every field from education to health, from manufacturing industry to tourism, from industrial zones to research infrastructures.

Our development agencies, which perform their activities under the coordination of the Ministry of Industry and Technology, carry out studies at the regional level in order to reduce the negative impacts of COVID-19 on the national and regional economies and to identify the sectors most affected by the pandemic. One of our works in this field is the Government of Japan funded COVID-19 Resilience and Response Project, which we have implemented together with the United Nations Development Program (UNDP), the General Directorate of Development Agencies, and our development agencies.

Within the scope of the project, 25 region-based "fragile sector analysis reports" were prepared in the textile, logistics, food, machinery, and automotive sectors, which are of key importance for the Turkish economy. These reports, taking into account global developments and trends, offer new policy recommendations that will increase the resilience of the relevant sectors against crises. In addition, the "New Market Analysis" and "Product Space Analysis" reports, which cover studies to increase the export potential of enterprises operating in fragile sectors, were also completed within the project. These reports aimed to create road maps to support the business continuity of fragile sectors and to prevent supply chain disruptions.

We believe that the policy recommendations in these reports, which are in line with the targets within the framework of our national technology move, will support inclusive and sustainable development; it will carry Turkey to a more strategic point in the international trade and investment decisions that will be reshaped in the post-COVID-19 period and will contribute to our country's 2023 goals.

I would like to thank the Government of Japan for their generous contribution to mitigating the economic impact of the COVID-19 crisis, ensuring economic recovery, strengthening sectors, and transforming SMEs in this process.

I congratulate all our stakeholders, particularly UNDP Turkey management and project team, and the employees of the Development Agencies General Directorate and development agencies, who have made these studies realised and turn them into concrete outputs, and I hope that the reports will contribute to the future of our country.

**Mustafa Varank**

**Republic of Turkey Minister of Industry and Technology**

# FOREWORD


The global context for development has fundamentally changed with the COVID-19 pandemic. The pandemic created many new obstacles to overcome as well as new problems to be solved. Although COVID-19 started as a health crisis, it has turned into both a humanitarian crisis and a development crisis.

This unprecedented crisis is pushing millions of people into extreme poverty, changing and widening existing inequalities, and disrupting progress towards the Sustainable Development Goals (SDGs). Therefore, the SDGs are now more important than ever. The 2030 Agenda remains the only option for a more prosperous future for people and planet.

The COVID-19 pandemic has also shaken the global trade and development landscape. The global health emergency turned into a global economic shock with its impacts on growth, international trade, investments, global production, value chains, employment and eventually livelihoods of people.

UNDP is responding to a growing volume of requests from countries to help them prepare for, respond to, and recover from the COVID-19 pandemic with a particular focus on the most vulnerable. As of now our focus is to help decision-makers look beyond COVID-19 recovery, towards 2030, making choices and managing complexity and uncertainty in four key areas: governance, social protection, green economy, and digital disruption.

UNDP's COVID-19 Resilience and Response Project, which is funded by the Government of Japan is a part of our rapidly developed integrated response to the COVID-19 health, humanitarian, and development crisis. Being complementary with the efforts of the Government of Turkey and other development partners and fully aligned with the country-specific needs, UNDP aims to tackle the impacts of the pandemic under three priority areas: Health system support; Inclusive and integrated crisis management and response; Social and economic impact needs assessment and response.

I am pleased to present these 25 region-based sectoral analysis reports that provide policy recommendations and action plans for key economic sectors in Turkey that are most impacted by COVID-19 pandemic.  These reports, which were developed within the COVID-19 Resilience and Response Project in cooperation with Ministry of Industry and Technology and Development Agencies, formulated in the light of recent global context and trends as well as UNDP's response to COVID-19 crisis. Through this work, our aim is to support national capacities for an integrated and inclusive crisis management, ensure business continuity and prevent supply chain disruptions and speed up the development of the key economic sectors -automotive, textile, food, machinery, and logistics in different regions of Turkey and to increase competitiveness on a regional basis.

Our recovery efforts focus on rebuilding more inclusive economies and societies, moving towards a low-carbon and climate-resilient world where no one is left behind.

We believe that these reports will provide a pathway for economic recovery of sectors and development of regional competitiveness. In the reports the review of the pandemic crisis impact is accompanied by a set of policy recommendations targeting both the interventions in response to the negative effects of the pandemic and the post-COVID-19 social and economic recovery support measures. Overcoming the challenges faced by the sectors and society and ensuring better recovery can only be possible with joint efforts of the entire private sector, authorities, and the society as a whole.

In this regard, we appreciate the cooperation of Ministry of Industry and Technology, Development Agencies, and all experts for the preparation of these reports. We believe that these reports will also enable better cooperation in key economic sectors and help to accelerate the implementation of the Sustainable Development Goals in Turkey.

**Louisa Vinton**

**UNDP Turkey Resident Representative**

# EXECUTIVE SUMMARY

With this report prepared specifically for TR51 Region, for the machinery sector, which is one of the 5 fragile sectors defined within the scope of “Response to the COVID-19 Crisis and Resilience Project” funded by the Government of Japan and conducted by the United Nations Development Program (UNDP) in cooperation with the Ministry of Industry and Technology of the Republic of Turkey; the overall assessment of the sector during the COVID-19 pandemic has been made and policy recommendations and action plans have been put forward to accelerate the development of the sector and to increase the level of regional competition in the light of global trends.

The commercial protectionism trend inherited from 2018, the trade wars between the USA and China, and the Brexit process had a serious impact on 2019. For these reasons, there was a significant slowdown in the world economy in 2019. Global growth decreased from 3.1% in 2018 to 2.4% in 2019. In 2019, world trade in goods decreased 3.0% and fell to US $ 18.25 trillion. This slowdown and the contraction of trade, combined with the decrease in demand, decreased capacity utilization rates in industries and public investment also slowed down. Accordingly, the growth in global machinery and equipment investments in 2019 was narrowed down and realized as 2.5%.

The Machinery Sector in Turkey maintains its leadership in the manufacturing industry with the input it provides to other sectors, its contribution to the development of these sectors, the employment it creates for the trained workforce, the added value it provides and its wide industrial network. When it comes to the use of technology, the importance of the machinery sector for the manufacturing industry is increasing day by day with the exemplary production models it has developed and the synergy it creates. The qualified production structure of the Machinery Sector in Turkey, generally in the middle-high technology class, is of vital importance for the future of our country. The machinery sector is a strategic sector for Turkey with its positive contribution in productivity and economic growth. For these reasons, it has become one of the 7 sectors supported by the Technology Oriented Industrial Action Program of the Ministry of Industry and Technology for the reduction of foreign dependency in medium-high and high technology products and for the rapid implementation of localization in selected machine groups.

In 2019, due to the increasing protectionism in global trade abroad, machinery and equipment investments in our country decreased by 5.5%. Although the increase in exports only compensated the contraction in domestic demand to a limited extent, the machinery sector production in 2019 decreased by 6.2% compared to 2015. Thus, the rapid growth in machinery sector production since 2010 started to shrink in 2019 for the first time.

The machinery sector turnover increased by 8.2% in 2019 with the slowdown of domestic and foreign sales and reached 117.71 billion TL and showed the lowest increase in recent years. While its share in total manufacturing industry turnover rose up to 5% in 2017, it became 4.93% in 2018. Despite the 12.7% increase in the manufacturing industry turnover in 2019, the machinery sector could not follow the same increasing trend and grew by 8.2% and its share in the manufacturing industry decreased to 4.74%. This relative shrinkage is considered to be due to a decrease or pause in the global investment appetite and decreasing exports.

However, despite the shrinkage in its share in the manufacturing industry in 2019, the Compound Annual Growth Rate (CAGR) of the Machinery Sector, calculated over its turnover between 2010-2019, is 19%. This ratio clearly reveals the annual growth performance of the sector.

When looking at the number of enterprises on the basis of the machinery sector; according to the social security data for the year 2019, it is seen that 1,245 companies in TR51 Region provided employment for 18,137 people. According to the data of 2018, it is seen that there is a concentration in Construction Machinery sub-sectors in Ankara i.e TR51 Region with 355 companies.

Construction Machinery Sector reached a size of 110 billion USD in the world in 2019. In 2020, with the Covid-19 Crisis, there was a decrease by 22% excluding China, which is the world leader in the market, and 13%, including China.

While TR51 Region shrank by 5.54% in the machinery sector with an export amount of approximately 1.14 billion USD in 2020 compared to the same period of the previous year, the share of Turkey in the total exports of the machinery sector decreased from 15.41% to 15.12%. With these figures, a greater contraction was experienced in Ankara's Machinery Sector exports in 2020 compared to the 3.71% contraction in Turkey's machinery exports. The biggest reason for this is thought to be the inability to dispatch goods due to logistic problems.

Along with the Covid-19 Crisis that emerged during the above-mentioned global, national and regional conditions; the crisis approach, crisis management and the effects of the crisis in the Machinery Sector and sectoral trend changes in the world, in our country and in TR51 region have been examined herein.

Primary and secondary data sources were used for the analysis. The survey conducted for sector representatives, the Working Group and Focus Group Meetings were used as the primary data source. As the secondary data source, the reports and statistics prepared by NGOs and global research companies representing the sector were used. In the light of these data, the national and regional results of the survey were compared and Value Chain, SWOT, PESTEL, Five Forces and Gap analyzes were conducted.

Companies quickly overcame the concerns of workers and workplace health, lack of personnel, order cancellations and not being able to receive new orders with the first shock experienced with the Covid-19 Crisis. The fact that Human Resources is a critical factor for competition has stepped up to a higher level of importance with the Covid-19 Crisis, as expressed in Focus Group meetings. It has been understood that HR, especially the strategic personnel, is the most important basis of companies to get out of crises. In order to protect this valuable resource, flexible working hours and working from home for employees with low workplace requirements have been urgently implemented throughout the sector. With the contribution of the short-time working allowance in order to prevent lay offs, there was no significant personnel reduction in the sector.

As can be understood from the information obtained during the study, in addition to the current problems of the sector, the most troublesome issues with the Covid-19 Crisis are as follows:

1. **Cash Flow Problems**
    - Difficulty in accessing Credit Guarantee Funds,
    - Lack of limit in banks,
    - Density, late response, high interest demands in Banks
    - Delays in VAT refund payments
2. **Disruptions in the supply and logistics chain**
    - Pricing difficulty due to fluctuating exchange rates,
    - Increase in intermediate product prices,
    - Disruption of payment balance to suppliers,
    - Slowdowns in customs,
    - Cash demand from suppliers instead of maturity,
    - International logistics disruptions,
    - Increases in freight costs.
3. **Operational difficulties due to travel restrictions**
    - Inability to perform customer controls during the delivery of finished products,
    - Failure to assemble the delivered products, failure to receive payment for finished products, and delaying of subsequent orders

Problems caused by the disruptions in the supply and logistics chain and travel restrictions, as a consequence, negatively affected the cash flow and caused the financial crisis to deepen for the companies.

There have also been opportunities in the industry with the Covid-19 Crisis. Thanks to the flexibility, rapid response and customer-oriented aspects of the sector, these opportunities have enabled companies to reach the milestones they will attain in product development and innovation in 4-5 years time within months and to increase the strategic awareness of localizing imported goods in their supply chains.

Progress in product development and innovation has enabled companies to receive new orders and even gain new customers in times of crisis. Besides, thanks to the rising motivation of localization in the supply chain, the imports of intermediate goods will decrease with the production of substitution domestic products in the short and medium term and therefore, the domestic supplier industry will gain strength. Also, the increase in the need for protective equipment and disinfection due to the pandemic was reflected in the sector as an additional machine order, enabling small SMEs to breathe during the crisis.

In order to get rid of the troubles experienced during the Covid-19 Crisis, there have been companies that switched to Crisis Management and were in search of new customers, except for producing the orders of their existing customers. These companies saw the necessity to increase their competitiveness in order to be able to sell in markets that they did not or could not reach until the crisis period. In addition to reducing costs in order to enter these new markets, the awareness of companies about the need to make progress in the areas of Innovative Product Development, Resource Efficiency and Energy Efficiency for being more respectful to the environment and to increase competitiveness has also increased considerably.

The Covid-19 Crisis in the Machinery Sector in TR51 Region has caused exchange rate fluctuations, uncontrollable rise in logistics prices, contraction in logistics facilities, travel restrictions and problems in raw material supply and consequently cash flow troubles. First, the cash trouble was tried to be alleviated with governmental supports such as credit use and short-time working allowance, and then logistical problems preventing the delivery of orders were tried to be overcome. Profitability has been sacrificed as the products have been sent to customers at high logistics prices to complete the deliveries which let companies relax a bit in cash and take the first step towards exit from the crisis. In addition, the sector representatives of TR51 Region, trying to reach new customers and markets both with their own efforts and international cooperation, have achieved new customers and sales in the Middle East, Africa, Eastern Europe and Turkic Republics. With the crisis, disinfectant tools, pressure washers and aircraft loading machines started to be sold to these new markets. Increasing the sales of garbage trucks, sprinklers and dump vehicles, which are only slightly affected by logistical problems due to their high localization has created the opportunity to reach a safer point in the crisis. This management style and flexibility in production has been the formula of providing both sufficient and rapid response to customer demands and resistance to crisis in TR51 Region.

The most important experiences that turned the crisis into an opportunity for the companies in the sector were the Knowledge Economy and Innovation infrastructures, which enable them to respond quickly to different customer demands. Investments to be made and the developments to be achieved in these two issues will bring along important opportunities in terms of private sector performance and economic growth, as well as being the key to long-term competitiveness for SMEs. It has been noticed also by them that a great opportunity stands near SMEs for achieving digital transformation with the Knowledge Economy and Innovation infrastructure, closing the shortcomings in terms of market and product diversity with smart machines faster than expected, and thus catching the 4th Industrial Revolution. With this opportunity, it has been clearly noticed that the export of the region, which is predominantly based on medium-high technology products, has the opportunity to switch to high technology products.

As a result, firms' cash flows were disrupted as the first shock with the Covid-19 Crisis, however, policies and practices that were quickly implemented enabled companies to survive financially. The crisis has shown that companies that can react to the crisis and change operationally, have found new customers and increased their sales during the crisis period, beyond surviving. These companies are the ones that respond quickly to customers, provide solutions to customer demands with innovation, and easily adapt these innovations to their production and meet customer expectations with the new product they produce, that is, companies that are resistant to crisis.

In order for all companies in the sector to gain these characteristics, certain strategies were developed and policy recommendations were made within the scope of the study. Moreover, although these strategy and policy suggestions were methods foreseen before the Covid-19 Crisis, this crisis clearly revealed the necessity of these methods in order to catch the new industrial revolution.

In this sense, the strategies developed should not only be innovative, but also should enable the regional industry to switch from low to high value added and efficient production. As with all Turkey's Machinery industry stakeholders, the machinery sector companies in TR51 Region, have a common consciousness that supports innovative and continuous development regarding the need for change and the necessary sectoral transformation. While this awareness is the most important force for the development of the Machinery Sector, which is a strategic sector for our country, it is also the most important reason to look at the future with hope. Sectoral Development, which must be completed and constantly renewed, should be supported by professional management and qualified employees. It is clear that development will be achieved through export-oriented production and in order to start or advance this cycle, it is necessary to manage digital transformation and to ensure the transition to high value-added, technology-based production across the industry.

The proposed policies, short, medium and long term strategies, sub-strategies and actions under sub-strategies to achieve these goals are shared in the relevant sections.

# 1. INTRODUCTION

The Covid-19 pandemic that emerged on December 1, 2019 in Wuhan, the capital of the Hubei region of China has started to spread around the world in 2-3 months. Most countries of the world have halted their economies to slow the spread of Covid-19 and have taken many measures to mitigate the short-term impact of the Pandemic Crisis. The main measure implemented has been social distancing and this resulted in a sudden stop in the services sector, a decrease in companies' cash flow and income, and a serious decline in economies with an increase in unemployment.

Turkey reported the first positive case of Covid-19 on March 11, 2020. Similar to other countries responding to the pandemic, the number of positive cases in Turkey has increased every day with the increase in the number of tests performed across the country. The fight against Covid-19 is still continuing today, however, the temporary closure of businesses has caused lower wages, unemployment, loss of income, and continues to affect all segments of the society.

Thus, the Covid-19 pandemic continues its effects on social and economic lives, public health systems, livelihoods and economy, with casualties, quarantines and job losses. In response to the medium-term impacts of Covid-19 and priority needs identified with stakeholders at national and local level; it is aimed to accelerate companies in making investments in supportive, inclusive, sustainable and climate-friendly businesses for technological transformation.

Within the scope of the report, region-based sectoral analysis and guidance were provided to increase the resilience and adaptation capacity of companies in TR51 Region Machinery sector and to support them against crises. Strategies and policy recommendations for reducing the effects of Covid-19 in the short / medium and long term for the machinery sector in the relevant region have been made into a detailed report as a result of analysis obtained from focus group meetings attended by sector representatives and surveys conducted with sector representative companies.

In order to slow the spread of the Covid-19 Pandemic, the closure and / or restriction measures taken in our country, as in the whole world, started to affect all economic activities, especially the service sector, foreign trade, industrial production and tourism, as of mid-March 2020 and the effects deepened as of April and spread to the entire economy.

In this context, the "Fragile Sectors Analysis" project is thought to contribute to the technological transformation of SMEs and to develop more inclusive, sustainable and climate / environment friendly business models as a medium and long-term response to the negative effects of Covid-19 on the economy. Within the scope of the project, while region-based sectoral analyzes and guidelines were prepared for 5 fragile sectors (Machinery, Food, Textile, Automotive and Logistics), the most important output of the studies are short, medium and long-term strategy and policy recommendations on a sectoral / regional basis.

Machinery Sector analysis and guidelines were determined according to the Code 28, which is the dual group of the NACE classification used in the European Union. The NACE Codes of the sub-sectors are as follows:

**C.281:** Engines, turbines, compressors, pumps, faucets, valves, bearings, gears, etc.

**C.282:** Ovens, furnaces, lifting machines, baling machines, office machines, cooling and ventilation equipment, general purpose machines, etc.

**C.283:** Agricultural and forestry machinery such as tractors, planters, trailers and semi-trailers, combine harvesters and harvesters, seed graders, animal feed preparation machinery, etc.

**C.284:** Metalworking machines such as lathes, milling machines, hydraulic presses, forged iron machines.

**C.289:** Construction Machinery, other workbenches for working with other materials such as wood, stone, glass or rubber. Special machines for other purposes such as food industry, textile, garment and leather industries, paper and card industry, rubber and plastics industry, Construction Machinery, etc.

The Construction Machinery Sub-Sector, which is mainly included in the C289 NACE Code, has been mostly clustered in TR51 Region. 15% of the total exports of Turkey's Machinery Sector is in

TR51 Region [Table 13]. In addition, the OSTIM Construction Machinery Cluster and OSTIM Spare Parts (OSP) cluster are in this Region.

This report has been prepared specifically for the machinery sector in the region. Meetings with industry representatives aim to explain the conditions that developed before and after Covid-19 and the current challenges faced by companies, using the results of studies and surveys conducted. The report also aims to provide an interpretation of the sector with strategic and operational points of view, to create regional recommendations, strategies and action plans by sharing global, national and regional assessments of sectoral trends and changes.

In the report, in Section 3, where the sector profile was drawn, the data up to 2019 were used; then, the data for the year 2020, which includes the effects of Covid-19, are given in Chapter 4, where the effects of crisis are examined and again in the same section, sector performance predictions for the end of 2020 are shared in the Tab 4.2. This ordering was made in order to see the impact of Covid-19 more effectively.

# 2. METHODOLOGY

Interviews were held with all project stakeholders to determine the methodology. A consensus has been reached on the work flow chart detailed below to be used as the methodology as a result of the desk-based work of the project expert team of 7 from 5 sectors and one-on-one interviews.

Assumptions, Risks and Risk Reduction Methods were studied with the support of key experts and associated risks have been identified and rated; and comments have been made on the analysis, mitigation and monitoring of these risks. The time schedule of development activities is determined in the project report and sectoral meeting dates were specified within the scope of this plan and activities were started.

As seen in the Work Flow Chart shown in Figure 1, the working methodology consists of Data Collection, Analysis, Verification and Result stages.

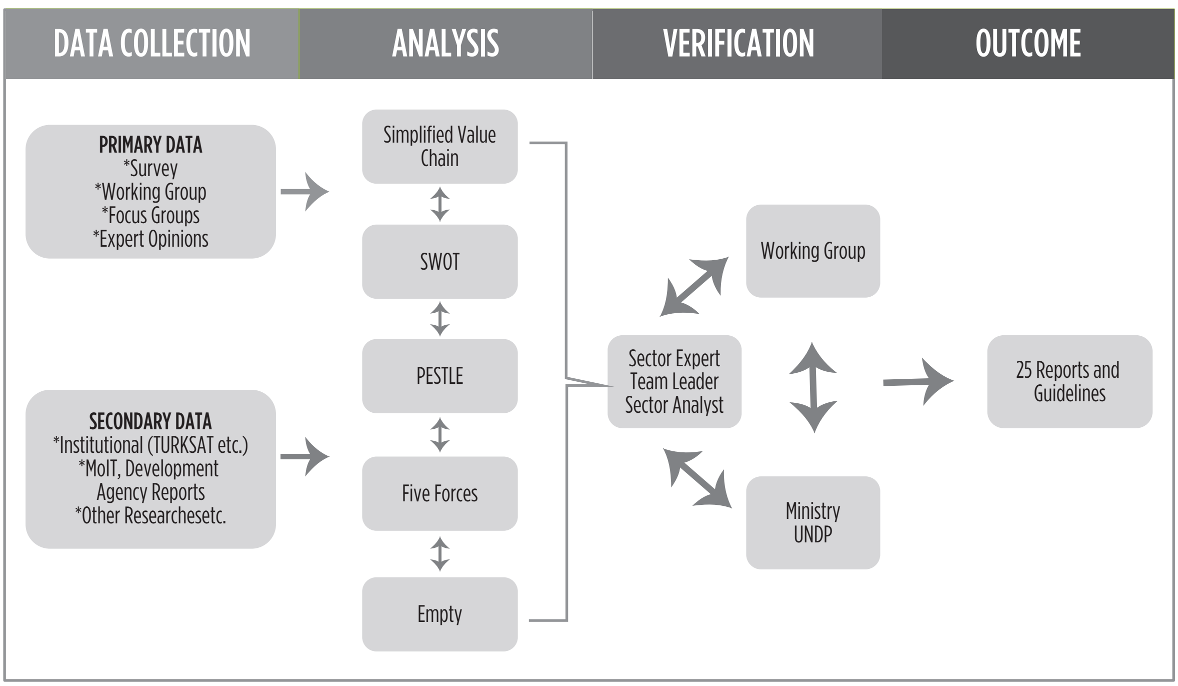



***Figure 1:*** *Work Flow Chart*

In Data Collection, Survey Studies, Sectoral Studies, Focus Groups and Expert Opinions were considered as Primary Data. While the summary of the Focus Group meetings was given in the relevant section of the report, reference was made to the data obtained from the Focus Group meeting where necessary. The Focus Group Participant List is given in Annex 1. Working Group meetings were held in order to support the works of the Machinery Sector Experts, to provide guidance and to share information. Institutional Data Sources, Reports Prepared by the Ministry of Industry and Technology and Development Agencies, Reports prepared by Sectoral Organizations, Other Researches, Publications and Reports were discussed as the secondary data.

Data collected from institutions such as World Bank, UNDP, ITC, UNCTAD, WTO, WEF, TURKSTAT, SSI, TOBB, CBRT, BRSA, TIM, Ministry of Trade, Ministry of Industry and Technology were used as institutional data sources. Many reports have been prepared by the Ministry of Industry and Technology and Development Agencies in order to examine the effects of Covid-19. Relevant reports were used as a reference during the preparation process. In addition to these, reports prepared by professional and umbrella organizations, etc. were also examined.

The Spatial Value Chain Analysis prepared by the General Directorate of Development Agencies was taken into consideration for the analysis of the data. The current situation of companies operating in the sector that is the subject of the reports and in the specified regions has been analyzed. For this purpose, Simplified Value Chain Analysis, SWOT, PESTEL, Porter's Five Forces Analysis and Gap Analysis, which are among the most effective analysis methods decided at the beginning of the project, were used. In addition to collecting region-specific data; the Working Group and Focus Group Studies contributed to both the analysis of the data and the verification of the analyzes.

One of the most important sources of information for the report is the Machinery Sector Working Group established by the Ministry of Industry and Technology. 9 experts were assigned within the Working Group. During the 14-week study period following the preparation of the inception report, the working group met 5 times in total every 2 weeks. The Working Group has examined the work done by the Sector Expert and made comments and served for validating analyzes, assumptions and policy / strategy proposals. Working Group meeting participant list is given in Annex.2 and meeting dates are given in Annex.3

One of the important sources of qualitative information has been the Machinery Sector Focus Group. Focus Group members selected on the basis of the sector and the region consist of Ministry of Industry and Trade, Development Agencies, Chambers of Industry and Commerce, Organized Industrial Zones, Umbrella Organizations (TAYSAD, TÜRSAB, Exporters' Unions etc.), Clustering Organizations, Universities, SMEs, Large-Scale Enterprises, UNDP, Sector Specialist, Sector Analyst and Team leader. The Focus Group contributed to the determination and prioritization of policy / strategy recommendations. In addition to the issues expressed by the participants at the meetings, the opinions of experts from different institutions and organizations, who know the relevant sector / region well, were also evaluated.

The sectoral sizes included in the report were calculated based on the Trade map data of Harmonic System 84 in order to make comparison with other countries. For this reason, the difference between the data expressed in the report and the data used by sectoral organizations such as MAKFED and prepared by TURKSTAT has been ignored since only proportional evaluation and trend analysis will be made in the report.

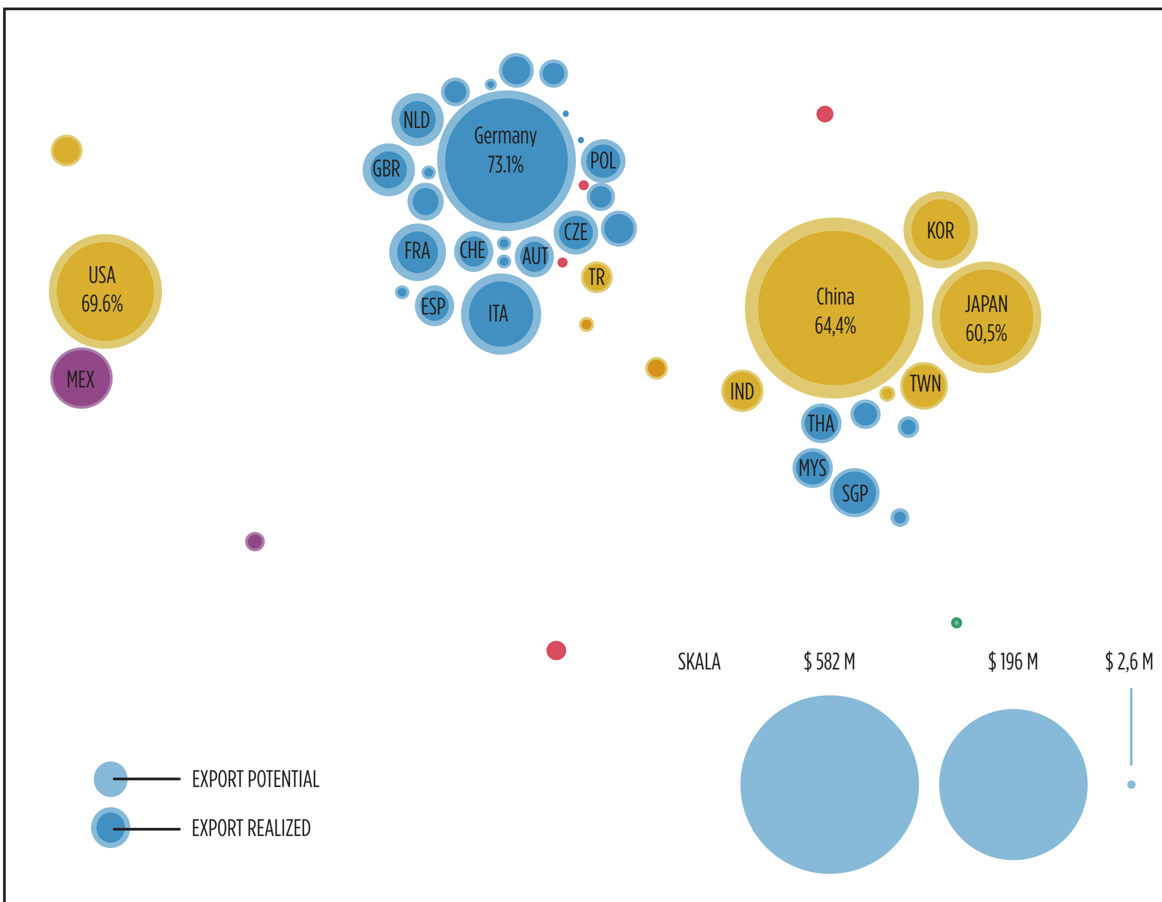
As a result of the study, a Machinery Sector Report and Guideline was created specific to TR51 Region.

# 3. Profile of the Machinery Sectory

## 3.1. General Outlook of the Machinery Sector in the World

In 2018 and 2019, a transition period was experienced in the investment environment due to the effect of trade wars and investor behaviors suppressed by this effect. During this transition period, international investors sought alternative investment locations outside of China to avoid the restrictions and sanctions they may encounter. The delay in the implementation of investment decisions during this searching period firstly manifested itself as a decrease in demand in the machinery sector. As a result, the growth in world machinery and equipment investments in 2019 slowed down and realized as 2.5%.

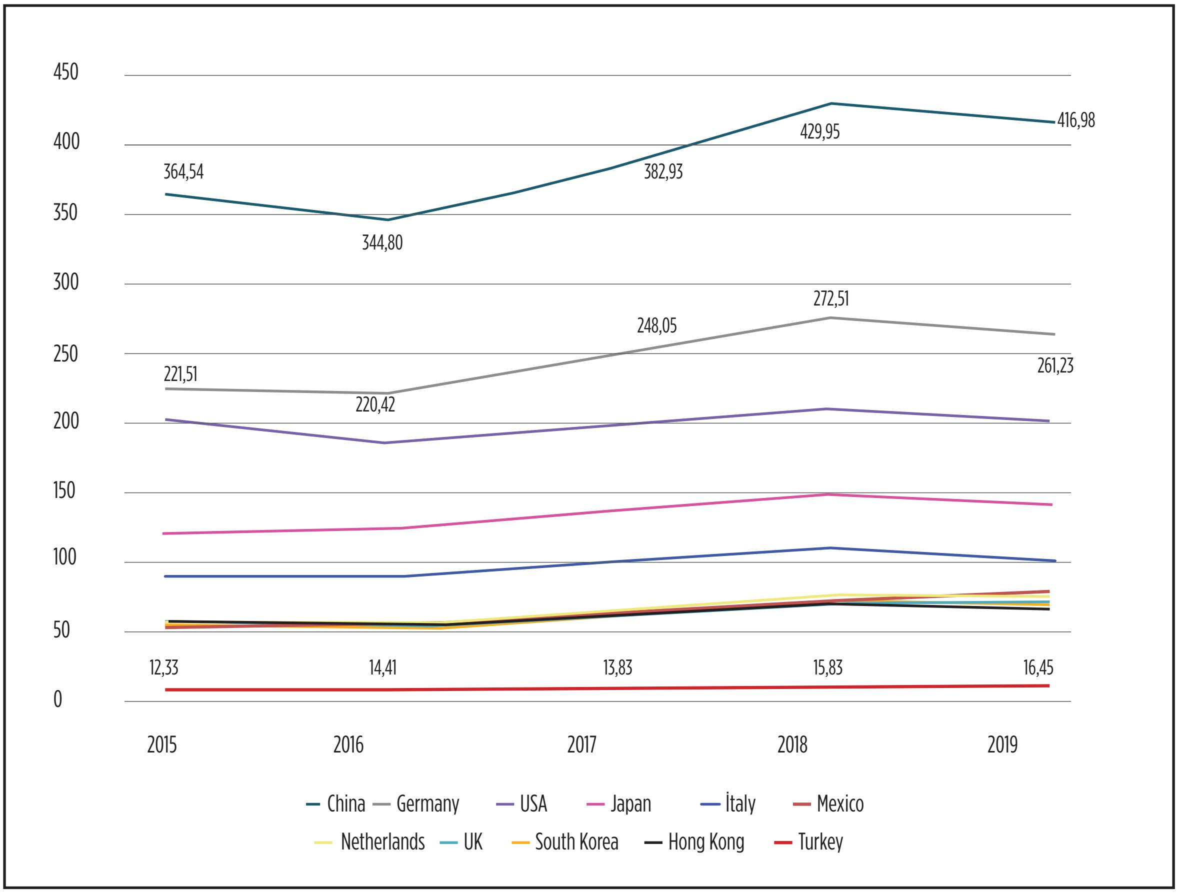
In the development process of countries, the importance of the machinery in the manufacturing industry is gradually increasing. The Machinery Sector directly affects the production, quality and competitiveness of the manufacturing industry sectors where it provides machinery and equipment. The export sizes and additional export potentials of the top 50 exporting countries in the Machinery Sector can be seen in Figure 2 below. The top countries mainly have medium and large-scale companies on the basis of turnover, which positively affects the competitiveness and market power of the countries.




*[ITC Trademap, 2021]*

*Figure 2. Top 50 Countries in Machinery Sector in 2019, Their Exports and Export Potentials (HS84)*

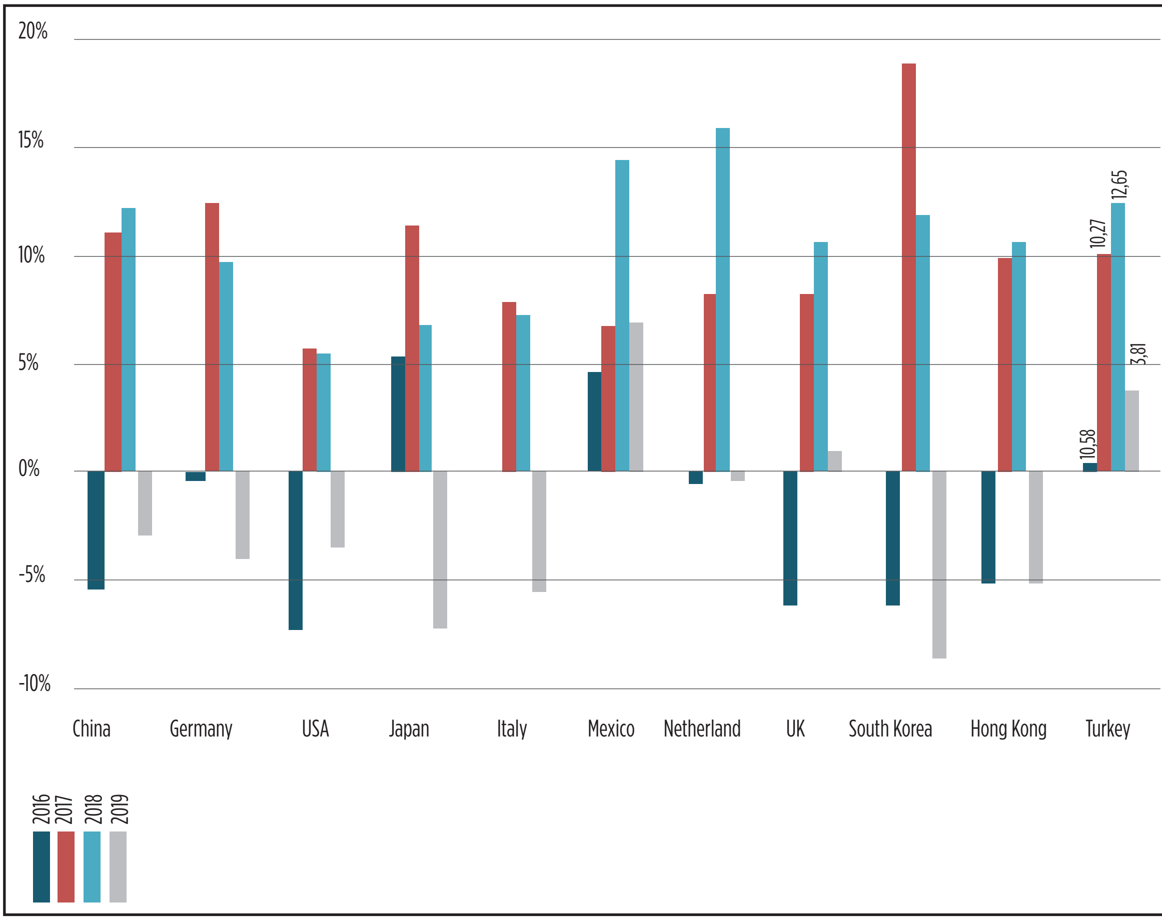
We can compare the exports of the top 10 countries and Turkey which ranked 17 between 2015-2019 in Figure 3. China, Germany, United States of America, Japan, Italy are the top exporting countries of the world in the sector.




*[Trademap HS84, 2021]*

***Figure 3:*** *Export Values of Top 10 Countries and Turkey (billion USD)*

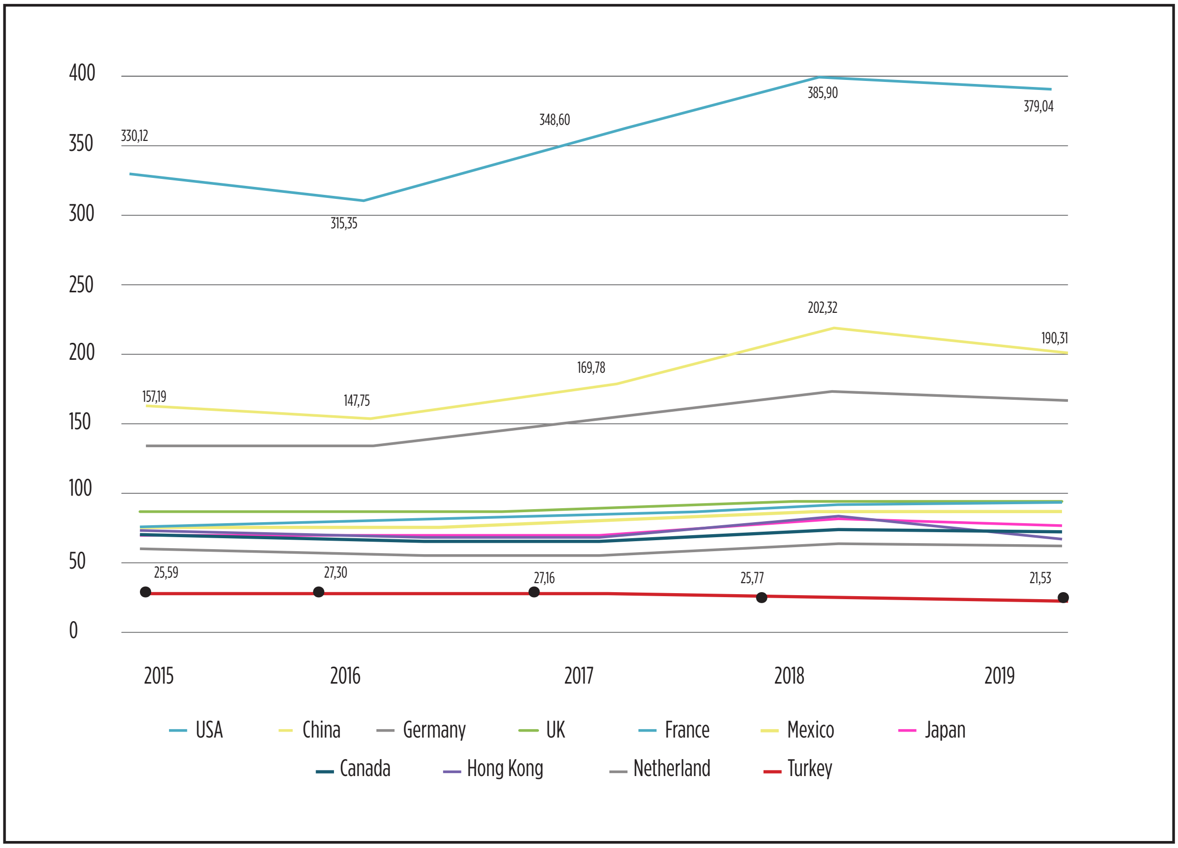
While the annual exports of machinery and equipment of major economies in the world pointed to a general decrease in 2016, there was a recovery in exports in 2017 and 2018. However, it can be seen in Figure 4 that there has been a decrease in the export figures of all countries with the decreasing investment appetite in 2019 due to the aforementioned reasons.




*[ITC_Trademap, 2021]*

***Figure 4:*** *Export Increase Rates of Top 10 Countries and Turkey between 2016-2019 in World Exports*

In terms of world machinery imports, the size of the machinery imports of the country is directly proportional to the size of the investment made by the industry of that country in production. Therefore, attention should be paid to a strategy that pays attention to the balance of foreign trade in the machinery sector and to increasing sectoral production and scale. The import ranking also shows the production capacity of the countries in other sectors. Investments made by the manufacturing sectors in machinery and equipment are among the most important components in increasing production capacity and capabilities. Top 10 Countries with the Highest Import in the Machinery Sector in 2016-2019 and the import values (billion USD) of Turkey, which ranked 27th in the machinery import list, are shown in Figure 5. Of course, meeting the relevant machinery imports from domestic manufacturers directly affects both the development of the machinery sector and the ratio of country's exports to its imports and eventually its current account deficit.



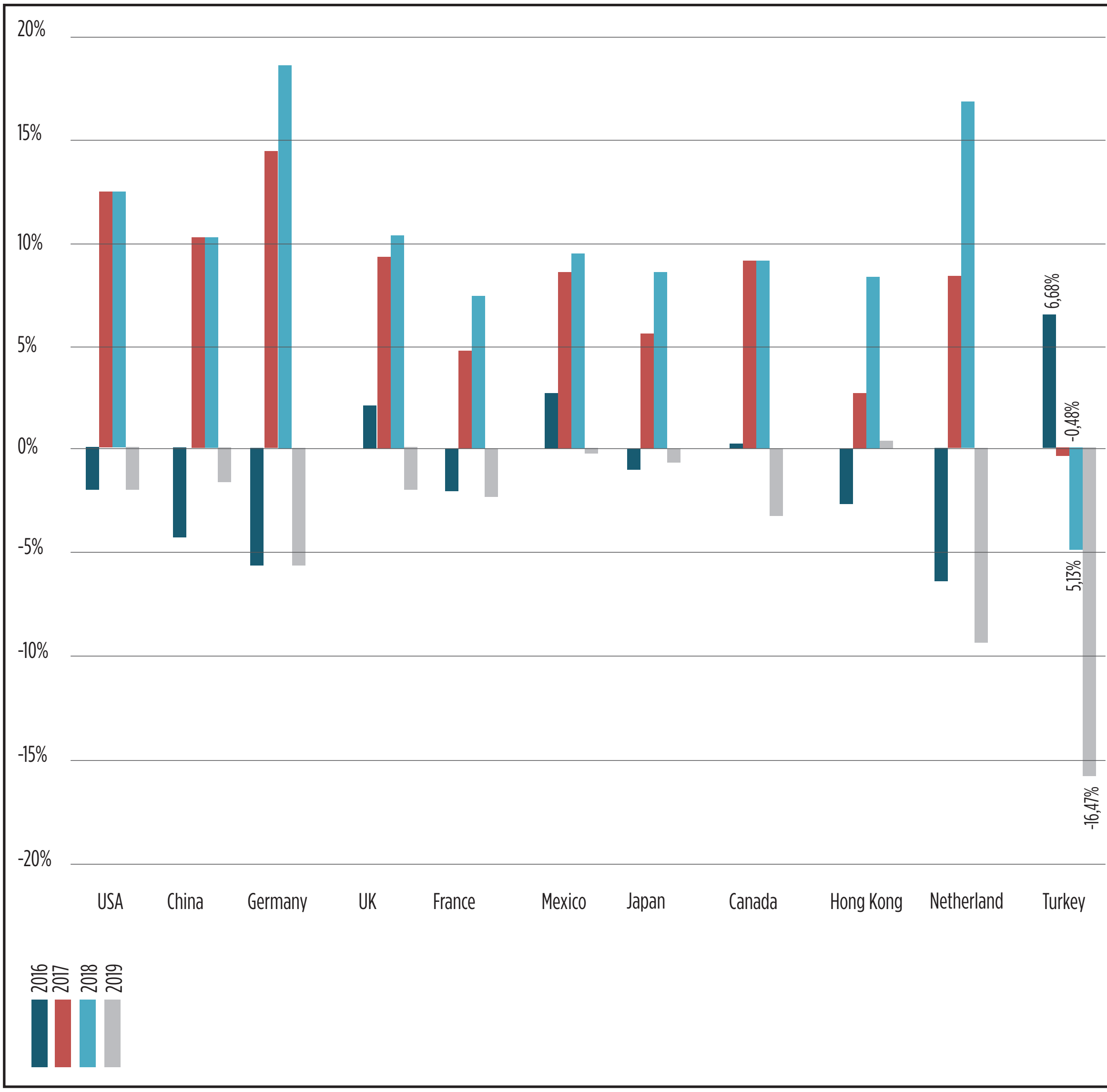

*[Trademap HS84, 2021]*

***Figure 5:*** *Import Values of Top 10 Countries and Turkey (billion USD)*

According to the data of 2015-2019, the United States, China, Germany, England and France are the world's largest machinery importers. As seen in Figure 5, increasing machinery imports in these countries indicate that investment is being made in manufacturing sectors.

While the annual increase in machinery and equipment imports of major economies in the world indicates a general decrease in 2016, it is recovering in 2017 and 2018 as in exports. However, it is seen in Figure 6 that in 2019, with the decreasing investment appetite due to the reasons we mentioned earlier, there was a greater decrease in all countries compared to exports.

What is important for a developing country is not that imports are less, but the higher ratio of export to import. However, the overall sharp decline in machinery imports indicate that investors are avoiding risks or that the investment climate does not attract investors.




*[ITC_Trademap, 2021]*

***Figure 6:*** *Import Increase Rates of Top 10 Countries and Turkey between 2016-2019*

As seen in Figure 6, while machinery import of Turkey is decreasing, there is no significant decrease in imports of Asian, Eastern European and African countries for the same period [ITC_Trademap, 2021].

## 3.2. General Outlook of the Machinery Sector in Turkey

The Machinery Sector is one of the key growth factors of Turkey's economy and the driving force of industrialization. Turkey is the 6th largest machinery manufacturer in Europe and around 80% of the sector consists of SMEs with less than 20 employees. Turkey's Machinery Sector has increased the ratio of exports to imports from 61.4% in 2018 to 76.5% in 2019 and increased its production value 3.5 times in 10 years (2010, 22.5 million TL; 2019, 99.5 million TL) and is a pioneering sector of development, exporting to more than 200 countries, including free zones.

*Table 1: Turkey's Machinery Sector Export-Import Balance Between 2015-2019*

| | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Export** [Billion Dollars] | 12,33 | 12,41 | 13,83 | 15,83 | 16,45 |
| **Export Increase Rate** [%] | - | 0,58 | 11,45 | 14,48 | 3,96 |
| **Import** [milyar dolar] | 25,59 | 27,30 | 27,16 | 25,77 | 21,53 |
| **Import Increase Rate** [%] | - | 6,68 | -0,48 | -5,13 | -16,47 |
| **Balance** (Deficit) | -13,25 | -14,89 | -13,34 | -9,94 | -5,07 |
| **Coverage Ratio** [%] | **48,20** | **45,45** | **50,90** | **61,42** | **76,44** |

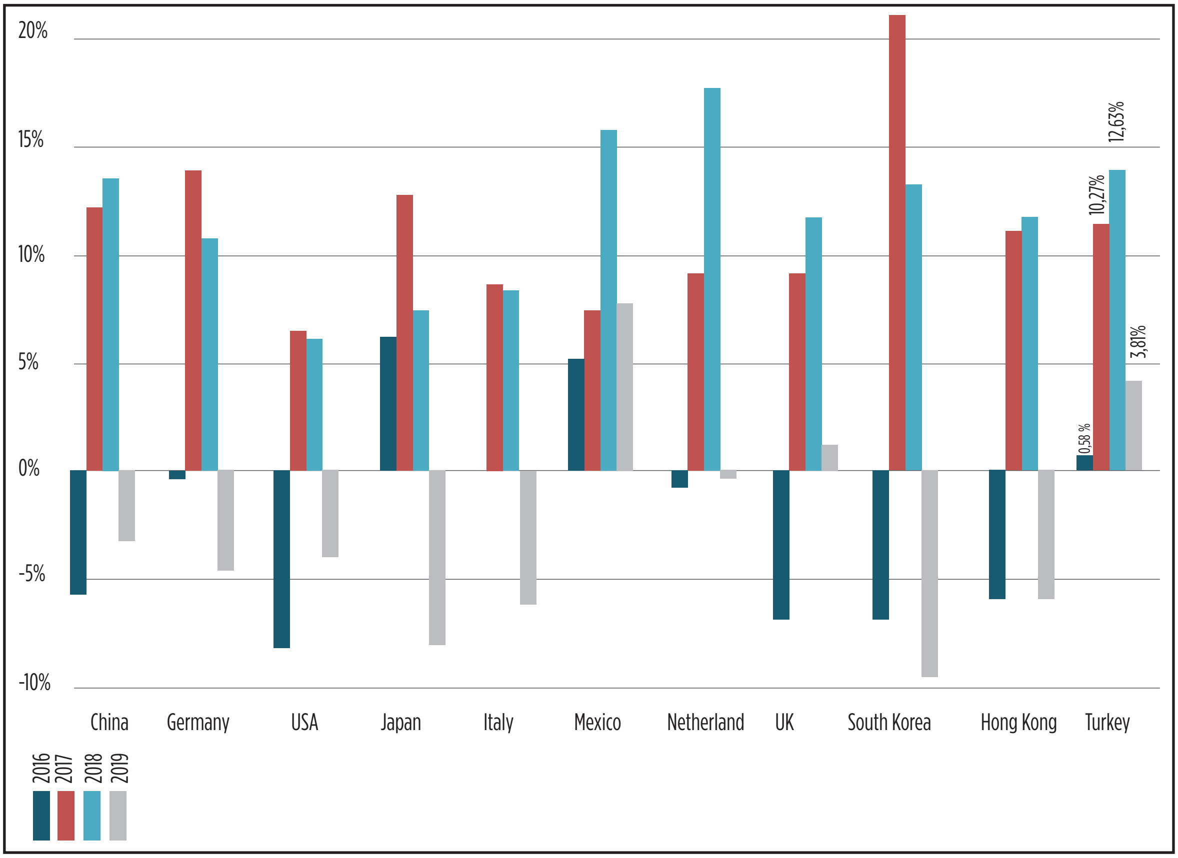
*[ITC, Trademap, 2021]*

As seen in Table 1, Turkey's machinery exports increased by 14.48% in 2018 to USD 15.83 billion, and in 2019 it increased by 3.96% to USD 16.45 billion. Despite the declining investment appetite in 2019, the sector was able to increase its exports and its coverage ratio between exports and imports from 61.4% in 2018, to 76.4%. However, it should not be ignored that the shrinkage in machinery imports, as seen in Figure 6, is due to the consecutive decline in demand after the exchange rate fluctuations in our country's economy in 2018 and 2019.

In the upcoming period, imports can be expected to increase faster than exports with the investment appetite, provided that the deferred investments are realized and economic confidence is ensured. In this case, even if the lowest trade deficit of the last five years (Balance, $ 5.1 billion in Open Position, Table 1) occurred in 2019, the deficit may increase drastically despite the mitigating effect of the increase in exports. In the following parts of the report, an evaluation will be made within the scope of the data obtained for the year 2020.

The future of the sector and the maximum benefit of our country can be achieved by finding new markets and increasing sales in existing markets thanks to structural developments that will be achieved through innovative and technological developments, and by permanent raise in the export-Import balance.

As can be seen in Figure 7, Turkey, which ranked 17th within machine export figures in 2019, is one of the countries with the highest rate of export growth and has the potential to force higher ranks in the list. Among the top 10 most exporting countries in the machinery sector, the countries that showed growth success in 2019 were Mexico with 7.1% and the United Kingdom with 1.0%. In 2019, when the world export average decreased by 2.8%, Turkey's 3.8% growth performance is an indication that our country has a high potential to rise to a higher position in the following years in the export ranking.




*[ITC_Trademap, 2021]*

***Figure 7:*** *Figure 7. Export Increase Rates of Top 10 Countries and Turkey between 2016-2019*

The Machinery Sector provides 4.3% of our country's industrial production, 10% of its exports, 6% of employment and 5.7% of its added value. As in all over the world, it is mainly composed of SMEs and has representatives from all scales; large, medium and small enterprises, in line with general and special purpose machinery branches. As seen in Table 2; the machinery sector consists of about 17,400 manufacturers classified within the Harmonized System HS84, of which 17,200 are in the class "Machinery Not Otherwise Classified" (NACE 28) and it employs approximately 243,000 people.

***Table 2:*** *Number of Machinery Sector Enterprises*

| Years | Machinery Industry | Manufacturing Industry | Share of Machinery Sector (%) |
|---|---|---|---|
| 2010 | 12.895 | 326.925 | 3,94 |
| 2011 | 13.317 | 335.571 | 3,97 |
| 2012 | 13.591 | 354.256 | 3,84 |
| 2013 | 13.921 | 365.723 | 3,81 |
| 2014 | 14.528 | 371.911 | 3,91 |
| 2015 | 15.347 | 375.480 | 4,09 |
| 2016 | 16.101 | 379.894 | 4,24 |
| 2017 | 16.707 | 391.024 | 4,27 |
| 2018 | 17.189 | 395.816 | 4,34 |
| 2019 GT | 17.210 | 396.410 | 4,34 |

*[TÜİK, 2021]*

The sector has made a great leap forward in the last 20 years and by achieving an average growth rate of 12.2% in exports, 59% of which were made by small and medium-sized enterprises, it grew 10 times by catching the second largest acceleration after China in the period when the world grew only twice. The figure for 2019 exports is US $ 16.45 billion [Trademap HS84, 2021], and this figure rises to US $ 19 billion when free zones are included.

Turkey's economy faced a significant financial shock in 2018, and the economy and real sector were adversely affected. In the first two quarters of 2019, the economy contracted, a recovery was experienced in the last quarter, and the year was closed with a 0.9% cumulative growth [TURKSTAT, 2021]. In 2019 increasing protectionism in global trade and decreasing domestic investments have created restrictive effects in the machinery sector. Depending on these developments in the economy, machinery and equipment investments decreased by 5.5% in 2019, while machinery sector production decreased by 6.2% in 2019 compared to base year 2015. Growth in export could only compensate for the contraction in domestic demand to a limited extent and the rapid growth in machinery sector production since 2010 paused for the first time in 2019 (Table 3).

***Table 3:*** *Machinery Sector Production Value (million TL)*

| Years | Machinery Industry | Manufacturing Industry | Share of Machinery Sector (%) |
|---|---|---|---|
| 2010 | 22.458 | 538.842 | 4,17 |
| 2011 | 32.144 | 712.234 | 4,51 |
| 2012 | 36.072 | 771.754 | 4,67 |
| 2013 | 40.163 | 866.169 | 4,64 |
| 2014 | 47.967 | 996.977 | 4,81 |
| 2015 | 54.503 | 1.116.847 | 4,88 |
| 2016 | 60.395 | 1.220.497 | 4,95 |
| 2017 | 78.297 | 1.574.831 | 4,97 |
| 2018 | 102.133 | 2.089.572 | 4,89 |
| 2019 | 99.537 | 2.217.955 | 4,48 |

*[Makfed, 2021]*

As can be seen in Table 4; while the share of the machinery sector in the total manufacturing industry turnover rose to 5% in 2017, it decreased to 4.93% in 2018. Despite the 12.7% increase in manufacturing industry turnover in 2019, the machinery sector could not follow the same increase and grew only by 8.2% and its share in the manufacturing industry decreased to 4.74%. It is evaluated that this relative contraction is due to the decrease or pause in the global investment appetite and the falling growth rate of Turkey's machinery exports, as seen in Table 1.

However, despite the contraction in its share in the manufacturing industry in 2019, the Compound Annual Growth Rate (CAGR) calculated over the turnover of the Machinery Sector between 2010-2019 has become 19%. This ratio clearly reveals the annual growth performance of the sector.

***Table 4:*** *Turnover of Machinery Sector (million TL) and its Share in Manufacturing Industry*

| Years | Machinery Industry | Manufacturing Industry | Share of Machinery Sector (%) |
|---|---|---|---|
| 2010 | 24.432 | 577.275 | 4,23 |
| 2011 | 35.694 | 761.945 | 4,68 |
| 2012 | 39.754 | 833.932 | 4,77 |
| 2013 | 45.721 | 930.896 | 4,91 |
| 2014 | 52.134 | 1.076.277 | 4,84 |
| 2015 | 59.281 | 1.203.634 | 4,93 |
| 2016 | 65.424 | 1.314.067 | 4,98 |
| 2017 | 84.834 | 1.695.855 | 5,00 |
| 2018 | 108.803 | 2.205.284 | 4,93 |
| 2019 | 117.710 | 2.485.514 | 4,74 |

*[Makfed, 2021]*

Although the non-performing loans in the machinery sector were relatively low, there was an increase in 2019 due to the cash flow difficulties. As can be seen in Table 5; the ratio of loans used in the machinery sector in 2018 and 2019 to loans used in the manufacturing industry is 4.04%. Despite this, in 2019, the share of the machinery sector in the manufacturing industry increased from 3.58% to 3.95% with regard to non-performing loans.

***Table 5:*** *Domestic Loan Usage in Machinery Sector (million TL)*

| Years | Total Loans | | | Non-Performing Loans | | |
|---|---|---|---|---|---|---|
| | Machinery | Manufacturing | Share of Machinery (%) | Machinery | Manufacturing | Share of Machinery (%) |
| 2014 | 9.246 | 250.486 | 3,69 | 159 | 7.086 | 2,24 |
| 2015 | 1.184 | 280.609 | 0,42 | 341 | 8.093 | 4,21 |
| 2016 | 12.962 | 315.557 | 4,11 | 502 | 11.339 | 4,43 |
| 2017 | 16.514 | 387.586 | 4,26 | 503 | 13.035 | 3,86 |
| 2018 | 19.471 | 481.363 | 4,04 | 693 | 19.334 | 3,58 |
| 2019 | 22.469 | 556.466 | 4,04 | 1.133 | 28.719 | 3,95 |

*[Makfed, 2021*

Considering the distribution of exports in the machinery sector among company groups, approximately 60% of exports are made by companies with less than 250 employees (Table 6); and this gives information about the magnitude of the added value that SMEs in the sector will create if they make progress in innovation and productivity.

***Table 6:*** *Export Shares According to Scales in the Machinery Sector*

| Years | Small and Medium Enterprises | | | | | |
|---|---|---|---|---|---|---|
| | 1-9 Employees | 10-49 Employees | 50-249 Employees | 1-249 Employees Total Share (%) | 250+ Employees Total Share (%) | Total (Million Dollars) |
| 2015 | 19,1 | 22,4 | 19,7 | 61,2 | 38,8 | 8.658 |
| 2016 | 19,0 | 22,5 | 19,9 | 61,4 | 38,6 | 8.582 |
| 2017 | 18,6 | 22,0 | 20,6 | 60,9 | 39,1 | 9.719 |
| 2018 | 17,9 | 21,1 | 20,3 | 59,3 | 40,7 | 11.489 |
| 2019 | 17,3 | 21,0 | 20,4 | 58,7 | 41,3 | 12.364 |

*[TÜİK, 2021]*

## 3.3. General Outlook of the Machinery Sector in TR51 Regio

TR51 Region consists of Ankara province and is the third largest province of Turkey with an area of 25.437 km2. As of 2019, approximately 27% of the population has a university or higher education and it is the second most populous city with a population of 5,639,076, 70% of whom is at working age [TURKSTAT, 2021]. The center of Ankara, which has 25 districts, is an area where technology development centers (Table 7), organized industrial zones (Table 8), universities (Table 9), strong sector clusters, high-level bureaucracy, international institutions and non-governmental organizations are concentrated

**Table 7: TR51 Region Technology Development Zones**

| | Technology Development Zones | Foundation Year |
|---|---|---|
| 1 | METU Technocity | 2001 |
| 2 | Bilkent Cyberpark | 2002 |
| 3 | Hacettepe Technocity | 2003 |
| 4 | Ankara University Technocity | 2006 |
| 5 | Gazi Technopark | 2007 |
| 6 | ASO Technopark | 2008 |
| 7 | OSTİM Technopark | 2014 |
| 8 | Technopark Ankara | 2014 |
| 9 | TechnoHAB | 2018 |

**Table 8: TR51 Region Organized Industrial Zones**

| | OIZ | Foundation Year |
|---|---|---|
| 1 | OSTİM Organized Industrial Zone | 1997 |
| 2 | Ankara-İvedik Organized Industrial Zone | 2001 |
| 3 | Ankara Chamber of Industry Sincan First Organized Industrial Zone | 1977 |
| 4 | Ankara Anadolu Organized Industrial Zone | 2002 |
| 5 | Ankara Polatlı Organized Industrial Zone | 1996 |
| 6 | Başkent Organized Industrial Zone | 2001 |
| 7 | Ankara Chamber of Industry Second and Third Organized Industrial Zone | 2000 |
| 8 | Şereflikoçhisar Organized Industrial Zone | 2001 |
| 9 | Ankara Polatlı Chamber of Commerce Organized Industrial Zone | 2008 |
| 10 | Ankara Castors Organized Industrial Zone | 2009 |
| 11 | Ankara Aviation and Space Organized Industrial Zone | 2015 |
| 12 | Elmadağ Furniture Organized Industrial Zone | 2017 |

*[Ankara Development Agency, Work and Construction ..., 2019]*

*Table 9: TR51 Region Universities*

| | University | Quota for Mechanical Engineering in 2018 |
|---|---|---|
| 1 | Ankara Haci Bayram Veli University | - |
| 2 | Ankara Social Sciences University | - |
| 3 | Ankara University | - |
| 4 | Ankara Music and Fine Arts University | - |
| 5 | Gazi University | 137 |
| 6 | Hacettepe University | 62 |
| 7 | Middle East Technical University | 260 |
| 8 | Yıldırım Beyazıt University | 62 |
| 9 | Anka Technology University | - |
| 10 | Ankara Medipol University | - |
| 11 | Atılım University | 50 |
| 12 | Başkent University | 70 |
| 13 | Çankaya University | 74 |
| 14 | İhsan Doğramacı Bilkent University | 95 |
| 15 | Lokman Hekim University | - |
| 16 | Ostim Technical University | - |
| 17 | TED University | - |
| 18 | TOBB Economics and Technology University | 80 |
| 19 | Turkish Aeronautical Association University | 40 |
| 20 | Ufuk University | - |
| 21 | Yüksek İhtisas University | - |

*[Ankara Development Agency, Work and Construction ..., 2019]*

According to the data of 2019, Ankara is the province with the highest share after Istanbul, with a gross domestic product of approximately 329 billion 831 million TL and a share of 8.9%. In foreign trade, Ankara has a share of 5% in the country with an export of 7.8 billion USD and is the 6th province with the highest exports [TIM, 2021]. Looking at the working life, it is seen that Ankara's share in the country's employment is around 7% as of 2019 [TURKSTAT, 2021].

Considering the use of technology in the manufacturing industry, it is seen that the share of medium and medium-high technologies is higher than in other regions. When the sectoral components of the Ankara economy are analyzed, it is seen that, an economic structure with a cluster of service and industry sectors has been formed as in Turkey. When looking at the number of enterprises on the basis of the machinery sector, it is seen in Table 7 that 1,245 companies in TR51 Region provide employment for 18,137 people according to SSI data for the year 2019 [SGK, 2021].

| **Table 10. Number of Machinery Companies and Employees in TR51 Region (2019)** | |
|---|---|
| Number of Companies and Employees in Class NACE 28 in TR51 Region | Ankara |
| Number of Companies | 1.245 |
| Number of Insured Employees | 18.137 |

*[SGK, 2021]*

As can be seen in Table 11, in 2018, there is a concentration in the Construction Machinery sub-sector with 355 companies in Ankara in TR51 Region. The Construction Machinery Sector reached a size of 110 billion USD in the world in 2019. In 2020, with the Covid-19 Crisis, there was a decrease of 22% excluding China, which is the world leader in the market, and 13% including China. The

Construction Machinery market in Turkey is expected to grow by up to 70% in 2020, thanks to the acquisitions of Local Authorities and the continuation of some major infrastructure projects. Since these budgeted and project-based works had to be completed, the construction sites did not stop and machine purchases continued during the Covid-19 crisis period. Despite this, while the International Market share in the sales of the Construction Machinery Sector in TR51 Region is increasing, the National Market share is gradually decreasing [UNDP, Fragile Sectors..., 2021].

***Table 11:*** *Number of Machinery Manufacturing Companies by City (2018) [4]*

| Class | Machinery Groups | İstanbul | Ankara | Kocaeli | Bursa | İzmir | Eskişehir | Konya | Manisa | G.Antep | Mersin | Adana | Sakarya |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2811 | Engines Turbines | 30 | 22 | 16 | 16 | 24 | 2 | 48 | 1 | 1 | 1 | 6 | 2 |
| 2812 | Fluid Power Eq. | 110 | 80 | 19 | 24 | 58 | 2 | 103 | 1 | 4 | 1 | 9 | 3 |
| 2813 | Pump & Comp. | 215 | 78 | 25 | 23 | 85 | 5 | 74 | 4 | 6 | 2 | 9 | 10 |
| 2814 | Taps & Valves | 239 | 25 | 26 | 10 | 28 | 4 | 37 | 10 | 1 | 1 | 7 | 1 |
| 2815 | Bearings & Gears | 142 | 25 | 11 | 15 | 41 | 4 | 77 | 13 | 1 | 1 | 7 | 7 |
| 2821 | Ovens & Furnaces | 173 | 54 | 27 | 15 | 32 | 1 | 28 | 8 | 6 | 4 | 4 | |
| 2822 | Lifting Handling | 544 | 236 | 86 | 74 | 146 | 26 | 179 | 24 | 30 | 28 | 32 | 17 |
| 2823 | Office Machinery | 14 | 3 | | | 1 | 1 | 1 | | | | | 1 |
| 2824 | Power Hand Tools | 12 | 1 | 1 | 1 | 4 | | 4 | 1 | | 1 | 1 | 1 |
| 2825 | Cooling Mach. | 345 | 116 | 57 | 41 | 118 | 17 | 44 | 29 | 19 | 3 | 19 | 12 |
| 2829 | Other Gen. Mach. | 617 | 158 | 83 | 41 | 163 | 14 | 84 | 16 | 19 | 11 | 22 | 25 |
| 2830 | Agr. & Forestry | 46 | 44 | 16 | 31 | 77 | 17 | 203 | 40 | 12 | 13 | 32 | 17 |
| 2841 | Metal Forming | 314 | 71 | 41 | 119 | 61 | 10 | 81 | 6 | 6 | 5 | 12 | 10 |
| 2849 | Machine Tools | 168 | 69 | 34 | 161 | 42 | 11 | 34 | 6 | 2 | 3 | 4 | 11 |
| 2891 | Mettalurgy | 49 | 10 | 24 | | 19 | 4 | 14 | | | 1 | 7 | |
| 2892 | Construction | 105 | 355 | 33 | 15 | 71 | 7 | 50 | 12 | 12 | 11 | 17 | 7 |
| 2893 | Food Mach. | 200 | 67 | 11 | 40 | 121 | 21 | 165 | 14 | 60 | 16 | 14 | 31 |
| 2894 | Textile Mach. | 252 | 15 | 5 | 34 | 40 | | 20 | 2 | 67 | 4 | 10 | 4 |
| 2895 | Paper Mach. | 54 | 6 | 9 | 3 | 15 | | 8 | 2 | 8 | | 6 | |
| 2896 | Plas. & Rub. Mach. | 221 | 13 | 27 | 24 | 31 | 4 | 15 | 3 | 21 | 3 | 7 | 11 |
| 2899 | Other Spec. Mach. | 309 | 112 | 41 | 69 | 86 | 13 | 54 | 27 | 9 | 2 | 7 | 4 |
| Total | | 4.159 | 1.560 | 592 | 756 | 1.263 | 163 | 1.323 | 219 | 284 | 111 | 232 | 174 |

*[Makfed, 2021]*

When the Machinery Manufacturing sector investment incentive documents between the years 2015-2020 in TR51 Region are examined in Table 12, it is observed that 8 foreign and 164 domestic investors in the region received investment incentive documents in the machinery sector.

*Table12: Investment Incentives Received Between 2015-2020 In TR51 Region under NACE 28*

| INVESTMENT INCENTIVES BETWEEN 2015-2020 IN TR51 REGION NACE 28 | Yerli Yatırımcı | | | Yabancı Yatırımcı | | |
|---|---|---|---|---|---|---|
| | Number of Incentives | Amount of Investment [Million TL] | Employment Provided | Number of Incentives | Amount of Investment [Million TL] | Employment Provided |
| **ANKARA** | **164** | **3.017** | **3.955** | **8** | **158** | **90** |

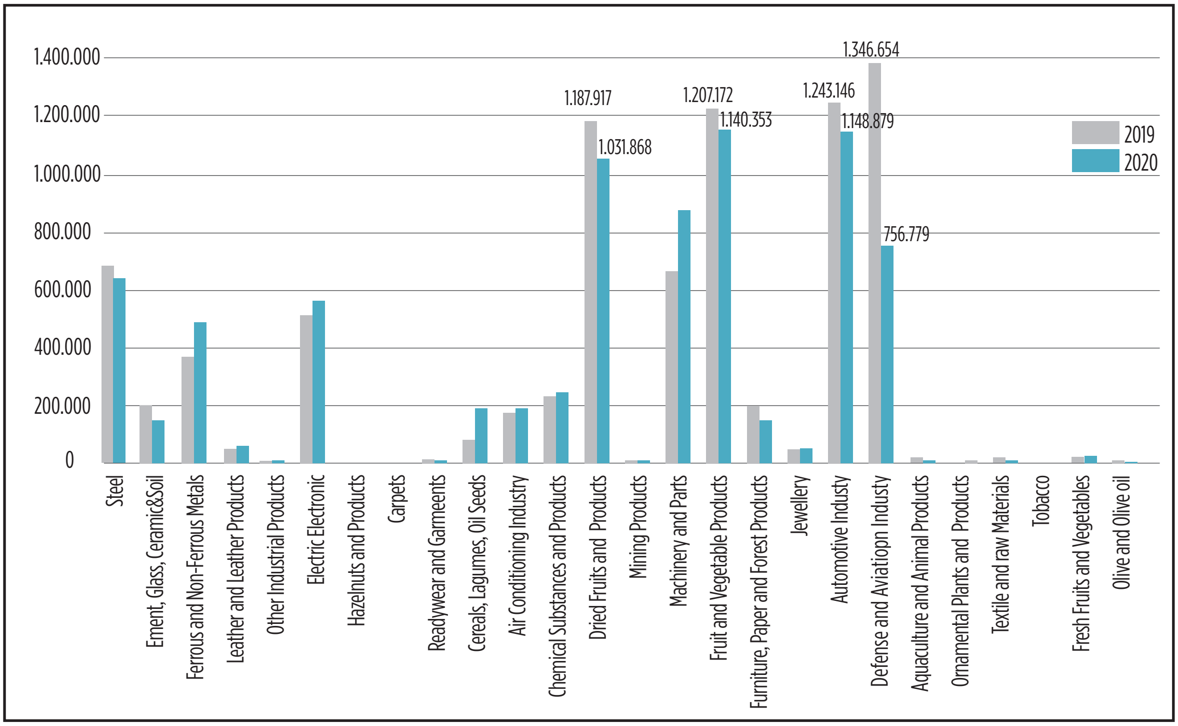
As can be seen in Table 13; in TR51 Region, with an export amount of approximately 1.14 billion USD in 2020, the Machinery and Parts sector decreased by 5.54% compared to the same period of the previous year. The share in machinery sector exports, which decreased by 3.7% in the same period, decreased from 15.41% to 15.12%. With these figures, a greater contraction was experienced in Ankara Machinery Sector exports in 2020 compared to the 3.71% decrease in Turkey's machinery exports. The biggest reason for this is thought to be the inability to dispatch goods due to logistics.

**Table13: Top 20 Cities in Machinery Exports in 2020 and Export Shares (Thousand USD)**

| 1 January-31 December | | | | | |
|---|---|---|---|---|---|
| **CITY** | **2019** | **Share** | **2020** | **Share** | **Difference** |
| İSTANBUL | 2.852.388 | 36,41% | 2.628.887 | 34,85% | -7,84% |
| **ANKARA** | **1.207.172** | **15,41%** | **1.140.353** | **15,12%** | **-5,54%** |
| BURSA | 806.518 | 10,30% | 686.714 | 9,10% | -14,85% |
| İZMIR | 574.502 | 7,33% | 533.762 | 7,08% | -7,09% |
| KONYA | 460.402 | 5,88% | 508.934 | 6,75% | 10,54% |
| KOCAELI | 471.293 | 6,02% | 469.943 | 6,23% | -0,29% |
| MANISA | 107.752 | 1,38% | 137.851 | 1,83% | 27,93% |
| MARDIN | 21.290 | 0,27% | 135.500 | 1,80% | 536,44% |
| GAZIANTEP | 146.239 | 1,87% | 130.715 | 1,73% | -10,62% |
| ESKIŞEHIR | 104.015 | 1,33% | 101.954 | 1,35% | -1,98% |
| MERSIN | 115.043 | 1,47% | 92.425 | 1,23% | -19,66% |
| TEKIRDAĞ | 84.815 | 1,08% | 92.195 | 1,22% | 8,70% |
| ADANA | 78.109 | 1,00% | 74.457 | 0,99% | -4,68% |
| AYDIN | 63.608 | 0,81% | 64.313 | 0,85% | 1,11% |
| ÇORUM | 75.017 | 0,96% | 63.269 | 0,84% | -15,66% |
| AKSARAY | 46.358 | 0,59% | 56.164 | 0,74% | 21,15% |
| KAYSERI | 61.449 | 0,78% | 54.023 | 0,72% | -12,08% |
| SAMSUN | 47.984 | 0,61% | 53.533 | 0,71% | 11,56% |
| SAKARYA | 56.346 | 0,72% | 48.664 | 0,65% | -13,63% |
| DENIZLI | 61.412 | 0,78% | 48.564 | 0,64% | -20,92% |
| **Türkiye Toplam** | **7.833.008** | 100% | **7.542.789** | 100% | -3,71% |

*[TİM, 2021]*

The most exported countries from TR51 Region are the USA, China, Iraq, Germany and Italy, while the highest import is from China, USA, Germany, Italy and England [Ankara Development Agency, 2019]. When the distribution of exports from Ankara to sectors is examined in Figure 8, in 2020, the Machinery Manufacturing Sector became the second most exporting sector in Ankara, right after the Automotive Sector.




*[TÜİK, 2021]*

***Figure 8:*** *Exports of Manufacturing Industry Sectors in TR51 Region in 2019-2020 (Thousand USD)*

Ankara is the province with the largest number of design centers after Istanbul with 44 design centers in the fields of construction, machinery and equipment, manufacturing industry, defense industry, media and communication, energy, health, engineering / architecture activities, furniture, software and mining [MOIT, 2021].

When the industrial production of Ankara is examined, the Construction Machinery (CM) Sector, stands out among the top five sub-sectors of the Machinery sector. There are many companies in the CM Sector in Ankara that are the distributors of both domestic and foreign brands. Ankara has shown to be a suitable place in terms of the sector and the business of construction machinery sector has strengthened in Ankara in the past 70 years. The sector has grown considerably, especially in the early 2000s. The main reason for this is, public institutions are located in Ankara and therefore the large public tenders are held in Ankara. For this reason, construction companies have established their headquarters in Ankara or moved to Ankara. In addition, Ankara provides an advantage in terms of finding qualified and intermediate staff that the sector needs. [SANIR, 2015].

Companies operating in the CM sector, based in Ankara, export to more than 100 countries. In addition, clustering activities for the sector are also at an important level. CCM is a cluster of 143 companies, which has been developing and continuing its activities since 2007, specialized in various sub-branches of the construction machinery sector, producing domestic products, and has 5,978 employees in these member companies. Federation of Machinery Manufacturing Industry Associations, Construction Machinery Engineers Association, Vehicle and On-Board Equipment and Construction Machinery Manufacturers Association are other relevant non-governmental organizations operating in Ankara


*[Ankara Development Agency 2021]*

***Figure 9:*** *Ankara Construction Machinery Product Segments*

Construction machinery companies manufacturing in Ankara have achieved many successes in national and international rankings. Hidromek A.Ş., Türk Traktör ve Ziraat Makineleri A.Ş., Ortadoğu Rulman San. ve Tic. A.Ş., Erkunt Sanayi A.Ş. ve Alimar Mak. San A.Ş are among the companies with worldwide recognition in the sector. Compliance with the relevant standards in the production processes in the sector is one of the main factors that brings quality. Based on the companies whose names are mentioned above; it is seen that companies that adapt to lean production and digitalization processes and attach importance to R&D and / or innovation have a say in the sector by being in a more competitive position.

# 4. The Effects of the Covid-19 Pandemic on the Machinery Sector

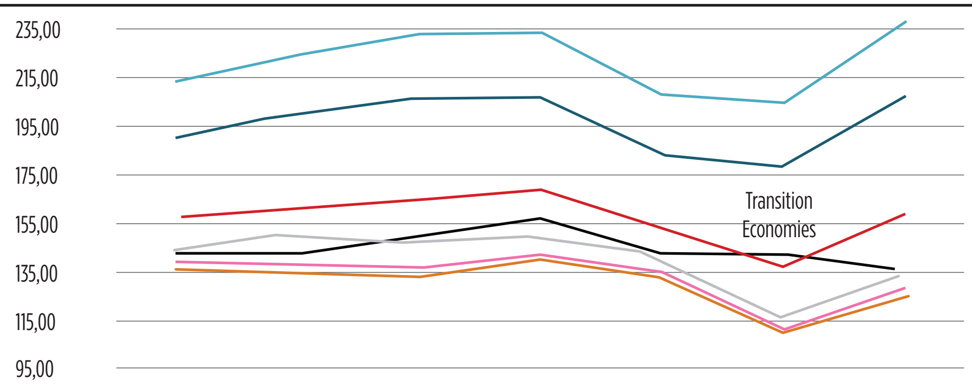
Most countries of the world have taken many measures to mitigate the short-term impact of the Pandemic Crisis. The main measure implemented has been social distance and this resulted in a sudden stop in the services sector, a decrease in companies' cash flow and income, and a serious decline in economies with an increase in unemployment.

The Covid-19 pandemic caused a significant contraction in the world economy and trade in 2020. The assumptions that the pandemic will take place in a single wave, that it will be taken under global control at the end of the summer months and the vaccine will be found and implemented in 2021 are the basis of optimism in predictions regarding the world economy and trade.

## 4.1. Comparison Before and After the Pandemic

As a general opinion in the world economy, a contraction of 5-6% is projected in 2020 and a growth of about 4% in 2021. As for World Trade, a recovery is expected from the third quarter of 2020, first in the form of shrinking and then in the form of growth. A total contraction of about 20% is forecast for 2020 and a recovery of up to 15% in 2021 [the World Bank, 2021].

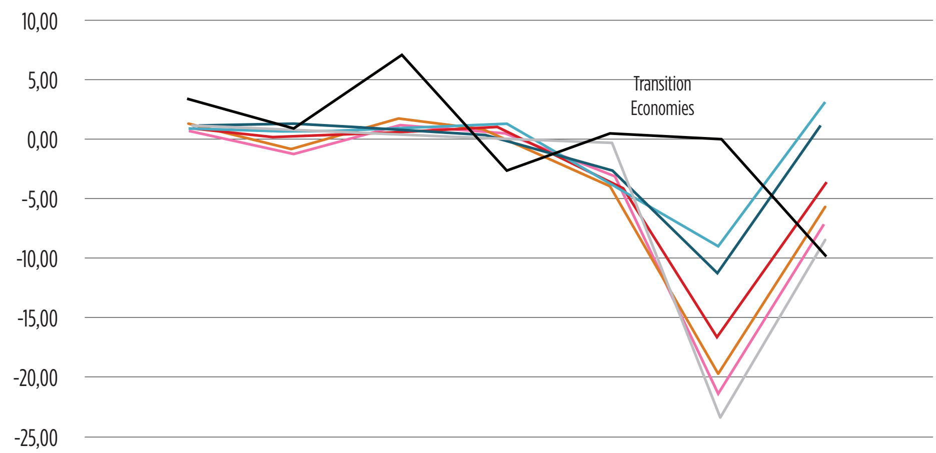
By using the data finalized as of January 2021, the world total and export volume and export growth rates in various economic regions can be examined in Figure 10 and Figure 11. As can be seen in Figure 10, it is seen that the decline in export volumes of both the world and economic regions with the onset of the pandemic in the first quarter of 2020 reached the bottom point at the end of the 2nd quarter and returned from this point, approaching the 1st quarter figures at the end of the 3rd quarter. However, in Transition Economies of the Former USSR (Russia, Ukraine, Belarus, Kazakhstan, Uzbekistan, Turkmenistan, Kyrgyzstan and Tajikistan) there is an almost stable progress in the second and third quarters with a relatively low retreat at the end of the 1st quarter. This might be due to the fact that countries of transition economies have implemented quarantine and travel ban practices taken against the pandemic later and more flexibly.




| | Q1 2019 | Q2 2019 | Q3 2019 | Q4 2019 | Q1 2020 | Q2 2020 | Q3 2020 |
|---|---|---|---|---|---|---|---|
| World | 156,80 | 160,76 | 161,41 | 165,17 | 152,19 | 134,40 | 155,55 |
| America | 143,63 | 150,64 | 148,65 | 150,44 | 142,82 | 116,30 | 136,76 |
| Asia | 211,61 | 222,80 | 231,49 | 233,04 | 205,11 | 203,03 | 238,01 |
| Europe | 136,67 | 135,60 | 133,10 | 139,18 | 131,36 | 109,42 | 125,60 |
| Developing Economies | 188,45 | 199,15 | 205,30 | 206,37 | 183,15 | 176,54 | 207,28 |
| Transition Economies | 143,06 | 142,80 | 150,73 | 157,73 | 143,54 | 142,57 | 136,03 |
| Developed Economies | 140,20 | 140,71 | 137,94 | 142,92 | 135,74 | 111,26 | 128,58 |

*[UNCTAD, 2021]*

***Figure 10:** Export Volumes of the World and Various Economic Regions [2005=100]*



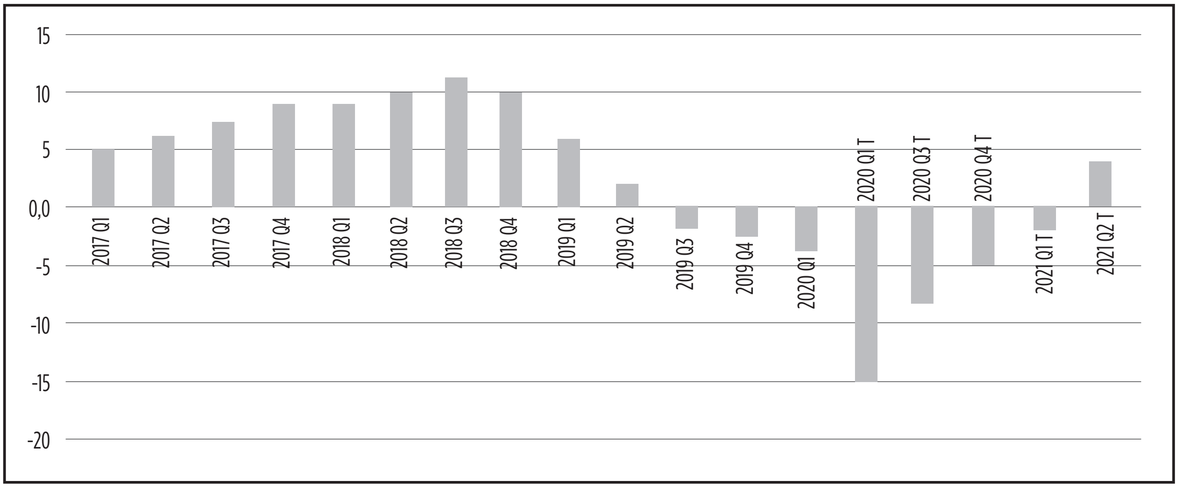

| | Q1 2019 | Q2 2019 | Q3 2019 | Q4 2019 | Q1 2020 | Q2 2020 | Q3 2020 |
|---|---|---|---|---|---|---|---|
| World | 0,62 | -0,20 | 0,84 | 0,22 | -2,94 | -16,40 | -3,66 |
| America | 0,94 | 0,29 | 0,49 | -0,37 | -0,57 | -22,80 | -8,00 |
| Asia | 0,84 | 0,66 | 0,31 | 0,97 | -3,07 | -8,87 | 2,81 |
| Europe | 1,05 | -1,10 | 1,42 | 0,39 | -3,88 | -19,31 | -5,63 |
| Developing Economies | 0,59 | 1,14 | 0,43 | 0,55 | -2,81 | -11,35 | 0,96 |
| Transition Economies | 3,00 | 0,67 | 6,53 | -2,53 | 0,33 | -0,16 | -9,75 |
| Developed Economies | 0,53 | -1,24 | 0,92 | 0,25 | -3,18 | -20,93 | -6,79 |

*[UNCTAD, 2021]*

***Figure 11:*** *Export Growth Rates of the World and Various Economic Regions Compared to the Previous Period*

The same is true for export growth rates, as can be seen in Figure 11. It is highly probable that in the 4th quarter the export growth rates of the transition economies will follow the rest of the economies and will make a comeback as other economies have performed in the 3rd quarter.

While the current information and expectations of the world economy are like this, UNCTAD's predictions regarding world machinery and equipment investments are as follows: As can be seen in Figure 12; world machinery and equipment investments will likely recess in parallel with the world economy; however, its recovery will take a longer time. World machinery and equipment investments shrank by 4.0 percent in the first quarter of 2020. It is estimated that there was a 15.0% shrinkage in the second quarter. In the third and fourth quarters of the year, contractions are expected as 8.0% and 5.0%. After a limited contraction in the first quarter of 2021, the first growth figure in world machinery and equipment investments is expected to be 4.0% in the second quarter of 2021.




*[UNCTAD, 2021], (Compared to the same period of the previous year)*

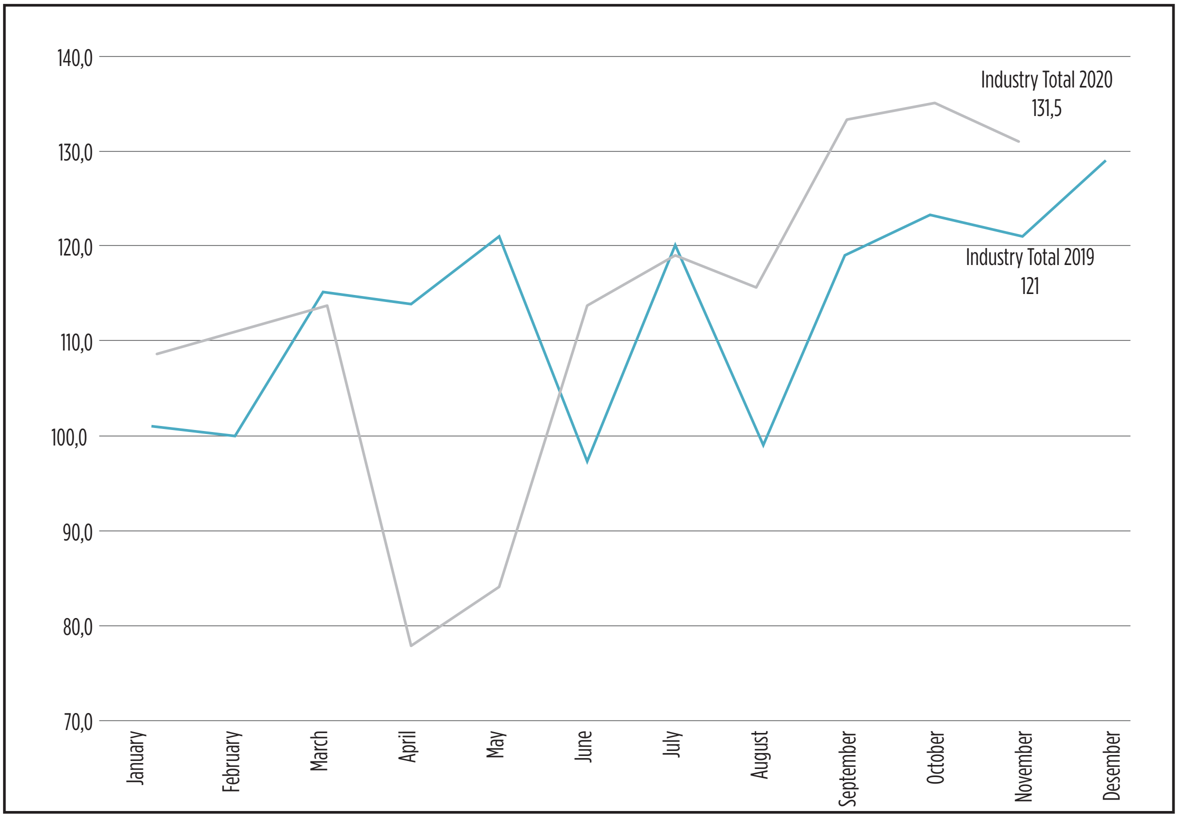
***Figure 12:*** *World Machinery Investments Growth Rates (%)*

These expectations and the export growth rates shown in Figure 11 do not match. Along with the recovery in world export volume and growth rate, a recovery in the machinery sector should be expected in parallel with the export growth rate. As a matter of fact, TURKSTAT data for 2020, which will be shared below, and monthly improvement comparisons of the manufacturing and machinery sectors also indicate a faster recovery.

In response to the Covid-19 Crisis, the Manufacturing Industry and Machinery Sector has taken hygiene and social distance measures in the workshop and business services in general to minimize the impact of the virus on production and employees with chronic illnesses and / or those over 55 years old were given the opportunity to take leave. A home-based working system has been introduced for white-collar personnel who are not obliged to actually work in the workplace. As a result, it has become evident that most white-collar workers can do their jobs remotely.

In this period when the fight against the virus is at a high level; efforts were made to produce with additional working hours in order not to interrupt the infrastructure services such as energy, water, sewage, cleaning and hygiene, infrastructure services such as elevators, air conditioning, cold chains, and to maintain agricultural production for food security of our country with the aim of protecting public health and eliminating the risks that may hinder social life. In this critical period, the machinery sector was able to take quick actions in areas such as respirators and mask manufacturing machines, and put the necessary work into practice very quickly.

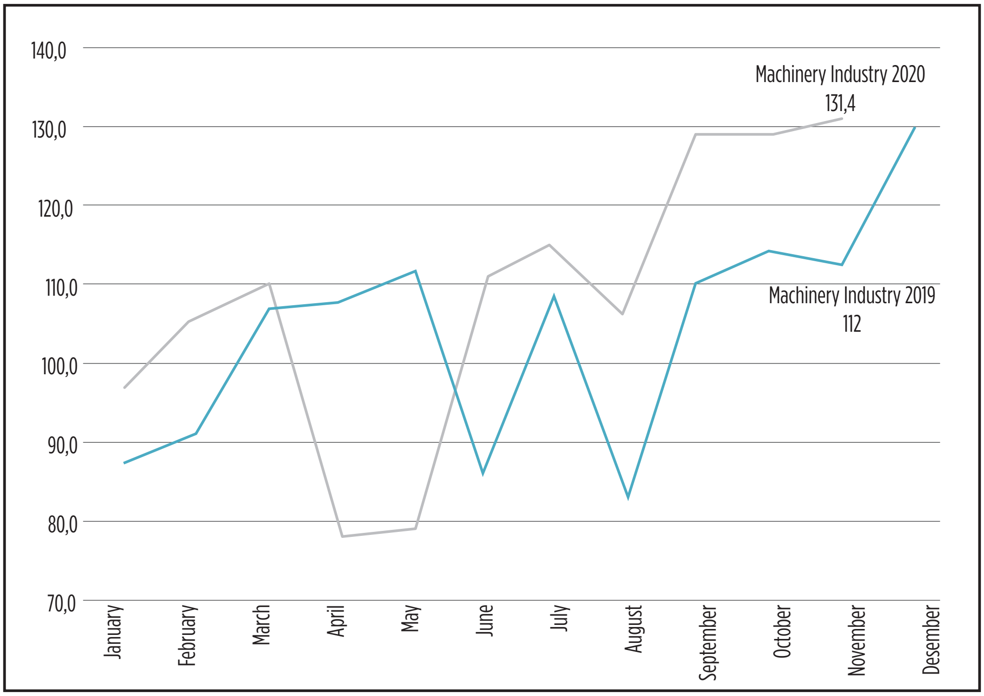
As can be seen in Figure 13, in 2020, when the Manufacturing Sector of Turkey started well during the Covid-19, the shrinkage, which continued increasingly from March to the end of April, started to return back in May and recover rapidly in June. The manufacturing sector index, which captured the figures of 2019 in July, managed to reach from August to November, parallel to the trend in the same period of 2019, but with a better performance. If the same trend continues, it is highly likely that there will be a rise again in December.




*[TÜİK, 2021]*

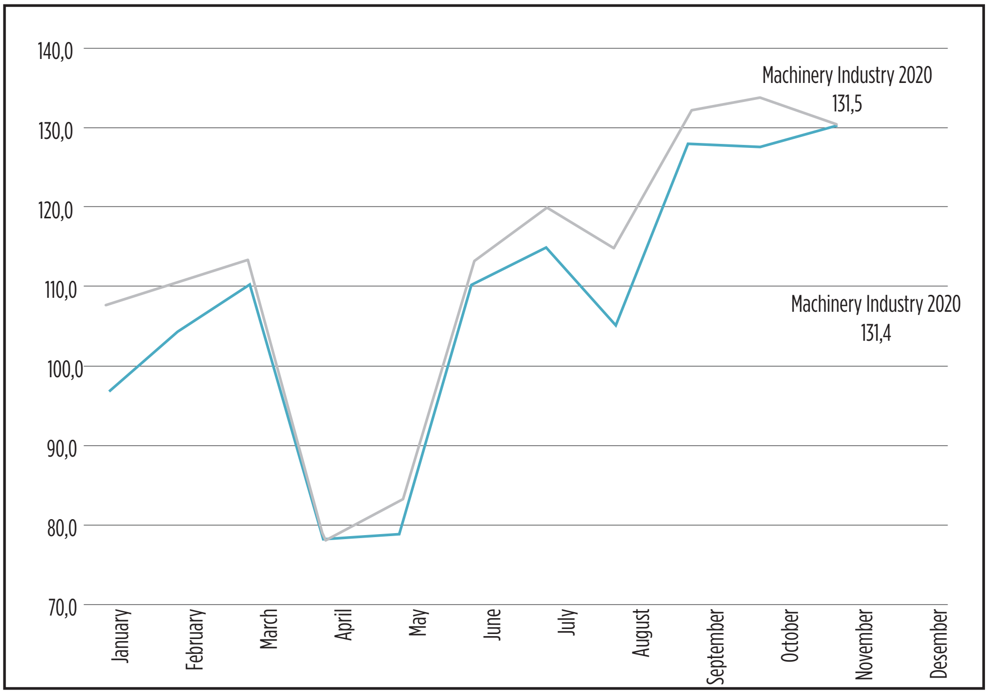
***Figure 13:*** *Manufacturing Industry Production Index 2019-2020 Monthly Comparison [2015=100]*

As can be seen in Figure 14, in 2020, when the Machinery Sector started well just like the manufacturing sector; the shrinkage, which continued increasingly from March to the end of April, started to return back in May, and recover rapidly in June. The machinery sector index, which captured the figures of 2019 in July, managed to reach from August to November, parallel to the trend in the same period of 2019, but with a better performance. If the same trend continues, it is highly likely that there will be a rise again in December.




[TÜİK, 2021]

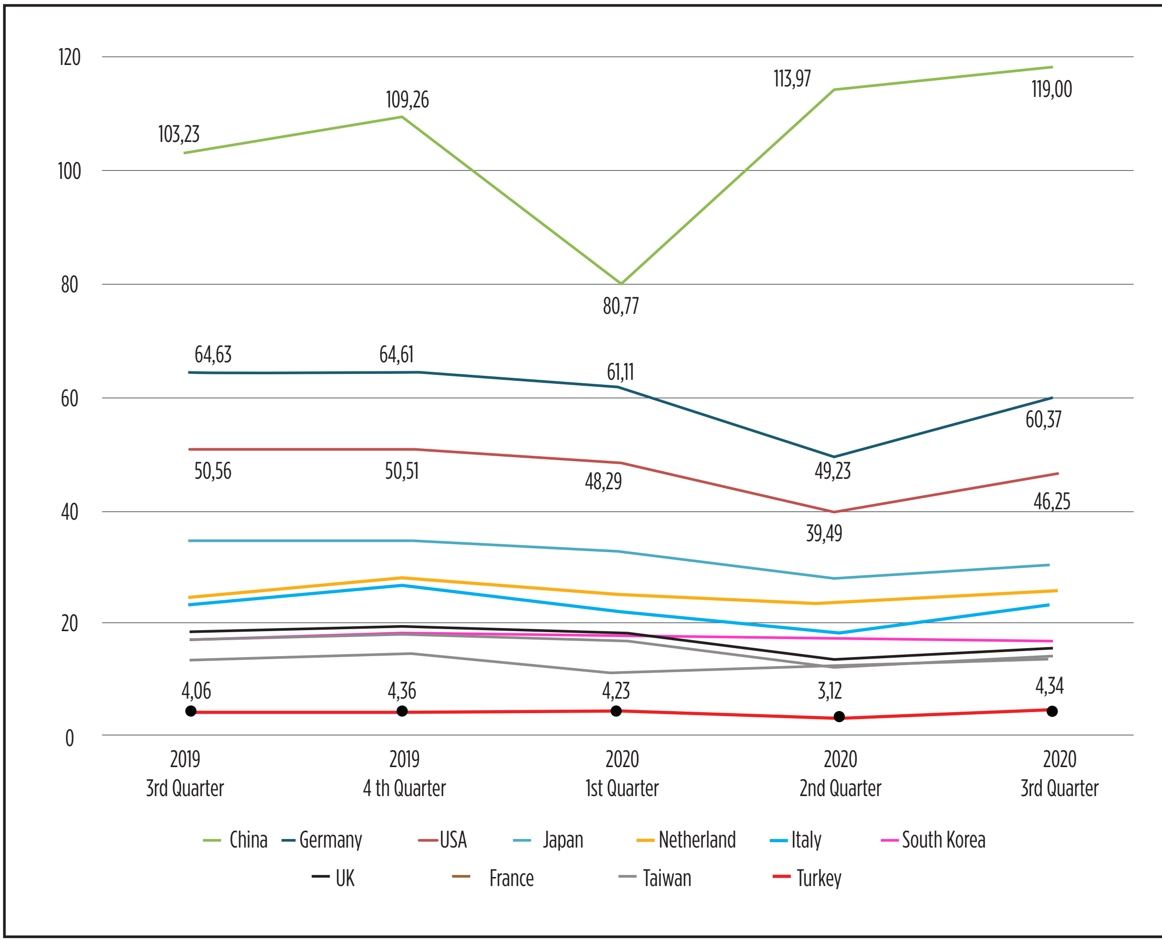
***Figure 14:*** *Machinery Sector Production Index 2019-2020 Monthly Comparison [2015=100]*




[TÜİK, 2021]

***Figure 15:*** *Comparison of Manufacturing and Machinery Sector Production Index for 2020 [2015=100]*

As can be seen in Figure 15, Manufacturing and Machinery Sector generally followed the same trend with the beginning of the pandemic. However, in November 2020, the Machinery Sector performed better than the Manufacturing Industry and signals that it will perform even better in the period after December.




*[ITC_Trademap, 2021]*

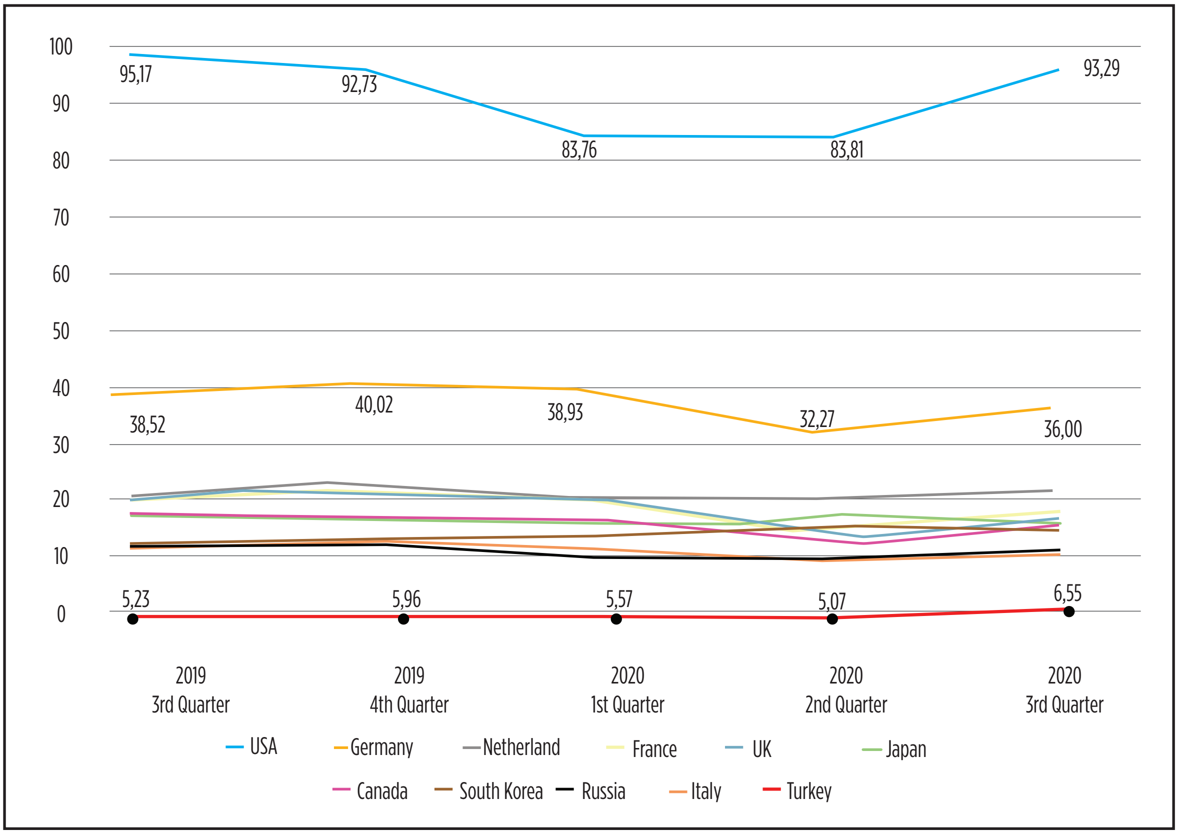
***Figure 16:*** *Impact of Covid-19 Crisis on Top 10 Countries and Turkey in Machinery Export (billion USD)*

As seen in Figure 16, in China, the country that experienced the crisis first in the world, the impact of the crisis on machinery exports manifested itself in the 1st quarter of 2020 and completed the recovery process in the 2nd quarter (For China, which has not yet shared the results of the 3rd quarter of 2020, the export value of the machinery sector for the 3rd quarter has been estimated.)

In all countries except China; the decrease that started in the export figures of the 1st quarter when the crisis started, reached the lowest level in the 2nd quarter and returned to the level of the end of the 1st quarter in the 3rd quarter. With the realization of the accumulated investment demands in the 4th quarter, export values can be expected to rise above the 1st quarter levels.

The machinery sector in Turkey is one of the few countries that have stepped out of this export trend and exceeded the 1st quarter level in the 3rd quarter of 2020, reaching the 3rd quarter level in 2019, when the decline started. As it can be understood from here, it is obvious that the Turkish machinery sector would have been capable of displaying a much different export and growth performance in 2020, if it were not for the crisis. Although the sector's performance in the first half of 2020 was not at the desired level, it closed the year approximately 15% above 2019 with its 3rd quarter and 4th quarter performances and it is expected to reach an export level of US $ 4.45 billion.

This rapid recovery is due to the Turkish Machinery Sector's ability to achieve flexibility, rapid response to change, customer focus and innovation potential. After the crisis, these characteristics of the sector representatives immediately manifested themselves and accelerated the actions taken following the first shock.

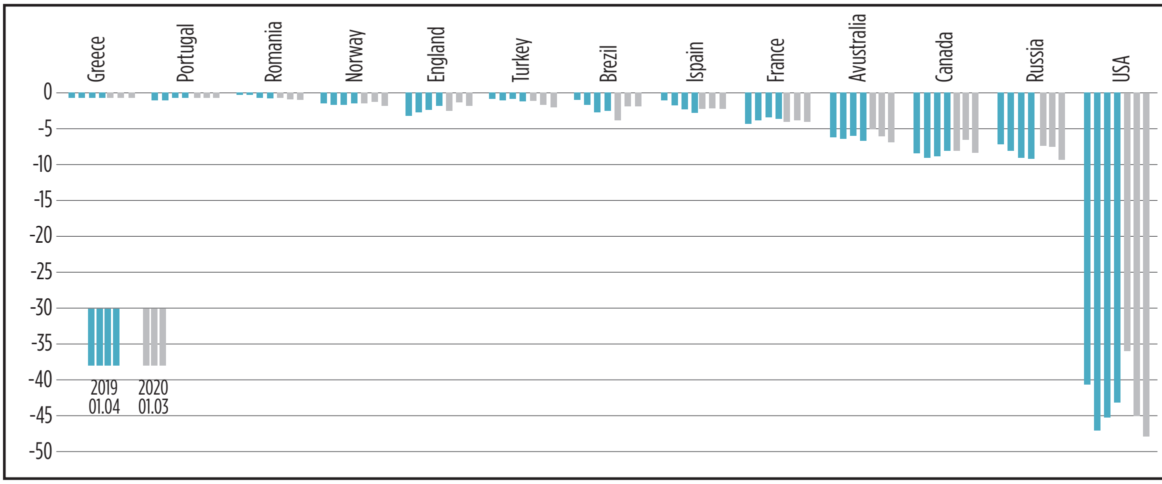



*[ITC_Trademap, 2021]*

***Figure 17:*** *Impact of Covid-19 Crisis on Top 10 Countries and Turkey in Machinery Imports (billion USD)*

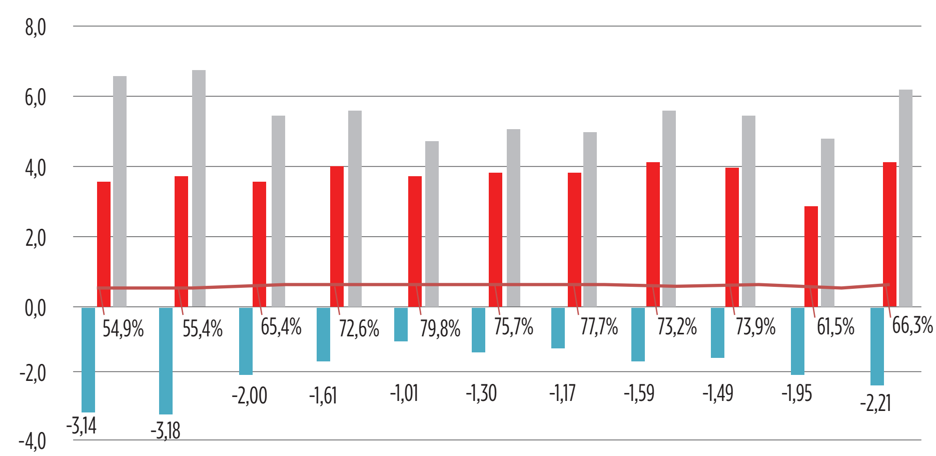
However, in the machinery sector, import is a topic that should be handled as carefully as export. The sector has a foreign trade deficit. As seen in Figure 17, it is seen that the decreased appetite for investment due to Covid-19, generally caused a decrease in imports in the 1st and 2nd quarters of 2020 although there are a few exceptional countries. The declining import in Turkey, unfortunately, did not decrease as fast as exports and completed its return faster than exports. Although the third quarter is 7% higher in exports compared to the same period of the previous year, this rate is unfortunately 25% in imports.

In Figure 18, there is a comparison of the countries with the highest foreign trade deficit in the machinery sector in 2019 and 2020 (countries with missing information are not included) on a quarterly basis. While the foreign trade deficit decreased in almost all countries in at least one of the first and second quarters of 2020, when the restrictions started and economies slowed down due to the pandemic, it is seen that Turkey was negatively different from them. Although Turkey's machinery sector foreign trade deficit improved in Q1 2020 compared to Q4 2019, it continues to rise in the second quarter of 2020 from where it left off.




*[ITC_Trademap, 2021]*

***Figure 18:*** *Countries with Highest Foreign Trade Deficit in Machinery Sector (billion USD)*




| | 2018 Q1 | 2018 Q2 | 2018 Q3 | 2018 Q4 | 2019 Q1 | 2019 Q2 | 2019 Q3 | 2019 Q4 | 2020 Q1 | 2020 Q2 | 2020 Q3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Foreign Trade Deficit | -3,14 | -3,18 | -2,00 | -1,61 | -1,01 | -1,30 | -1,17 | -1,59 | -1,49 | -1,95 | -2,21 |
| Export | 3,82 | 3,94 | 3,78 | 4,28 | 3,99 | 4,05 | 4,06 | 4,36 | 4,23 | 3,12 | 4,34 |
| Import | 6,97 | 7,12 | 5,78 | 5,89 | 4,99 | 5,35 | 5,23 | 5,96 | 5,72 | 5,07 | 6,55 |
| Coverage Ratio | 54,9% | 55,4% | 65,4% | 72,6% | 79,8% | 75,7% | 77,7% | 73,2% | 73,9% | 61,5% | 66,3% |

*[ITC_Trademap, 2021]*

***Figure 19:*** *Machinery Foreign Trade on the Basis of Quarters between 2018-2019-2020 (billion USD)*

Figure 19, where Turkey's deficit in foreign trade of machinery is examined in detail, shows the development of the foreign trade deficit, export, import and coverage ratio in 2018, 2019 and 2020 on a quarterly basis.

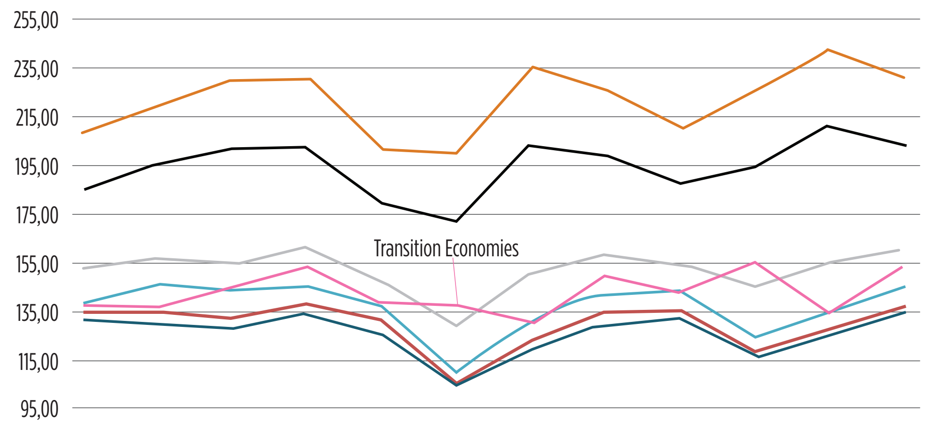
The positive trend that continued from the 1st quarter of 2018 to the 1st quarter of 2019 started to reverse in the 2nd quarter of 2019 and although there was a pause with the Covid-19 pandemic, the foreign trade deficit continued to grow despite the increasing exports. As it can be understood from here, the foreign trade deficit of the machinery sector has been continuing its growth trend for the last seven quarters, regardless of the pandemic effects. The necessary sectoral strategy and policy recommendations for reversing this trend will be shared in the relevant sections.

## 4.2. Possible Changes in the Sector After the Pandemic

Although various growth estimates are made by various authorities for the world economy [T.R. Presidency, 2020 / 1-2], it can be predicted that the World Economy will grow by 5% with a reactive return from shrinking in 2021.

It can be estimated that the machinery sector, which shows a growth performance above the world economy, will show a growth performance of 9% worldwide. It is a fact that the Machinery Sector of Turkey shows higher performance than the World Machinery sector, and the sector may achieve a growth performance of over 9% in 2021.

In the light of these forecasts, the graphics shared above were projected into December 2020 and 2021, and global export volume estimates on the basis of the World and Economic Regions can be seen in Figure 20 (Machinery Sector Expert Forecasts, 2021 through UNCTAD data). Accordingly, the figures of the last quarter of 2019 were obtained in the last quarter of 2021, however since the total export volumes within the year will spread more homogeneously, the export performance is expected to be 5.0% above 2020 in total.

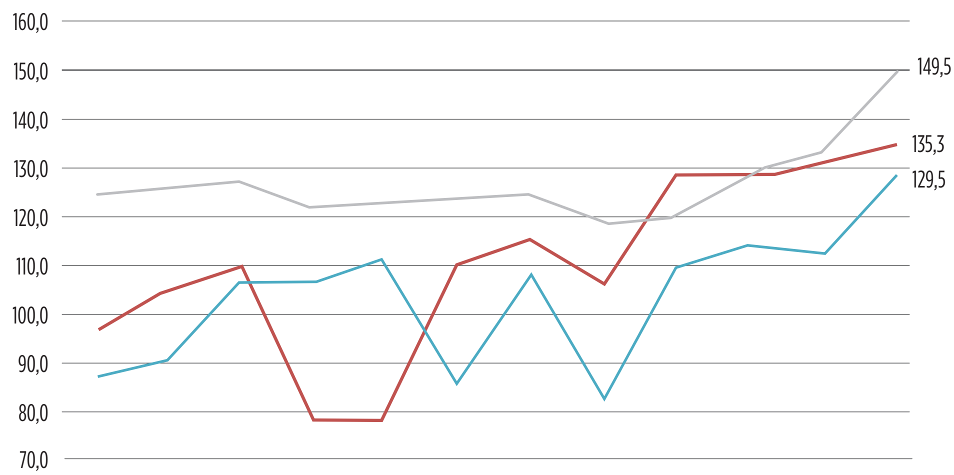



| | Q1 2019 | Q2 2019 | Q3 2019 | Q4 2019 | Q1 2020 | Q2 2020 | Q3 2020 | Q3 2020 T | Q1 2021 T | Q2 2021 T | Q3 2021 T | Q4 2021 T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| World | 156,80 | 160,76 | 161,41 | 165,17 | 152,19 | 134,40 | 155,55 | 161,86 | 158,27 | 150,53 | 160,21 | 165,10 |
| America | 143,63 | 150,64 | 148,65 | 150,44 | 142,82 | 116,30 | 136,76 | 147,43 | 148,53 | 130,25 | 140,87 | 136,76 |
| Asia | 211,61 | 222,80 | 231,49 | 233,04 | 205,11 | 203,03 | 238,01 | 228,38 | 213,32 | 227,40 | 245,15 | 232,95 |
| Europe | 136,67 | 135,60 | 133,10 | 139,18 | 131,36 | 109,42 | 125,60 | 136,40 | 136,62 | 122,55 | 129,37 | 139,13 |
| Developing Economies | 188,45 | 199,15 | 205,30 | 206,37 | 183,15 | 176,54 | 207,28 | 202,24 | 190,48 | 197,73 | 213,50 | 206,28 |
| Transition Economies | 143,06 | 142,80 | 150,73 | 157,73 | 143,54 | 142,57 | 136,03 | 154,58 | 149,28 | 159,68 | 140,11 | 157,67 |
| Developed Economies | 140,20 | 140,71 | 137,94 | 142,92 | 135,74 | 111,26 | 128,58 | 140,06 | 141,17 | 124,61 | 132,44 | 142,86 |

*[UNCTAD, 2021]*

***Figure 20:*** *Export Volumes of the World and Economic Regions for 2021 [2005=100]*

Based on the same estimates; when Turkey's Machinery Sector manufacturing index is projected to December 2020 and to 2021, it can be expected to perform well in 2021 compared to 2020 and as a result, as can be seen in Figure 21, it may achieve at least 15% growth in the total year compared to 2020.




| | Ocak | Şubat | Mart | Nisan | Mayıs | Haziran | Temmuz | Ağustos | Eylül | Ekim | Kasım | Aralık |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Machinery Ind. 2020 | 96,6 | 105,3 | 110,1 | 77,8 | 78,8 | 110,9 | 115,6 | 105,7 | 129,3 | 128,8 | 131,4 | 135,3 |
| Machinery Ind. 2019 | 86,9 | 90,7 | 106,6 | 107,3 | 111,3 | 85,0 | 108,6 | 82,5 | 109,8 | 114,1 | 112,1 | 129,5 |
| Machinery Ind. 2021 (T) | 124,5 | 125,8 | 127,0 | 121,9 | 123,1 | 124,4 | 125,0 | 118,8 | 119,9 | 128,3 | 133,5 | 149,5 |

*[TÜİK, 2021]*

***Figure 21:*** *Turkish Machinery Sector's Production Index in 2019-2020-20212 (Estimated) [2015 = 100]*

Apart from its effects on economic data, the Covid-19 pandemic had serious effects on the real economy. A restructuring is expected in global supply chains after the crisis caused by the pandemic.

Awareness about high dependence on China and other Asian countries in production and imports has increased. Especially developed countries had to face the difficulties of being dependent on a small number of suppliers in many industries, intermediate inputs and final products. This process will pave the way for restructuring of supply chains in the short and medium term in the upcoming period. Main elements of the new structuring will be reducing dependency on a small number of suppliers, using more suppliers and procuring inputs from domestic suppliers.

As in almost all sectors in supply chains, there is an expectation for restructuring in the supply chain of the machinery and equipment sector. Europe is the center of high technology in the machinery and equipment industry and has an important supply chain. For the machinery and equipment industry of Turkey, the most important expectation for restructuring the supply chains will be to increase the supply share in the new restructuring in Europe. However, considering the location of Turkey and the suitability of the technological competence level, it is highly likely that the sector will catch a larger potential business volume in Africa, which is although a smaller market compared to Europe, and Asia, the world's largest machinery market.

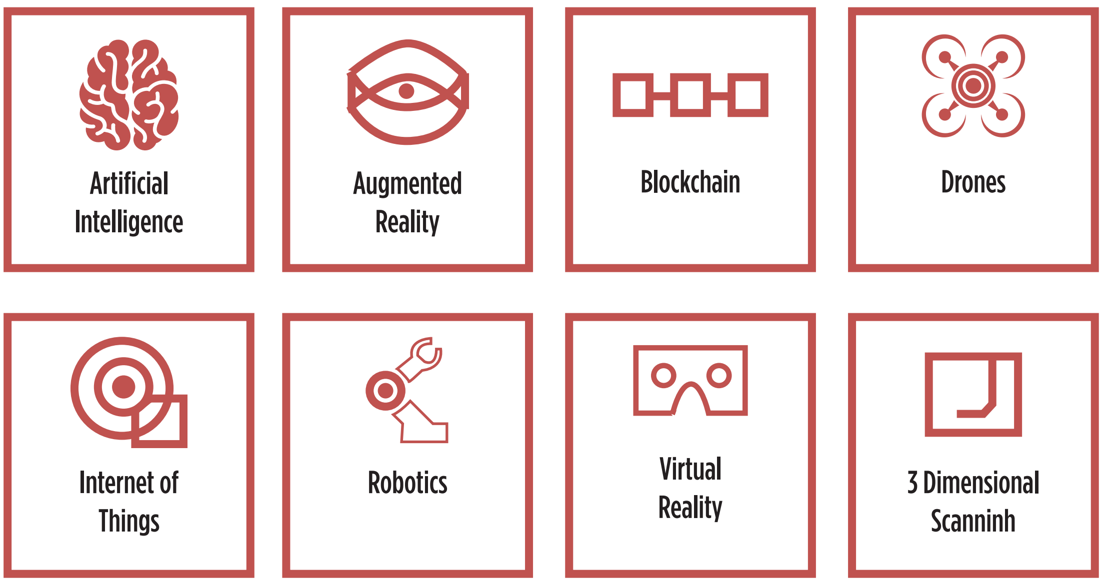
Before the Covid-19 crisis, rapid advances in technology were expected to encourage innovation in industrial machinery manufacturing and thus drive the market in the next 5 years. With the crisis, high-tech machinery exports, which is one of the most important competitive advantages in attracting new customers and overcoming the crisis, paved the way for sector representatives to rapidly renew their products without waiting for 5 years. In this way, with the effect of the crisis; the R&D, innovation and product development efforts, which are planned to be carried out in the future, were brought forward and the added value of the sector was increased. Moreover, digital technologies such as 3D printing, artificial intelligence, IoT and big data analytics started to be used more in production and this significantly helped protect the sector representatives from the effects of the crisis by enabling them to achieve higher productivity, lower operating costs and higher profit margins.

# 5. Special Trends in the Machinery Sector

## 5.1. Sectoral Trends in the Machinery Sector in the World

Robotic Automation, Enhanced Digitalization in the Supply Chain and Additive Manufacturing were identified as the 3 most important trends among the Latest Trends in World Industrial Policies [UNCTAD, World Investment Report, 2020].

PwC, on the other hand, states that the technologies it defines as "Essential Eight" (Figure 22) will be the main driving factors in the progress of companies after Covid-19 as before.




*[PwC, 2021]*

***Figure 22:*** *"Essential Eight" Technology*

Additive Manufacturing, including 3D printing, is rapidly transforming business models in the industrial world. This less wasteful and more efficient new approach to production is changing the rules of production and industry regarding minimum intermediate stock levels, minimum operating stock and storage, facility location and design, spare parts and maintenance.

Global sectoral trends can be grouped under the following headings

**1. Increasingly Rising International Competition**

In recent years, there has been an increase in international competition in the sector, especially with the effect of developing countries. For example, fastening products (screws, fasteners, clamps, etc.) and products such as valves have been affected by increased international competition. In particular, there is an increase in competition from Eastern Europe, North Africa and China. China has developed the "Made in China 2025" strategy, which aims to increase innovation and added value in the sector. This strategy has caused countries with low production costs to produce less value-added products.

**2. Implementation of Strategic Actions to Increase Competitiveness**

Increasing international competition has enabled countries to implement plans to increase their competitiveness. The ability to compete with standard machine production is decreasing day by day. For this reason, countries develop new strategies to increase the added value of their product groups by providing technology and quality improvements in products and services. On-Time Delivery, Modular Design and High Quality Assembly are those with the highest added value. Rather than the production of standard machines or low-tech and easy-to-produce machines, the production trend of medium-high and high technology machines is increasing. This situation has become necessary both to stay away from competition and to increase profit margin.

Cooperation with Start-ups has become a strategic trend applied by companies that cannot develop partnerships and cooperation to achieve high technology. Start-ups offer unique opportunities for the development and renewal of the machinery sector, especially in terms of R & D and innovation of small and medium-sized companies, as well as to renew their product line and increase their engineering competencies.

Awareness of the demand for remote access and automation in the sector has increased, and although it has not yet spread to the general public, there is a significant increase in the number of companies adding these features to their products through investments and developments. The Covid-19 crisis has had a compelling effect on companies taking quick steps to switch machines to remote access with a simple adaptation and increase the level of automation.

Maintenance of machines stands out as an important area that every manufacturing company should address. Manufacturing companies are trying to perform planned maintenance with different strategies based on working hours, the number of products processed, or a certain period of time. To avoid failures and adapt to the company-specific operating systematics, a large amount of data is produced with sensors adapted to the machines, and the establishment of a remote monitoring system in which the machine's operating status is monitored provides a significant competitive advantage, ensuring that it can perform predictive maintenance.

**3. Industry 4.0 and Technological Developments**

Another trend in Modern industrial policies is digital development, improvement of internet connection infrastructure and wider adoption of information and communication technologies in companies. Information technology has provided opportunities to increase productivity and create new sectors across all sectors. This allowed industrial policies to expand its scope to include neighboring service industries rather than the condition that manufacturing was the sole focus.

Information technology has long been integrated into various departments of companies (Management, Production, Marketing, etc.). Digitalization, computer-based controls and full automation in production systems are also increasing day by day, and there is a rapid upward trend towards Industry 4.0. Recently, the technological development of modern industrial policies has been on the shoulders of the areas of digital transformation and operational technology.

By combining technologies such as mechanical, micro-electronic, computer, optical, sensor, which are recently easy to reach in machinery manufacturing has enabled even small companies to catch the high technological level of certain large companies. Digital solutions and technologies that companies use to adapt to industry 4.0 include:

- Industrial Internet of Things
- Big Data
- Cloud Computing
- Additive Manufacturing
- Robotic Machines
- Augmented and Virtual Reality

**4. Increasing Trend in Outsourcing**

There is an increasing tendency to redirect some of the production activities to suppliers in order to increase flexibility. In the machinery sector, it is very common to outsource works like casting and machining.

## 5. Tendency of Customers to Procure Service Instead of Machinery

In recent years, machinery sector customers have entered a trend of demand shifting to service procurement instead of plants and systems. This means that machinery manufacturers start to provide services not only for machines, but also for software, management and above all..

## 6. Internationalization and Branding

In recent years, the number of companies focused on foreign markets in the sector has increased either by exporting or by establishing production or sales branches abroad. The measure of good internationalization of companies has begun to be measured by how less they are affected by the negative effects of crises in the countries where they are located. In machinery manufacturing, exports are the most important factor of internationalization and have been a safe zone for companies, especially in times of national and regional crisis. Internationalization, which had a limited effect at first during the Covid-19 crisis, has again shown itself as a way out of the crisis with the rapid transformation of alternative solutions offered to customers to exports.

The need for companies to be more international has increased the demand for international sales professionals and especially trade professionals who speak English and other languages well, and the growing demands have also led to changes in the desired professional profiles. The production of final products has forced companies to internationalize intensively in recent years, leading to the establishment or development of export departments.

Branding, which is one of the most important steps of internationalization, has become a factor that has been accumulated with the services provided over the years and has become a factor that gives the company after a certain level, a power that cannot be purchased with money and still continues its existence as an active trend. Companies not only exporting but also supporting their products and services and so, progressing their brand image, achieve growth and success beyond expectations in the medium and long term. In today's world, the first condition of being an international company is to make maximum use of e-commerce, especially in the machinery sector, and this trend is growing very strongly and rapidly.

## 7. Customer Oriented Production

Currently, buyers can easily access prices and information for comparison of technical characteristics. Therefore, sellers or manufacturers have to listen to customer feedback and quickly implement solutions for customers' needs in order to be competitive in the market. As a result, the boutique manufacturing trend based on customer expectations has developed with the aim of differentiation.

Customer-oriented innovation has been the first condition of customer-oriented production. Innovation increases the loyalty of customers to the brand and opens the way for new orders. Customer-oriented innovation is one of the most important elements in the sector that increases the resilience of companies against crises.

## 8. Reducing New Product Launch Time

With increasing technology and high levels of communication through social media, attracting customers has become more difficult for large companies, while small companies have the opportunity to capture customers through social media and introduce new products they have just designed and produced. Even though this rapid and effective promotion through social media affects the textile industry, where the buyer and user are the same, it has also significantly affected the machinery and equipment industry, because customers have started to know much more about all the products in the market, especially through Youtube, than in the past.

This brings the market to a higher competitive environment, allowing it to attract more customer interest with better features than competitors. Thus, the trend of companies to invest in high technologies which are more preferred by customers is increasing. Companies focus on producing new products by applying digital transformation to their existing machines or products. In fact, the added value that will be offered to the customer by digital transformation of machines will be marginal or zero, except for the added value that remote control structures bring.

On the other hand, companies will have the advantage of updating a digitally transformed product in the form of versions, such as versions of a software, and will be able to launch a new product with a feature that can be added with every software update. In recent years, it is an increasing trend to launch new products to the market at short intervals with software releases and minor structural changes, especially in European machinery manufacturers.

**9. Customer Financing**

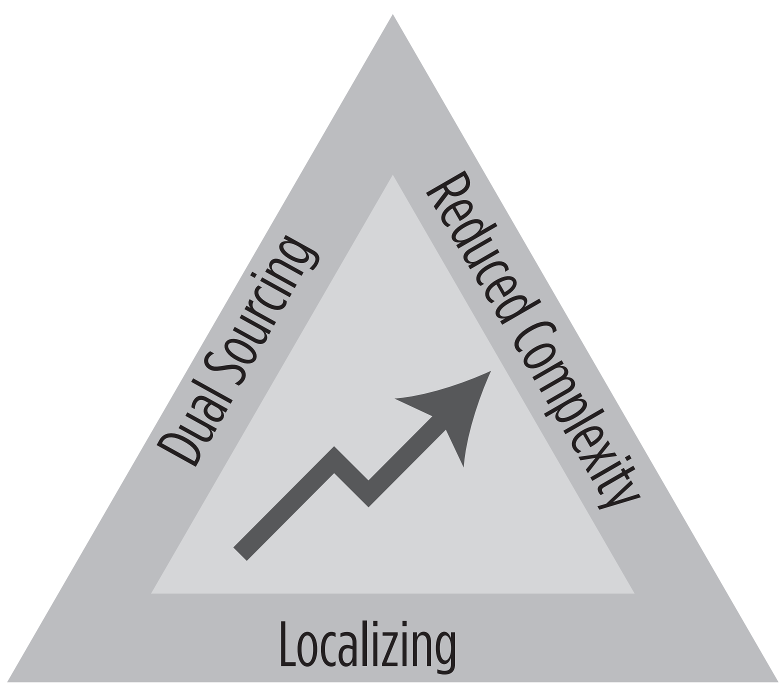
It is seen that especially European and Chinese machinery manufacturers in the world sell their products very comfortably with customer financing options such as 2-year grace period, low-interest 3-year maturity, 2 + 3 model. In fact, these sales can be realized at higher prices than the machines with higher added value. This shows how important customer financing is to create an export market and to retain customers.

**10. Change in Environmental Regulations**

Especially in countries such as Canada, USA and Mexico, it is predicted that the machines that comply with the 5$^{th}$ phase emission criteria by 2025 will have a large market. The EU, on the other hand, has started to implement the 4$^{th}$ phase within the framework of its own regulations and decreased its emission levels within the scope of the Paris Agreement signed in 2015.

**11. Restructuring the Supply Chain**

Among the three ideas proposed to increase resilience to the crisis, Localization, Dual Sourcing and Reduced Complexity are the ones that are recommended to be implemented with priority, and it is an increasing trend in Europe, which tends to give up supply from China (Figure 23). In this way, it is aimed to prevent the interruption of strategic product supply in case of any logistic setback, embargo, commercial restriction.




*[AT Kearney, Building Resilience..., 2021]*

***Figure 23:*** *New Supply Chain Structuring*

## 5.2. Sectoral Trends in the Machinery Sector in Turkey

In addition to global trends, trade wars between America and China, trade restrictions imposed on North Korea, Iran, Syria, Libya, and Venezuela have been effective in almost all regions of the world. Economic and political sanctions imposed on countries have restricted the economic activities of both the country under sanctions and the countries which are trade partners of that country. In addition, geopolitical risks in Turkey directly affect the machinery sector as well as every sector of the manufacturing industry in our country.

The above-mentioned negative developments have led to a loss of momentum in the world economy, while investments in machinery and equipment and the machinery sector have also been negatively affected by this loss of momentum. But companies that evaluate sectoral trends well, especially in our country, continue to experience improvement in their business, rather than being affected by these risks.

**1. Increasingly Rising International Competition**

In addition to having the most qualified human resources, the machinery and equipment sector in our country is the sector consisting of the most innovative, fast-reacting and flexible companies. These are the most important elements in international competition that moves the sector forward compared to its competitors. The sector representatives of our country consist of companies that are export-oriented as well as the national market, attach importance to international marketing activities, and are managed with an export vision.

**2. Implementation of Strategic Actions to Increase Competitiveness**

In our country's machinery sector, new strategies are developed to increase the added value of product groups by providing technology and quality improvements in products and services. On-time Delivery, Modular Design, High Quality Assembly and After Sales Services in Standard Quality are effective values in the machinery sector of our country and are becoming noticeably widespread among sector representatives.

Especially with the Covid-19 crisis, high competition in standard machine production and difficulties in finding new customers have prompted industry representatives to seek new markets in the medium-high and high-tech machinery segments. The number of customers that sector representatives sold for the first time in 2020 with technology-enhanced products has gone far beyond 2018 and 2019.

The importance given to high-tech start-ups that are the driving force and dynamos of technology in the machinery sector is unfortunately low, as in other sectors. Almost all industry branches in our country are inadequate and weak in terms of supporting, purchasing and establishing partnerships with start-ups.

While the awareness of the demand for remote access and automation in the sector is increasing, there is a significant increase in the number of companies that add these features to their products. The Covid-19 crisis has had a compelling effect on companies to take quick steps to switch machines to remote access with a simple adaptation and to increase the level of automation.

There are industry representatives who create a significant competitive advantage by ensuring predictable maintenance. Increasing the share of after-sales revenues in total revenues, which are tried to be guaranteed by preventive maintenance, increases financial resilience by significantly contributing to cash flow during periods when the firm's sales decline or crises occur.

**3. Industry 4.0 and Technological Developments**

Information technology has also been integrated into various parts of companies (management, production, marketing, etc.) for a long time. Although this point is thought to be solved by making an ERP investment in our country's industry, this is a great illusion. A good evaluation of the value that ERP software adds to the product or the customer and the most accurate measurement of its effect will prevent companies from making unnecessary investments.

Although the industrial sector of our country is one step ahead in this regard, it is seen that Industry 4.0 is not fully understood in the machinery sector, and the added value that can be created with its use has not yet been fully recognized. Although there are companies that have a tendency towards Industry 4.0 and started the transition period with restricted applications, it is important to take the necessary steps together with a strategic management plan. The technologies that should be worked on with the New Information Revolution and that should be used to create added value by developing company-specific strategies are as follows:

- Industrial Internet of Things
- Big Data
- Cloud Computing
- Additive Manufacturing
- Robotic Machines
- Augmented and Virtual Reality

**4. Increasing Trend in Outsourcing**

In the machinery sector of our country, it is common for suppliers to be used as outsources depending on the work for orders that cannot be made ready on time, and on a continuous basis for parts produced outside. As branding comes to the forefront, outsourcing of industry representatives, except for critical processes and parts, can reach quite high levels.

**5. Tendency of Customers to Procure Service Instead of Machinery**

In line with the demands of customers abroad, the demand for purchasing systems and facilities instead of purchasing machines and, beyond that, the demand for supplying services instead of purchasing systems and facilities has been a rising trend today.

In order for companies whose competence is not sufficient to supply facilities and systems instead of machines, they must take part in clusters and work according to the understanding of solidarity competitiveness. Examples of such cooperation are still in progress in our country and are improving rapidly day by day. The awareness of benefiting from start-ups that will adapt high technology to the industry in software and system automation issues and establishing partnerships if necessary, is becoming widespread just recently. It is hoped that the number of successful examples of service supply instead of machinery, systems and facilities in our country will increase day by day.

**6. Internationalization and Branding**

Sector representatives have made intensive efforts to find new customers and promote themselves at fairs and abroad for many years on both branding and internationalization using the phrase "Made in Turkey".

However, to provide authorized service abroad and spare parts availability, which is an important step of internationalization for the machinery sector, are elements that can be realized with planned growth and cooperation beyond travel and fair participation. For this reason, this growth must be supported by planned and controllable growth, both in sales and after sales. Despite the increased awareness in recent years, the sector has still not reached the desired level in providing after-sales service abroad.

The percentage of e-commerce usage of the machinery sector is increasing day by day. It is a realistic prediction that the sector's presence in e-commerce will increase faster with the supports.

**7. Customer Oriented Production**

Customer orientation, which is the point where the sector representatives of our country are strongest and gain high competitiveness, ensures that both production and customer complaints are evaluated and the necessary modifications are made in the product quickly and problems are solved with customer-oriented innovation. Timely response to the customer, flexible production and quickly solving problems of customers, have been among the most important factors that increase the resilience of our companies in the sector to crises. These competencies are behind the rapid recovery of the industry and even gaining new customers during the Covid-19 crisis.

**8. Reducing New Product Launch Time**

Unlike European competitors, unfortunately, it is a trend open to improvement in our country. Sector representatives of our country tend to sell cheaper and easily, rather than raising the price by introducing new products. However, the proposition that the introduction of machines combined with a software or even software updates in these machines are launched as a new product which increases the added value as a competitive advantage that works in the market. With the application of the same method by the sector representatives of our country, new product and added value increase can be achieved more easily; so that, while increasing sales and profitability, customer loyalty can also be achieved.

Mergers and acquisitions in the Machinery and Equipment sector have increased in recent years, especially in the EU. One of the reasons for this development is that companies prefer to establish a structure that will gain an advantage by establishing production lines in the market instead of selling individual machines. Chinese companies in the sector tend to purchase branded and technologically advanced machinery manufacturers in the EU in order to gain competitive advantage.

Production in the world machinery sector is shifting towards large companies rather than SMEs. One of the main reasons for this is the requirement for an R&D budget, which is very important to be innovative and competitive in the market. Large companies with this competence have an important share in the machinery production market in countries such as Germany, USA, Japan and China.

**9. Customer Financing**

In addition to added value and competence; financing opportunities that attract customers have also become a major factor in increasing sales. So that machines with lower quality or higher maintenance costs are preferred to be imported by investors only because the provided financing solution is attractive.

**10. Compliance with Environmental Regulations**

In line with the European Union's directives 2012/46 / EU, 2011/88 / EU and 2010/26 / EU and 97/68 / EC directive; there are also practices in Turkey according to the procedures and principles determined within the framework of the regulation for the particle and gas pollutant emissions from the engine to be at certain limit values. In order to comply with the relevant regulations, technological development, certification and standardizing the respect shown to the environment also ensure that the companies have a rising brand image in the eyes of their customers.

**11. Local Production**

There has been a rising trend in National Production specifically in our country due to restrictions, sanctions and even embargoes on some special products that Turkey is subjected to, and it has been strengthened with the consequences of Covid-19 Crisis. This trend has the potential to positively affect the machinery sector, which is the first pillar of the investment. As can be seen in foreign sources (Figure 23 [AT Kearney, Building Resilience..., 2021]), among the ideas proposed to increase resilience against the crisis, Localization and Reduced Complexity are the efforts that should be implemented primarily in our country.

With the Technology-Based Industrial Action Program, there is a comprehensive and wide support for increasing localization in the machinery sector. The areas of support are wide if the sector plans to produce in the NACE codes included in the Program.

## 5.3. Sectoral Trends in the Machinery Sector in TR51 Region

**1. Increasingly Rising International Competition**

TR51 Region is one of the regions with the most qualified human resources in the machinery sector of our country. The dynamics of the sector to be most innovative, fast responding and flexible have been embodied in the majority of Construction Machinery sector representatives in Ankara, which are the leaders of our country's machinery and equipment sector. This is one of the most important factors that move the region forward in international competition compared to its competitors in the construction machinery sector. Regional sector representatives consist of export-oriented companies that attach importance to international marketing efforts and are managed with an export vision [TR51 Focus Group, 2020].

**2. Implementation of Strategic Actions to Increase Competitiveness**

TR51 Region Sector Representatives are very successful in providing On Time Delivery, Modular Design, High Quality Assembly and Standard Quality After Sales Services. Besides, there have been many sector representatives who have closed the year 2020 better than 2019 by adapting new technologies to their products even during the crisis period and increasing the localization rates in their products. Although public procurements have a share in this, there has been a growth in exports in the Construction Machinery sector.

As in all Turkey, the importance given to the adaptation of high technology start-ups, which are the dynamos of innovation and development, to industrial companies is not high in Ankara. There is a potential for development in the region in terms of supporting, purchasing and establishing partnerships with start-ups.

The awareness of the demand for remote access and automation has increased in the region, and the number of companies that add these features to their products has started to increase significantly. Although certain problems of the customer can be solved with this technology, sector representatives in the region should cooperate to establish international after-sales organizations as well. Otherwise, exports of construction equipment that require intensive maintenance face the risk of decreasing day by day [TR51 Focus Group, 2020].

**3. Industry 4.0 and Technological Developments**

Technology-oriented structures such as universities, technoparks, innovation centers, model factories and lifelong education centers are intense in TR51 Region. This intensity enables companies in the region to reach Industry 4.0 and technological developments whenever they want, get support or find companies to cooperate easily. Although there are potential opportunities in the region, a needs analysis should be made on how Industry 4.0 can be adapted to the production environments of the sector representatives and besides the necessary steps to be followed by the company should be defined.

**4. Increasing Trend in Outsourcing**

TR51 Region is a successful and exemplary region where outsourcing and cooperation is intense by distributing the works received by major companies to their suppliers, especially in the Construction Machinery sector. Especially, the leading companies in the Construction Sector, sharing with their suppliers both domestic and international projects/orders they have been awarded; so that this enables the sector to grow, develop technology, stay up-to-date and support solidarity. Ankara Construction Machinery Sector representatives have developed a work flow that will set an example for Turkey [TR51 Focus Group, 2020].

**5. Tendency of Customers to Procure Service Instead of Machinery**

As in all Turkey there are almost no examples of service procurement instead of machinery, systems and facilities in TR51 Region. Instead of purchasing machinery and investing, there is a tendency to purchase the work to be done with the machine or the complete facility installation as a service. This situation allows the contractor companies to become stronger. Contractor companies are growing both as a buyer and a user for the sector. The sector should ensure and increase their loyalty in the medium term by elaborating and diversifying their relations and business practices with these companies [TR51 Focus Group, 2020].

**6. Internationalization and Branding**

Ankara sector representatives pioneered the implementation of the “TURQUM” product compliance brand in order to create a Product Conformity Brand for the machinery sector and to strengthen the image of “HIGH QUALITY TURKISH MACHINERY” in international markets. Sector representatives have documented the standardization in the following details with the "TURQUM" brand:

- Company and production system competence
- Production in accordance with the Quality Management System
- Product Safety
- Product Quality
- Service and after sales services
- Constant surveillance

Although progress is made in the field of internationalization in TR51 Region, the sector has not yet reached the desired level in providing after-sales service abroad. Sector representatives from Ankara express their support and cooperation requests directly and in every channel through NGOs, in order to establish an after-sales point abroad. [TR51 Focus Group, 2020], [Turqum, 2021].

TR51 Region sector representatives faced increased costs and lost profits during the Covid-19 Crisis due to the high costs of transportation from Ankara to the ports. They had to pay $ 4,000 logistics cost from domestic port to Ankara for the goods which have been transported from China to Turkish ports for 4,000 USD. In addition, during the crisis period, while the cost of a truck based machinery was 17-18 thousand USD, the cost of shipping the goods to an export customer reached 11 thousand USD. This situation has had a very negative impact on the competitiveness and profit margin of TR51 Region's Construction Machinery Sector against international competitors [TR51 Focus Group, 2020].

Although, Construction Machinery Manufacturers in TR51 region were mainly able to sell Garbage Collection Vehicles, Sewage Trucks and Canal Opening vehicles before Covid-19, they succeeded to respond quickly to the changing demand with the crisis. During the crisis, they started to produce Disinfectant Vehicles, Pressure Washing, Aircraft Loading vehicles by cooperating with local producers in the Middle East, North Africa and Turkic Republics. Thanks to the advantage obtained with this flexible production competence, they gained new customers and markets during the crisis period, especially in Tunisia, Morocco, Algeria, Turkmenistan, Uzbekistan and Kazakhstan [TR51 Focus Group, 2020].

**7. Customer Oriented Production**

Customer orientation, which is the point where the sector representatives of our country are strongest and gain high competitiveness, ensures that both production and customer complaints are evaluated and the necessary modifications are made in the product quickly and problems are solved with customer-oriented innovation. Timely response to the customer, flexible production and fast solving have been among the most important factors that increase the resilience of our companies in the sector to crises. These competencies are behind the rapid recovery of the industry and even gaining new customers during the Covid-19 crisis.

Apart from customer visits, fairs and sales relations, sector representatives of TR51 Region have a solution-oriented approach especially towards customer complaints and demands they collect. They make maximum effort to use the feedback from the customers in production and new product development. This is an important factor in increasing the competitiveness of the sector in the region and improving itself.

**8. Reducing New Product Launch Time**

Although it is a common strategy to produce new products and try to increase market share in the region, there is no strategy to reduce the time to launch new products to the market. This strategy prevents business and income loss, with an increase in the loyalty of customers who make purchases over time.

**9. Customer Financing**

TR51 Region Machinery Sector representatives are using Eximbank Buyer loan. However, extending the existing interest and maturity range of the Eximbank buyer loan to 5-6-7 years to compete with foreign competitors will provide the opportunity to achieve a significant increase in exports [TR51 Focus Group, 2020].

Since there are many customers which use leasing in the purchase of construction machinery, offering credit opportunities to leasing companies will help to expand customer finance alternatives.

**10. Compliance with Environmental Regulations**

For the construction machinery sector, it is important to comply with the changes in the EU legislation and to produce vehicles / machines that comply with the USA phase 5 criteria for the coming years. The products that will be mostly affected by these regulation changes are farm tractors, excavators, bulldozers, wheel loaders, backhoe loaders, road graders, diesel grass mowers, tree cutters, portable generators, skid-turn loaders and forklifts [Ankara DA, Regional Innovation..., 2019]

**11. Local Production**

The leader of TR51 Region Machinery Sector, the Construction Machinery sub-sector, pay special attention to local production in order to solve the problems they experience in non-domestic product parts, especially the engine and powertrain [TR51 Focus Group, 2020].

As the crisis began, there has been a rapid decrease in raw material stocks within the region since raw material suppliers in TR51 Region have directed their existing stocks of sheet metal, profile, sponge and chipboard to export. But due to the crisis, the supply of imported raw materials to the region increased from 4-6 weeks to 12-14 weeks, and even extended an additional 10-15 days due to the difficulties in customs [TR51 Focus Group, 2020]. On the other side of the coin, there has been the opportunity to produce and sell high quantities of garbage trucks, sprinklers, dumpers and sewage trucks which have very high locality in TR51 region. These two situations have once again clearly demonstrated how important domestic production is in terms of the continuity, durability and competitiveness of industrial production in raw materials and intermediate goods.

In order to increase the state support to be given to domestic goods or to increase the rates of special support for domestic machines; TR51 Region Machinery Sector Representatives should continue their lobbying activities in every possible stage by using the advantages of being in Ankara.

# 6. Current Status of the Machinery Sector

## 6.1. Primary Research Results

### 6.1.1. Surveys

The number of survey responses in the survey conducted within the project for the machinery sector in TR51 region is shown in Table 14 below.

***Table 14:*** *Number of Answers by Sub-Sectors in TR51 Region*

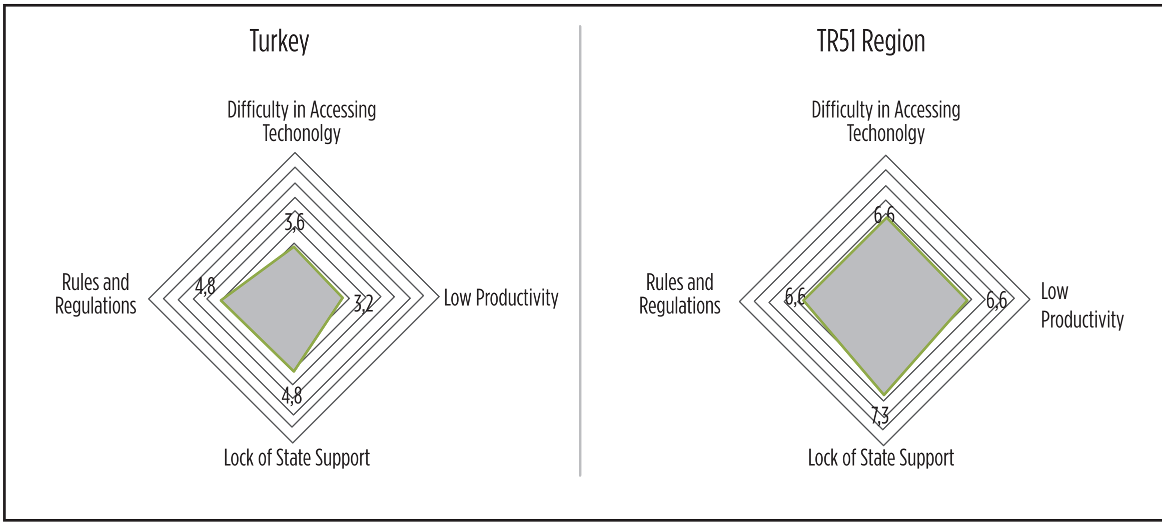
| Sub-Sector Fragmentation | Ankara |
|---|---|
| **NACE 281**<br>Engines and turbines, pumps and compressors, taps and valves, bearings, gears etc. | 2 |
| **NACE 282**<br>Furnaces, burners, lifting, bailing, cooling and ventilation equipment, general purpose machinery etc. | 2 |
| **NACE 283**<br>Agriculture and forestry machinery like tractors, planters, trailers, semi-trailers and combine harvesters, seed graders, animal feed preparation etc | |
| **NACE 284**<br>Machine tools, cutters, hydraulic presses, forged iron etc. metal processing machinery | 2 |
| **NACE 289**<br>Construction Machinery, other tools for wood, stone and rubber. Special machinery for other purposes such as food, textile, apparel and leather production, paper and paperboard, plastic and rubber. | 4 |
| **Total** | **10** |

*[FSR Machinery Sector Survey Results, 2021]*

When looking at the number of survey responses, it is clear that the current number of answers is not sufficient to obtain regionally significant statistical results. The survey study aiming to obtain information about the Construction Machinery sub-sector, which is especially important for the region, is far from the targeted sample numbers and therefore it is not sufficient to represent the Construction Machinery subsector. However, it is also possible to make a comparison based on the responses of the 158 participants participating in the survey across the whole Turkey and the responses from TR51 Region. The comparisons, whose details you can see below, are selected among the criteria that are thought to give an idea about the status of the region, with the risk of differences in perception [FSR Machinery Sector Survey Results, 2021].

The results obtained from the answers to the questions about the difficulties experienced by the companies in the field of Competitiveness are shared in Figure 24 for Turkey and TR51 Region. Looking at the figures, the sector representatives of TR51 Region stated that they perceive a higher rate of difficulty in Difficulty in Accessing Technology, Low Efficiency, Lack of State Support under the title competitiveness.

From the point of view of the region, it can be easily said that the sector representatives of TR51 Region follow the country dynamics and the interaction of the sector with a higher awareness. For this reason, it is thought that the interpretation from the Region is closer to the reality. Also, this Country-Region mismatch in the survey results shows the Strong Civil Society Organization in the region, Technoparks, Universities, Companies supporting NGOs and the general level of awareness of sector representatives interacting with qualified manpower.




*[FSR Machinery Sector Survey Results, 2021]*

***Figure 24: Comparison of Competitiveness Infrastructure from the Perspective of Entrepreneurs***

The results obtained from the questions about Operational Areas where Digital Transformation is Applied are shared in Figure 25 for Turkey and TR51 Region. Looking at the figures, TR51 Region sector representatives see that there is an adaptation process above Turkey in Production, Purchasing and Sales under Digital Transformation, but they foresee that there is less progress in process management applications such as ERP when compared to Turkey.

The results obtained are close to each other, and it seems compatible with the fact that the adaptation of Digital Transformation to the operational processes within the companies is open to development and the potential is high in TR51 Region as in Turkey.

It is stated that the added value that can be achieved through digital transformation will amount to 100 trillion US dollars in the next 10 years in addition to those achieved by conventional production and management techniques [WEF, 2021].

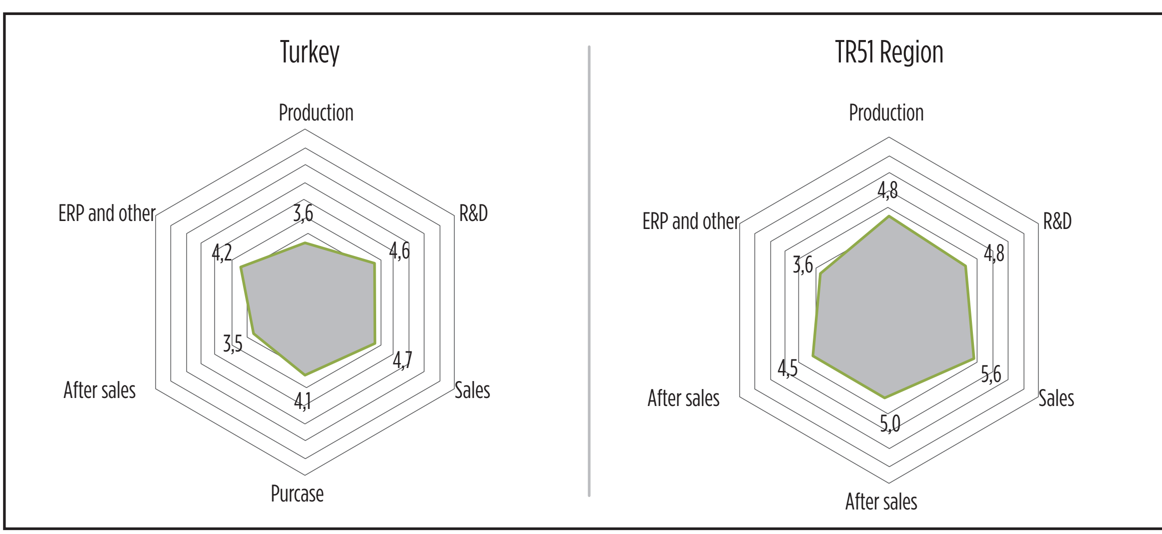
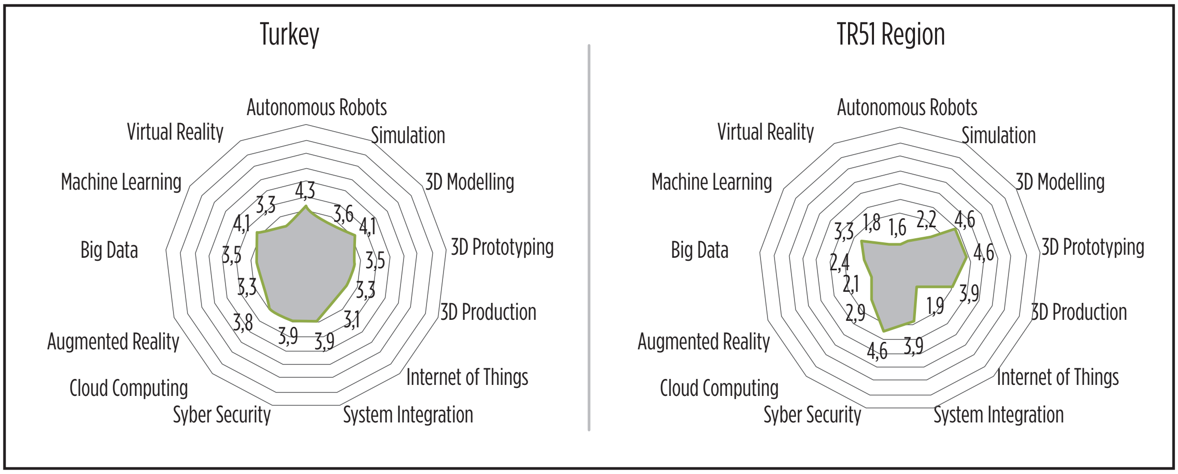



***Figure 25: Comparison of Operations where Digital Transformation is Implemented***

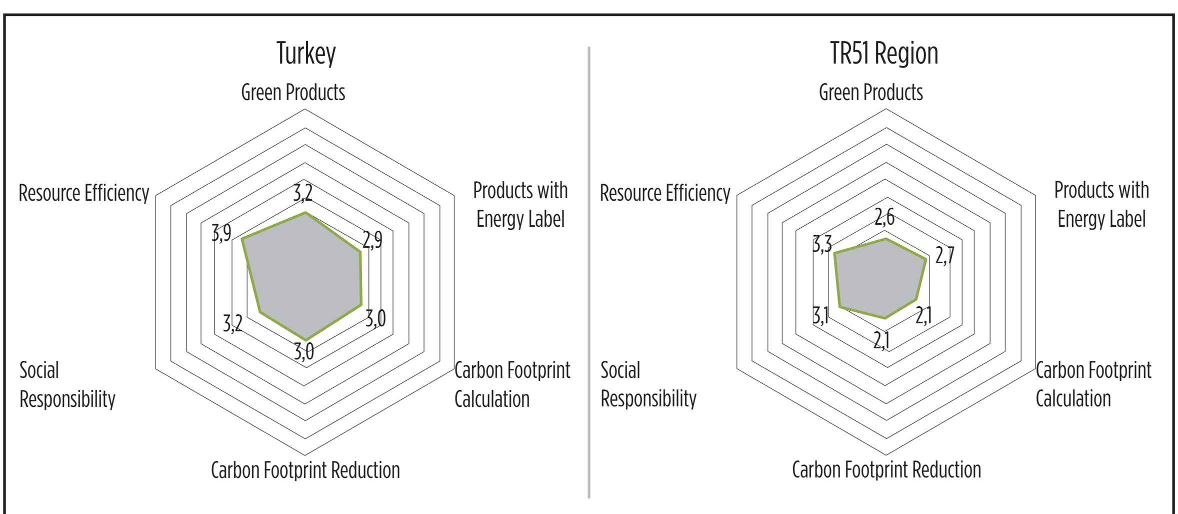
The results obtained from the answers about the Application of Industry 4.0 are shared in Figure 26 for Turkey and TR51 Region. Looking at the figures; sector representatives of TR51 Region stated an application density below Turkey average on Industry 4.0, Virtual Reality, Autonomous Robots, Simulation, Internet of Things and Augmented Reality. These comparison results are considered to be unrealistic w.r.t the dynamics on the field. The sector representatives in TR51 Region are mostly composed of companies that have higher awareness in almost every subject in the fields of Digital Transformation and have performed progresses in the transformation process.




*[FSR Machinery Sector Survey Results, 2021]*

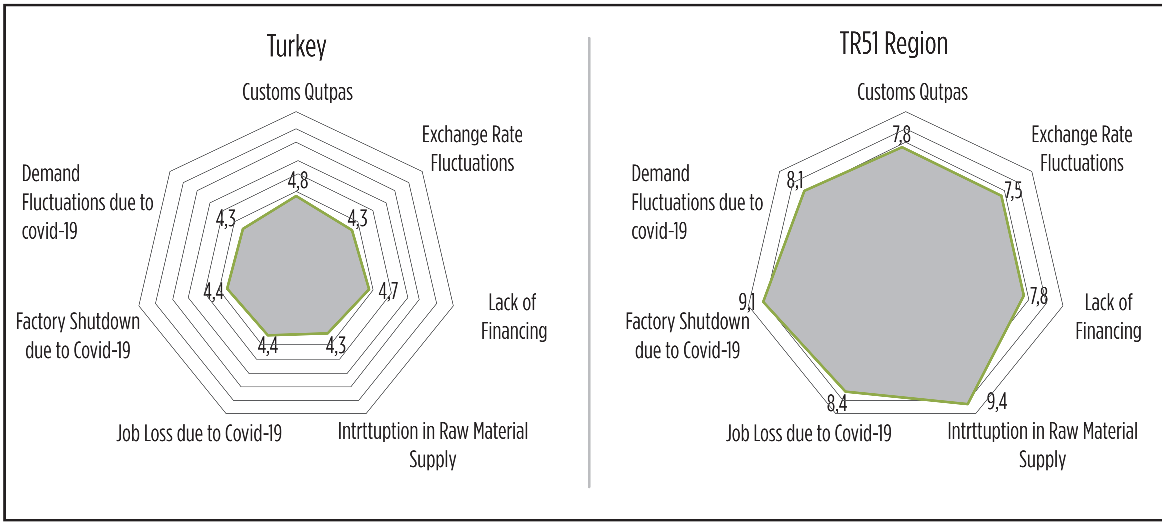
***Figure 26:*** *Comparison of Industry 4.0 Applications*

The results obtained from the answers about Environmental Awareness and Environment-Friendly Production Areas are shared in Figure 27 for Turkey and TR51 Region. Looking at the figures; sector representatives of TR51 Region are in line with the Turkey average in Environmental Approach and Production. However, considering the effects of climate change that are felt even in our country today, it is obvious that this will be the most important issue of the next 10 years. For this reason, it is very important to comply with the decisions to be taken on Green Production in target markets in terms of both commercial growth and respect for the environment. Progress should be made with decisive actions on the development potential that exists in both Turkey and TR51 Regions in terms of environmental production.




*[FSR Machinery Sector Survey Results, 2021]*
***Figure 27:*** *Comparison of Environmental Awareness and Environmentally-Friendly Production*

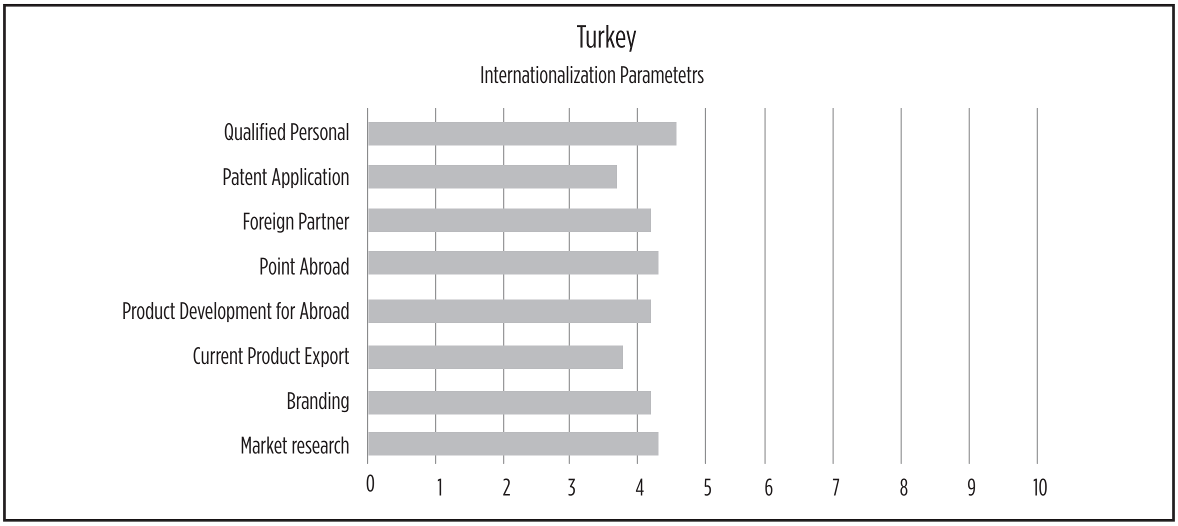
The results obtained from the answers about Sustainability are shared in Figure 28 for Turkey and TR51 Region. Looking at the figures; sector representatives of TR51 Region stated that they experienced sensitivity far above Turkey average in every issue under the topic of Sustainability. Factory Shutdown, Job Loss, Demand Fluctuation and Raw Material Supply Constraints especially due to Covid-19, have been the areas of trouble in the region [TR51 Focus Group, 2020].

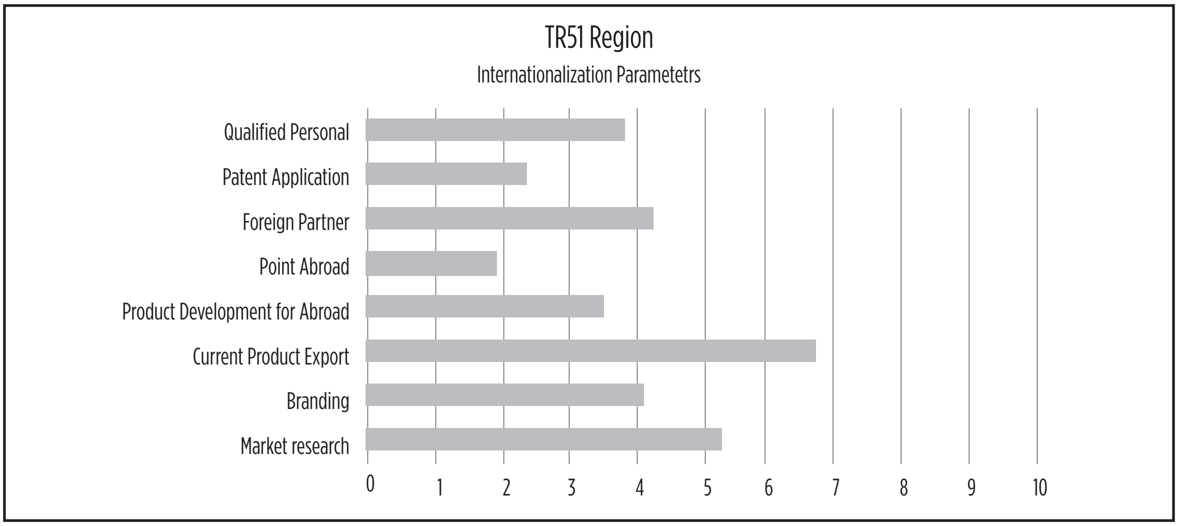



*[FSR Machinery Sector Survey Results, 2021]*
***Figure 28:*** *Comparison of Sustainability*

The results obtained from the answers about "internationalization" are shared in Figure 29 for Turkey and TR51 Region. Looking at the figures; while the sector representatives of TR51 Region have a position below Turkey average in "Patent Application and Abroad Restructuring", it is seen that they are above Turkey average in Exports of Existing Products and Market Research. Although the machinery sector throughout Turkey is inadequate in Patent Applications and Abroad Structuring, the lack of organization especially in abroad aftersales is felt much more in TR51 Region due to the fact that it has a sub-sector structure focused on Construction Machinery. The necessity of establishing an international After-Sales Organization by the sector representatives of TR51 Region by acting together and making use of the state support, manifest itself clearly in the results [TR51 Focus Group, 2020].

It is understood that there is a development potential in internationalization both throughout the country and regionally, from the fact that the scores of the questioned criteria could only approach 5 points out of 10. Export is absolutely essential for sector representatives with capacities above the national market demand to develop, make profit, and invest in product development and innovative technologies with these profits. It is indispensable to meet the internationalization criteria for export.

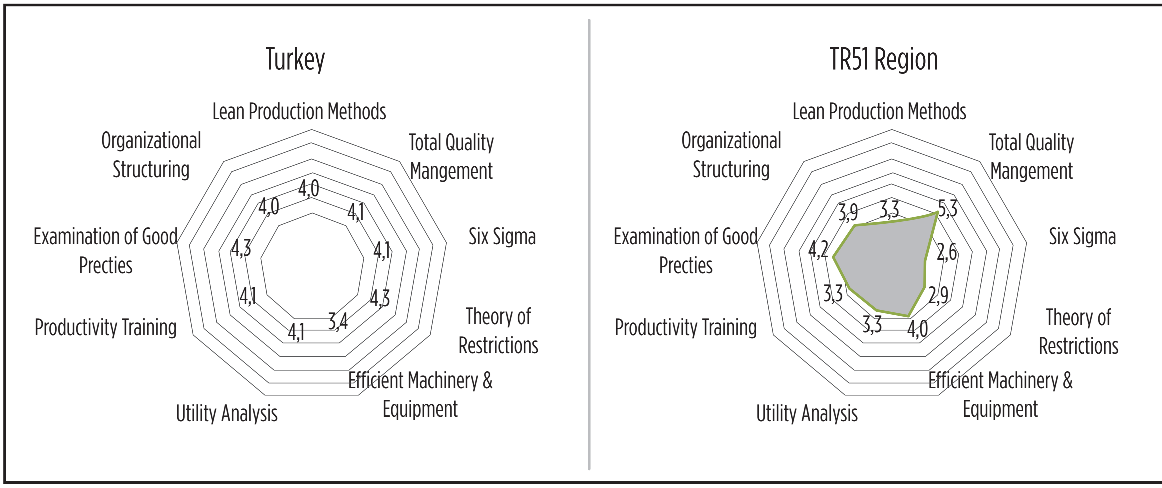



*[FSR Machinery Sector Survey Results, 2021]*
***Figure 29:*** *Comparison of Internationalization Criteria*

The results obtained from the answers about Productivity Focus are shared in Figure 30 for Turkey and TR51 Region. Looking at the figures; sector representatives of TR51 Region have a position above the Turkey average in Total Quality Management and Efficient Machinery & Equipment under the title of "Productivity", while they are below the average of Turkey in Six Sigma, Theory of Constraints, Productivity Utility Analysis and Productivity Training. When this situation is evaluated, it is seen that the knowledge and application competence of TR51 Region on Total Quality Management is already quite sufficient, while a development potential is seen in focusing on productivity-enhancing studies including different management and systematics.

Also across the country; the necessity of a more intensive implementation of productivity studies that will provide both increase in quality and added value and decrease in costs with productivity-oriented work, embedding productivity culture in production and continuous improvement clearly manifests itself in the region.




*[FSR Machinery Sector Survey Results, 2021]*
***Figure 30:** Comparison of Productivity Criteria*

### 6.1.2. Focus Groups

Among the participants were mainly representatives of the Construction Machinery sector, as well as the participants of NGOs such as Turkish Machinery Federation, OSTİM CCM Cluster, Ankara Chamber of Industry, Machinery Exporters Union.

In the Machinery Sector Focus Group, the opinions and suggestions of the sector representatives and stakeholders were listened to in 4 groups in Ankara Region and ideas on related issues were exchanged mutually. Within the report, the outputs of the Focus Group work were utilized to the maximum extent specific to the region.

The following questions were sent to the Focus Group participants in advance as the meeting agenda and they were expected to make preparations. During the meeting, each question group was asked one by one to the participants, and the answers, ideas and suggestions of the whole group were received. The question groups shared as the meeting agenda are as follows:

**1st Group of Questions**

What was the situation in the sector before Covid-19?

How is the current situation after Covid-19, are there new trends emerging?

What are the 2021 forecasts for the sector?

How will the sector be affected if the Covid-19 pandemic ends in the medium-long term (1-3+ years)? What are the scenarios they foresee?

**2nd Group of Questions**

What are the national trends in the sector and what are the regional repercussions of these trends?

What are the sectoral trends specific to the region?

Which province stands out in the region in which sub-sector, why?

What are the needs and demands of sector representatives in the region?

What are the strengths and weaknesses of the sector in the region?

What are the opportunities and threats faced by the sector in the region?

What are the aspects open to development in terms of competitiveness in the region?

**3rd Group of Questions**

What are their thoughts on the following horizontal issues specific to the sector?

(Managing the pandemic crisis, Energy Efficiency, Climate Change, Gender Equality)

**4th Group of Questions**

What are the national and regional short, medium and long-term strategy proposals?

What are the sectoral actions that can be taken in the region, how much can the estimated budgets of these actions be?

What are the governmental policy recommendations?

Below is a summary of the responses to the above questions during the Focus Group Meetings:

**TR51 Region Machinery Sector Focus Group Meeting Summary**

It was stated that before Covid-19, rather than the effect of global fluctuations, the course of the sector in the region contracted with the effect of exchange rate fluctuations at the Turkish economy in 2018, the wounds began to heal as the exchange rate movements ceased in 2019, and a good introduction was welcomed for 2020.

Although there are fears of contraction in the sector along with Covid-19, the Turkish market has grown by 70% in the construction machinery sub-sector due to the impact of Public Purchases and large infrastructure projects which are either under construction or budgeted by municipalities. Orders for pandemic-specific products, such as mobile clinics, disinfection units, have also supported the sector stand straight with additional orders.

Covid-19 has had a serious impact on business life; the fact that white collars can work remotely has been well digested. There have been serious problems in the supply of vehicle engines and drivetrain with the disruption of supply chains. The fact that the supply chain is located in nearby regions and, if possible, in the country has settled in the minds of manufacturers as a growing trend. Besides; transportation to ports, which are very expensive with existing logistics channels, caused the construction machinery sector to suffer serious costs and lose its competitiveness due to heavy transfer loads, while reduced flights and rising shipping costs due to Covid-19 significantly reduced the competitiveness of the region against China and consequently caused losses in orders.

It became clear for the sector representatives that industry 4.0 began to enter the sector quickly and showed itself firstly within communication and autonomous machines. A period has started when customers tend to buy services rather than products, and demand for services has increased. Also, how much occupational safety and employee health are critically important to the company's existence has been the first proven fact with the beginning of the pandemic.

Sector representatives expressed the need to make the fastest progress on the following issues, especially after Covid-19;

- Innovative and production-oriented training,
- Updates and innovations in the legal system,
- Public purchases of domestic goods,
- Increased informatics within companies,
- Being a brand whose image has been strengthened with government support such as Turquality,
- Development of national and international rail and maritime transport strategies and even government policies to increase exports by reducing transport costs,
- Focus on innovation and development rather than R & D
- Development of export financing instruments at a level that can compete with international competitors,
- Compliance with the European Green Deal,
- Green production and institutionalization

It has also been stated that reducing the carbon footprint, green products, green production are prerequisites for achieving satisfactory progress in the harmonization with the European Consensus and for the sector to be competitive in Europe for the upcoming period. TR51 Region

Focus Group Participant List is in ANNEX.1 It has also been stated that reducing the carbon footprint, green products, green production are prerequisites for achieving satisfactory progress in the harmonization with the European Consensus and for the sector to be competitive in Europe for the upcoming period. TR51 Region Focus Group Participant List is in ANNEX.1.

## 6.2. Sectoral Analysis

### 6.2.1. TR51 Region Machinery Sector Value Chain Analysis

Value chain is essentially a systematic method to examine the development of competitive advantage. In this respect, the model is used as an useful analysis tool in identifying the main competence areas of an organization and determining the operations that are effective in gaining competitive advantage. It is not possible to understand the competitive advantage by looking at an organization in general. The competitive advantage arises from the different operations that the organization performs, such as design, production, marketing, delivery and product support services.

In order to better understand the operations that attracts competitive advantage, it is necessary to start from the value chain with its general scope and then to identify the appropriate operations specific to that organization or structure. The competitive advantage of an organization stems from its ability to outperform its competitors in key operations in the value chain.

Competitive advantage depends on whether the organization performs its value-creating functions at a cheaper cost than its competitors or offers its products to the market at a high price by differentiating their quality and functions. Therefore, differences from competitors provide competitive advantage to the organization.

In other words, value chain is a method of dividing the firm's operations into strategically important operations and understanding the effects of these operations on cost and value. Value chain is essentially a systematic method to examine the development of competitive advantage. In this respect, the model is used as an analysis tool to identify the main competence areas of a company or the whole sector and to determine the operations that are effective in gaining competitive advantage.

While preparing the simplified value chain belonging to the machinery sector in Figure 31, machinery sub-sectors in our country are listed according to the added value they create and the size of the added value they produce has been rated with box sizes. (The added value of Agriculture and Forestry Machinery is US $ 2.316 million according to 2019 data) [MAKFED, 2021]

The added value produced by sub-sectors increases from left to right and from top to bottom. After the sub-sectors, operations that create added value are listed considering the current structure of the machinery sector in our country. These operations are also the ones that create higher added value from left to right from top to bottom. The added value creation potential of these operations is also proportional to the box sizes.

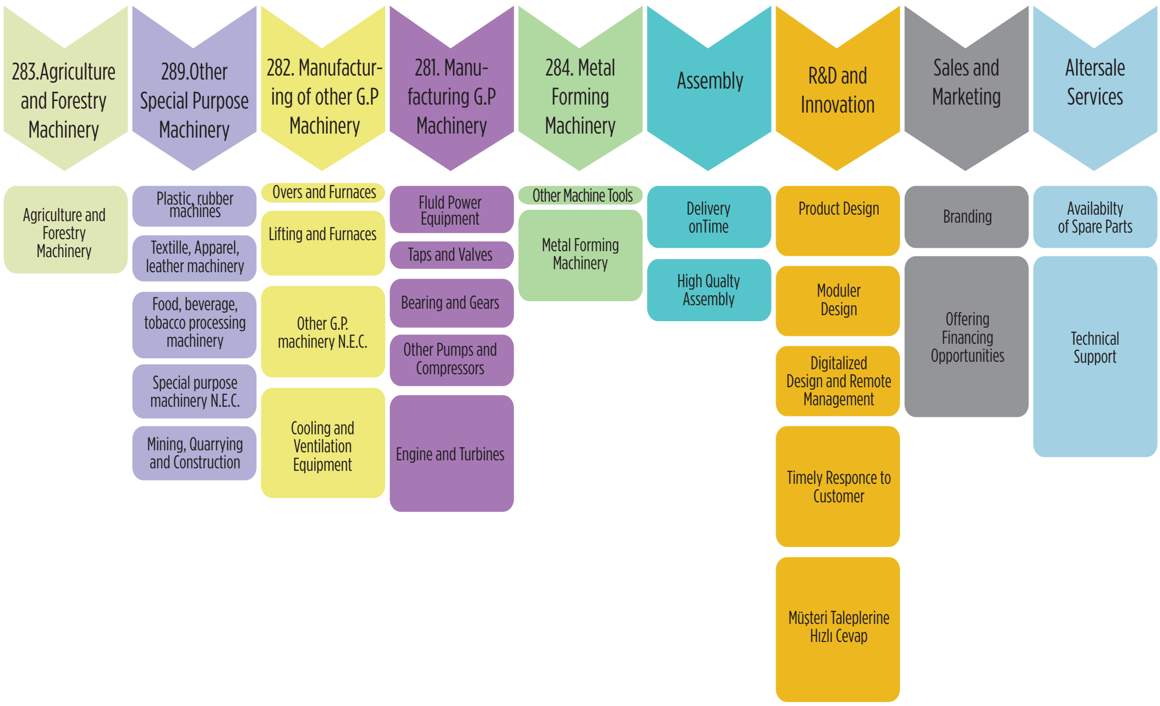



***Figure 31:*** *Simplified Value Chain for the Machinery Sector*

Figure 32 shows the simplified value chain of the Construction Machinery Sector, the largest sub-sector of the Ankara Region. Analysis of the value chain will be covered in the Sector Gap Analysis.

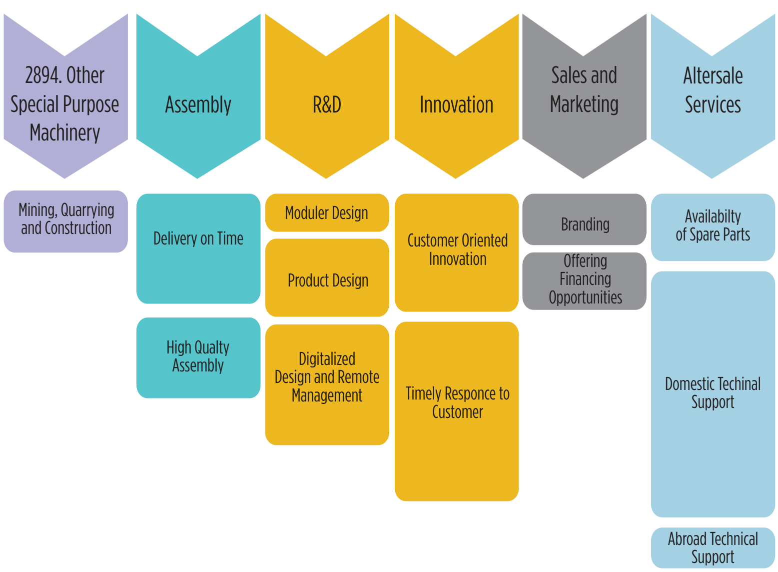



***Figure 32:*** *Simplified Value Chain Analysis for Construction Machinery*

### 6.2.2. TR51 Region Machinery Sector PESTEL Analysis

PESTEL analysis, which is made to provide input in determining the opportunities and threats for short, medium and long-term strategies, by evaluating the effect of macro developments on political, economic, sociocultural, technological, legal and environmental scales in the distant environment of the enterprises of machinery sector in TR51 Region is shared in the table below.

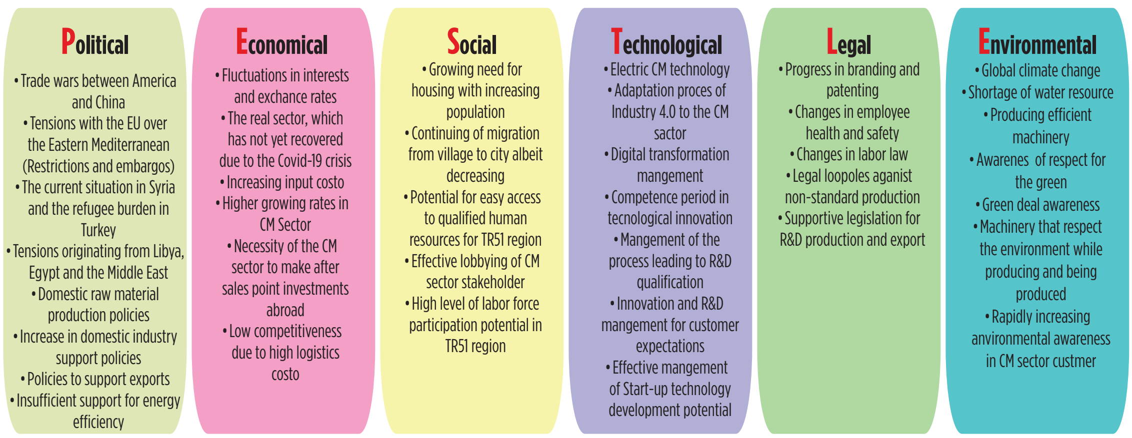



***Figure 33:****PESTLE Analysis for the Machinery Sector in TR52 Region*

### 6.2.3. TR51 Region Machinery Sector SWOT Analysis

The strengths and weaknesses of TR51 region and the main issues creating Opportunities and Threats for the region in line with the data obtained from secondary sources and the information obtained from the focus group meetings are presented in the table below.

| STRENGTHS | WEAKNESSES |
|---|---|
| • Strong organization in CM sector<br>• Strong sectoral clustering within CM sector<br>• Capability of flexible production<br>• Advanced collaboration and distribution of work as a model<br>• Qualified manpower, especially high quality engineer resource<br>• Competence in R&D<br>• Export oriented production<br>• Customer focus and rapid response to requests<br>• Open to innovation and entrepreneurial sector representatives<br>• Intensity of construction investments in Turkey<br>• Public administrations and main contracting companies being in Ankara<br>• Strong experience from CM Sector in the region<br>• After-sales service<br>• Stronger TURQUM brand | • Lack of institutionalization<br>• Lack of common standards in products and processes<br>• Lack of marketing plan<br>• High logistics cost in maritime and rail transport<br>• Lack of abroad after-sales organization<br>• Insufficient resources and attention to design and R&D,<br>• Inability to reach markets with development potential<br>• Lack of compliance with environmental standards<br>• Lack of qualified staff<br>• Lack of qualified education and insufficient vocational schools<br>• Lack of domestic production of engine and powertrain in CM Sector<br>• Lack of high added value, original strategic product<br>• Lack of sharing technology among industry representatives<br>• Lack of using digital opportunities in internationalization |

| OPPORTUNITIES | THREATS |
| --- | --- |
| • Increasing IOT, Remote Access and Autonomous Product expectations in the CM Sector<br>• “Made in Turkey” label that can be positioned correctly<br>• Industry-Industry Cooperation<br>• Increasing trend in national production due to restrictions and sanctions<br>• Inclusion of Turkey to European supplying network<br>• Companies with the potential to create brands<br>• Young and dynamic population structure<br>• High production cost in developed countries<br>• Significant number of companies in the region to produce in accordance with international standards<br>• "European Turkey" image in the Far East<br>• Increasing construction demands in nearby geographies<br>• Increasing trend in procuring services instead of product ownership<br>• •Increasing demand for technology contracting<br>• Model factory and productivity studies | • Division and shrinkage of growing companies in CM Sector<br>• Foreign dependency in important parts of products<br>• Low-price policy implemented by low-tech companies<br>• Increasing imports of Asian and Far Eastern Machinery<br>• "Made in China" strategy and tendency to sell cheap products in Far Eastern countries<br>• High competitiveness thanks to China's freight support<br>• Covid-19 crisis repeating with attacks or pandemic process not ending within 2021<br>• Slow tendency in transition to Industry 4.0<br>• High input (energy, raw material) costs<br>• Qualified personnel going abroad due to conditions of country / loss of qualified workforce |

### 6.2.4. TR51 Region Machinery Sector Five Forces Analysis

This analysis is based on the data obtained from the surveys and the information obtained from the remarks of the sector stakeholders in the Focus Group meetings.

Porter points out that competition in industry is influenced by five competitive power factors that shape the industry. According to Porter, the industry structure consists of the threat from new companies entering the sector, the threat from substitute products, the market dominance of the suppliers, the power of the buyers and the intensity of the current competition. These factors affect the strategies that businesses will determine according to each other and their understanding of competitive advantage.

Understanding the forces that shape sector competition is the starting point of strategy development. Each company needs to know the average profitability of its sector and the change it has undergone over time. Five Forces reveal why sector profitability is in its current state. Only then a company can incorporate sector conditions into its strategy. Five Forces reveal the most important aspects of the competitive environment. They also provide the basis for measuring a company's strengths and weaknesses. Porter Five Force Analysis is a framework for measuring the level of sectoral competition and developing strategies based on it. Firms can build their core competencies, business models or networks to achieve a profit above the industry average. But we can say that an "unattractive" sector for investment is one where the combination of these five forces acts to reduce overall profitability.

In the analysis, there are 4 competitiveness together with "Competition in the sector" to see the process; “Threats from New Companies”, “Market Dominance of Suppliers”, “Threats from Substitute Products” and “Power of Buyers”.

The scoring specified according to the results of the survey was made according to the following principles. The answers between "Very Low" and "Very High" in the survey were scored between 1 and 10. Accordingly;

**- Threats from New Companies:** What is the rate of convenience for a new company to enter your market?

(1: Very Low 10: Very High)

The score in the analysis is 4.3, representing that the threat from new companies is "low".

**- Power of Suppliers:** What is your dependency on a limited number of suppliers?

(1: Very Low 10: Very High)

The score in the analysis is 6.5, which represents the strength of the suppliers as "high".

**- Power of Buyers/Suppliers:** What is your dependency on a limited number of buyers?

(1: Very Low 10: Very High)

The score in the analysis is 4.8, representing that the strength of the customers is moderate.

**- Threats from Substitute Products:** What is the danger of having equivalent / substitute products in the market?

(1: Very Low 10: Very High)

The score in the analysis is 6.5 representing a relatively high level of substitution threat.

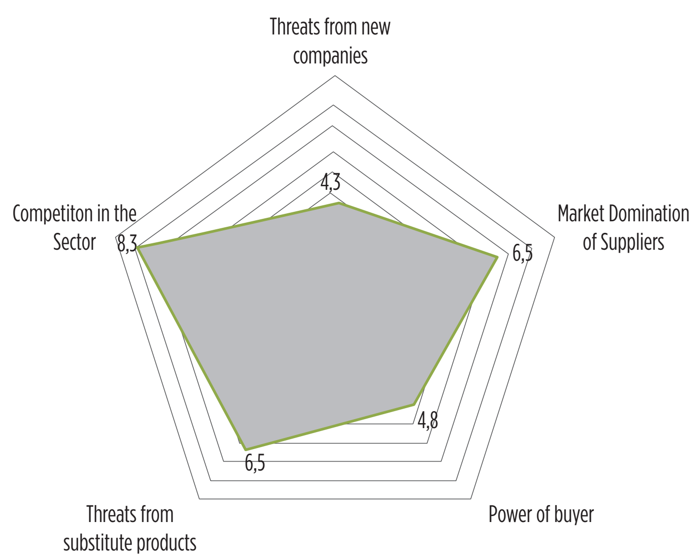
**- Competition: What is the Level** / Intensity of Competition in the Sector?

(1: Very Low 10: Very High)

The score in the analysis is 8.3, which represents the high level of competition in the industry

(1: Çok Düşük   10: Çok Yüksek)

Analizdeki puan, sektörde ki rekabetin yüksek seviyesini temsil eden **8.3'**tür.




*[FSR Machinery Sector Survey Results, 2021]*

***Figure 34:*** *Figure 34. Survey Answers for 5 Forces Analysis of TR51 Region's Machinery Sector*

**Threats from New Companies**

Newcomers to an industry have the desire to gain market share that suppresses the price, cost and rate of investment required to compete in the market. Therefore, the threat of entry has an impact on an industry's profit and growth potential. When the threat is high, existing companies in the market may move towards making a new investment to lower their prices or compete with new companies. Threats from new companies in TR51 Region has been designated as "Low-Medium" considering the high investment cost, high requirements for profitable operations, and the size of the new investment in the sector.

**Market Dominance of Suppliers**

Strong suppliers can capture more value by demanding higher prices, limiting quality or services. Supplier power in the region is at "Medium-High" level due to density, replacement cost and differentiation. In this sense, it should be noted that the main inputs of the sector depend mainly on import products.

**Power of Buyers**

Strong Customers can capture more value by driving prices down, demanding better quality or more service (thus increasing costs) and often at the cost of destroying industry profitability. According to the sector participants, the buyer power did not appear to be threatening due to the medium bargaining power of the customers, medium exchange cost, existence of illegal practices and product differentiation.

**Threats from Substitute Products**

Companies in the region feel the threat of market substitution, albeit to a lesser extent. Industry profitability suffers when the threat of substitution is high. Substitute products or services limit the sectoral profit potential by suppressing prices. Mainly, this situation is valid due to international competitors and their products. But when it is evaluated for regional companies with high exports, it is triggered not only with the product itself, but also through indirect means such as providing better financial conditions and branding power.

**Competition in the Sector**

Competition between companies is in the form of quality, price, new product promotions, advertising campaigns and service improvements. The nature of competition takes a different form today, with joint action and cooperation that offer new ways to compete in the sector. Also, technology is reshaping the competition. As a result, it was found in the analysis that the sectors in the region have a "high" level of competition. Capacity, product differentiation level, number of companies and the continuation of growth in the sector are the main drivers of competition

### Suppliers' Market Domiance
(Medium Low)

- The number of suppliers is not small, easy to access
- High maturities provided by the supplier
- Sources and presentation alternatives of the supolier are not few
- Supplier switching costs can be higher depending on the supplier
- Alternative sources are not enuogh
- The product is not different and has the ability to create loyalty
- Supplier have bargaining power
- The need for supply is not low

### Threats from New Companies
(Low-Medium)

- High investment cost
- Succes is not easy with single product
- Companies can enter the market as the supplier of main brands
- Copying is not easy
- Selling final products is hard or there is fixed number of buyers
- Sector business potential is not low
- Sector profitability is not high
- Branding can take a long time
- Low-Medium level bureaucratic obstacles
- Low-Medium learning curve

### Compeititon in the Sector
(High)

- High number of competitors
- High variety of products
- Numerous and equal competitors
- The growing market
- The cost of switching suppliers is high
- High fixed costs
- Large companies have high promotional power
- Branding is important
- Financial burderns are high
- There are dominant leaders in the market
- Medium competitor diversity

### Threat from Substitute Products
(Medium-High)

- Medium risk for change
- High potential for change in product properties depending on the techonology
- Availability of products with a completely new techonology
- High tendency towards service procurement
- Information available in the market on substi-tute products

### Power of Buyers
(Medium)

- The number of customers is not low
- Contracted work, order-based production
- Purchases are not high
- No tendency to hold stock
- Brand perception available
- Demand for low price is not low
- Medium bargaining power
- Quality matters as much as price

***Figure 35:*** *TR51 Region Machinery Sector 5 Forces Analysis*

## 6.3. TR51 Region Machinery Sector Gap Analysis

The sectoral GAP analysis is shown in Figure 36, which has been prepared by showing the potential progress area that should be filled for the sector in each field through the simplified value chain.

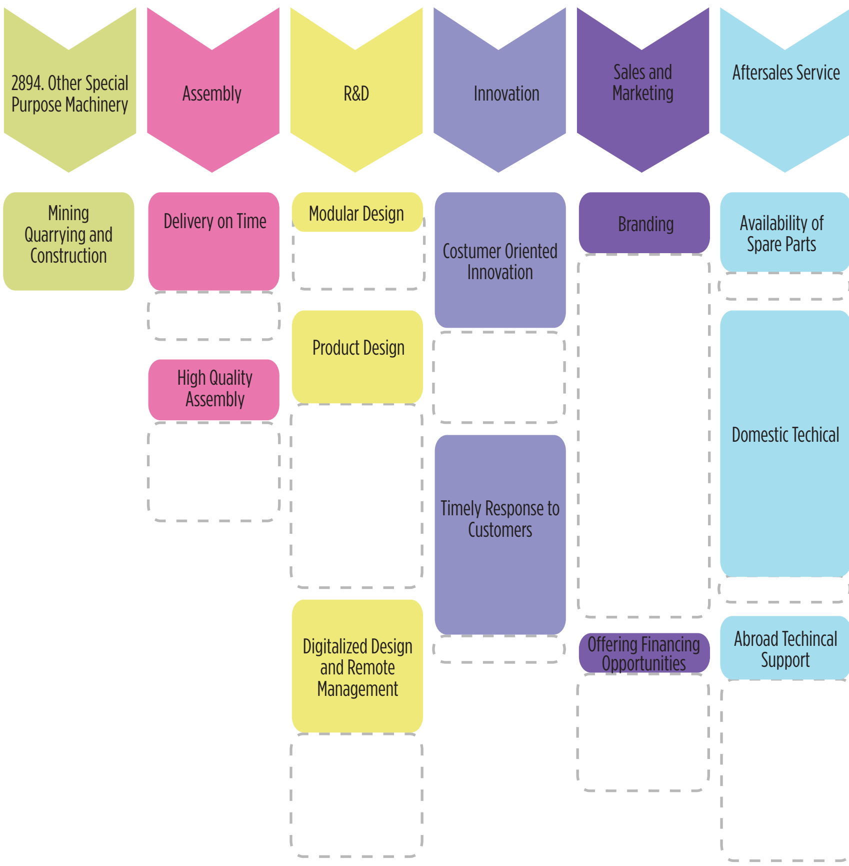



***Figure 36:*** *TR51 Region Construction Machinery Sector Gap Analysis*

**On-Time Delivery:** It is very important in the eyes of customers and if there is nothing to reduce customer satisfaction within the product, is the strongest competitive feature. The value given to the customer, the promise of the enterprise and loyalty to job have the power to increase the image and brand value in the eyes of the customer.

The sector has sufficient power in this title, but the necessity to resolve the disruptions in the supply chain due to the logistical difficulties caused by Covid-19, enlarged the gap at this point.

**High Quality Assembly:** In Construction Machinery sector, for the products that are not ready-to-use but require assembly, high quality assembly has a positive effect on the added value that the machine will provide to the customer. Especially in foreign sales, there may be cases where ongoing orders from the same customer are lost only due to problems in assembly quality. The problems experienced due to travel restrictions caused by Covid-19 enlarged the gap at this point [TR51 Focus Group, 2020]. Augmented reality and virtual reality technologies and the technologies developed in the field of assembly will help to fill the gap here.

**Product Design:** With the Ministry of Industry's and Technology "R&D Center" application, 174 sector representatives across Turkey established R&D centers. There are 18 R&D centers in Ankara in the Construction Machinery sector. 365 Design centers have been established in Turkey and there are 5 Design Centers in Ankara in Construction Machinery sector. The sector has the potential to create added value that will reach much more targets than its current position if it focuses on developing original new product designs with its own R&D studies.

**Modular Design:** It is a method that must be applied in order to reduce the logistics costs that doubled during the Covid-19 crisis and to achieve better competitiveness and increase value added. The manufacturers which diagnosed the gap here and transformed their products into modular products, have differentiated themselves from their competitors by reducing the storage of end products, logistics, installation of the product at the customer site and all related costs. The gap at this point is open to development for the sector, in general.

**Digital Design and Remote Management:** When sector representatives collect and evaluate customer complaints with a goal of customer satisfaction, it creates a serious development motivation in companies. With this motivation, improvements have been made in the field of services, as well as improvements in operations and logistics. Most companies have installed remote control systems on their machines in order to instantly intervene in the troublesome situations that customers experience in machine use. In this way, they had the opportunity to solve the instant problems of the customers. At this point, the gap in the sector has been determined beforehand and started to be filled before the planned dates with the effect of Covid-19 crisis. However, there is still a gap across the sector and in order to close this gap, it is critical to recruit strategically important engineers and technicians who will bring this technology to the company.

**Customer Oriented Innovation:** Customer complaints from after-sales activities are accepted as important feedbacks to increase customer satisfaction by the machinery sector representatives. These feedbacks triggered the process of generating solutions by developing technology or changing operations to solve problems, and ultimately led to increased competitiveness in the company. These capabilities have enabled the product to be continuously improved in line with customer expectations and to gain competitive advantage in the short and medium term over competitors who do not have the same value but try to develop products directly through R&D. Because, although the same raw materials and production technology are used like the competitor, the changes and innovations made in operations without losing time in order to gain space, volume and process efficiency lead to the production of machines that produce higher added value or meet different customer demands. This process has an ongoing continuous improvement cycle.

The sector has a high added value in this area. However, it can be said that there is always a gap in terms of adapting to the recently developing technology and changing customer demands.

**Timely Response to Customer Demands:** Timely response and flexibility are vital for the firm to easily navigate from the crisis environment to the non-competitive zone, especially in times of crisis. During the Covid-19 crisis, construction machinery sector representatives reacted quickly using these capabilities and were less affected by the effects of the crisis. There is still a gap to be filled in terms of the principle of continuous improvement by adapting to the developing technology.

**Branding:** Although the exports of the regional sector representatives are high, it is obvious that they lag behind their European competitors in brand awareness and brand image creation. For these reasons, establishing a sales and marketing company in countries with high brand image and trying to sell the products produced in Turkey with different country origins is expressed as a solution applied by many regional representatives.

With the TURQUM brand, in which sector representatives are included, a sectoral alternative has been created in terms of branding.

The TURQUM Brand is a certification system that certifies the following standards for the Turkish machinery sector,

- Company and production system competence
- Production in accordance with the Quality Management System
- Product Safety
- Product quality

- Service and after sales services
- Constant surveillance

**Offering Finance Opportunities:** Sector representatives cannot compete with the financial alternatives offered by their European competitors in sales financing. It is difficult to compete as competitors, can offer alternative financing or grace periods. The difficulty, sector representatives encounter to sell their higher quality products in national market even at lower prices, indicates the development potential of this value.

There are many customer financing alternatives such as 5-6-7 years of low interest loans, leasing financing, buyer financing that can compete with Hermes and Coface which are open to development and form the gap in this value.

**Availability of Spare Parts:** Although largely seen as a fulfilled value, this problem manifested itself during Covid-19 crisis within the difficulties experienced in the supply of parts which is dependent on foreign suppliers. Spare parts availability for products sold abroad is a value that can be fulfilled more successfully with effective international after-sales organizations.

**Domestic Technical Support:** Domestic technical support is an important added value, and it is the first requirement to work in the field, especially for Construction Machinery. Filling the gaps of adaptation to new technological developments will increase its value.

**Foreign Technical Support:** Foreign technical support has a gap where Construction Machinery industry is open to development in terms of added value and is difficult to fulfill with individual efforts of companies. Progressing by individual efforts with new technologies and remote management will be beneficial in this regard, but these are solutions with a partial added value. Taking into consideration of the fact that a construction machine is under constant maintenance and monitoring, concrete and customer-satisfying actions should be taken with fast and rigid steps to fill the gap in this value with sectoral merger and government support for constantly reliable and growing export figures.

# 7. Horizontal Issues

## 7.1. Crisis Management

The Covid-19 pandemic caused a significant contraction in the world economy and trade in 2020. The assumptions that the pandemic will take place in a single wave, that it will be taken under global control at the end of the summer months and the vaccine will be found and implemented in 2021 are the basis of optimism in predictions regarding the world economy and trade.

During this period, as in all sectors, the representatives of the machinery sector in the region were directly exposed to the effects of the crisis. Some companies have been able to show high resistance to the crisis. This endurance has been achieved thanks to their ability to quickly implement the solutions they developed with innovation to customer demands with their flexibility in production. Synchronized operation of these three is the definition of resilience in a crisis period [AT Kearney, How to Rebound..., 2021] .

**Resilience Against Crisis = Timely Response to Customers + Innovation + Flexible Production**

In addition to fast response, innovation and flexible production specified in the formula; coordination with global logistics chains, increasing new methods of production and establishing inter-company cooperation to solve the problems encountered, have also been efforts to increase resilience against the Covid-19 Crisis.

In response to the Covid-19 Crisis, the Manufacturing Industry and Machinery Sector has taken hygiene and social distance measures in the workshop and business services in general to minimize the impact of the virus on production and employees with chronic illnesses and / or those over 55 years old were given the opportunity to take leave. [TR51 Focus Group, 2020].

In crisis management, additional precautions were taken in order to prevent strategic personnel with high added value from being out of work due to illness, and difficulties in operational processes.

## 7.2. Resource Efficiency

Resource efficiency is defined by the United Nations Environment Program (UNEP) as the sustainable production, processing and consumption of natural resources, as well as the reduction of negative environmental impacts during the production and consumption of products throughout their entire life cycle.

### Energy Efficiency

When it comes to resource efficiency, the first thing that comes to mind is energy, water and raw material efficiency. In reducing greenhouse gas emissions in the industry, especially energy efficiency comes to the fore. Energy efficiency can be defined as the conversion of each unit of energy consumed into more service or products [TMMOB, 2008]. Although the concept of energy efficiency is perceived as intangible for businesses in our country, it is a concept that can have serious financial, environmental and economic benefits.

Unfortunately, the machinery sector is far from successful positions it has at other subject matters in terms of energy efficiency. It is estimated that there are not many companies that have energy efficiency analysis and/or implementations of energy efficiency increasing measures according to efficiency analysis. Unfortunately, the reason for this is lack of awareness and the projects, practices that will increase this awareness in our country should be increased in quantity and diversity.

### Raw Material Efficiency

The most commonly used raw materials in the sector are steel and steel products. Steel is successful in terms of raw material efficiency, as it is recycled at a high rate. However, the production trend from recyclable materials, which are very effective in raw materials used in equipment other than steel, is recently being adopted by the sector representatives.

## 7.3. Climate Change

The Machinery Sector, where carbon footprint measurements started with the regulations and changes that emerged in line with the EU's "Zero Emission" target in 2050, needs to adapt much faster in terms of both respect to the environment and compliance with environmental processes with the current high level of internationalization in TR51 Region.

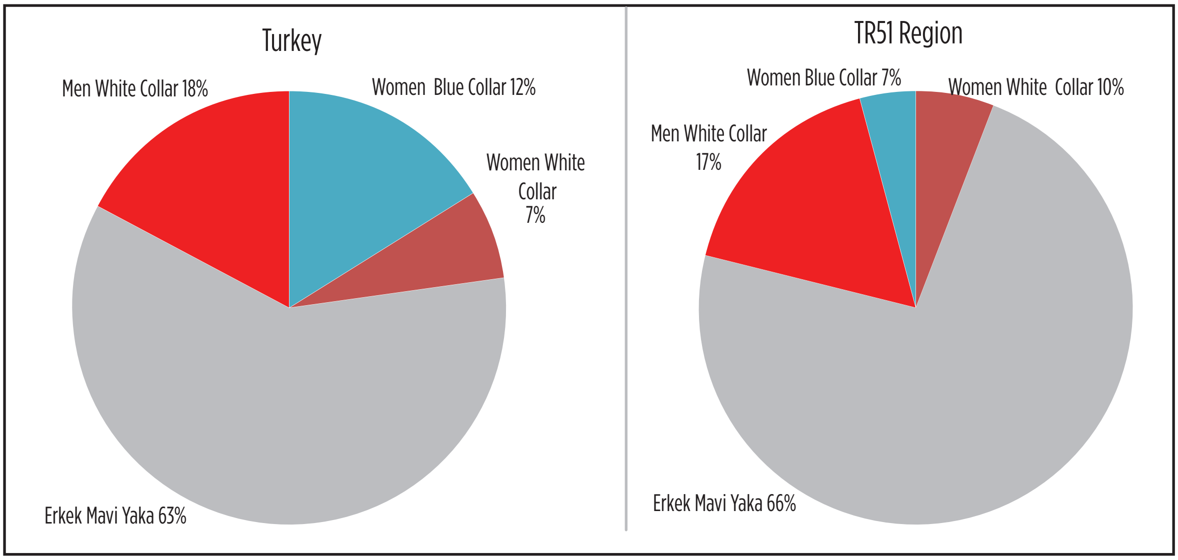
47.2% of net electricity consumption in Turkey is consumed by the industrial sector and more than 70% of the electricity used in industry is consumed by electric motors. In other words, approximately 35% of the total net electricity consumption of our country is consumed by the electric motors in manufacturing industry activities. However, 88% of the electric motors used in industry are in the low efficiency class [MOIT, Electric Motor Inventory Study, 2017]. It is observed that the sensitivity of the machinery sector customers in terms of both reducing their carbon footprint and saving electricity has increased and the tendency to use IE3 class motors and variable speed drive instead of IE2 class motors has also increased. The machinery sector is of key importance in terms of reducing the amount of electricity used in the industry and thus the carbon footprint of industrial production.

Sector representatives state that the motors accoupled to their machines, are selected according to the demand of customers. But, the establishment of green economies and the energy consumption classes of the supplied products are of greater importance in the developing world. So, that will encourage the sector both to protect nature by increasing the use of more energy-efficient motors and to strengthen their position in the supplier lists of European customers with the help of the importance they hold for nature.

## 7.4. Gender Equality

Currently, women working in the sector focus predominantly on low-skilled and low-paid jobs. Sector representatives generally prefer female employees because of their discipline and self-motivation. As their skills adapt to market demands, women have a chance to find a job in the machinery sector.

According to the results of the survey conducted within the scope of the project, the rate of female employees in Turkey and TR51 Region can be seen in Figure 28. It is an important detail that women in the region are employed in white-collar and executive positions with a ratio above Turkey average. This is due to the trust in the management experience of female managers in the machinery sector in TR51 region. It can even be stated that female managers are perceived to have higher images in the region [TR51 Focus Group, 2020].




*[FSR Machinery Sector Survey Results, 2021]*

***Figure 37:*** *Gender Distribution of Machinery Sector Employees*

# 8. Policy, Strategy and Action PlanRecommendations

## 8.1 Policy Recommendations

1.**Encouraging Purchase of Domestic Machinery**

1. Effective implementation of supervisory and regulatory practices in the sector while insisting on the choice of domestic products in government purchases
2. When government specifications are incompatible, allowing the development of domestic products in accordance with the specifications and not directly approving the import.
3. Cancelling income tax on scrap value of old machines in domestic machine purchases
4. Prioritization of domestic goods in the SSO purchases
5. Supplying demands of municipalities with domestic goods
6. VAT discount for domestic machine purchases

**2. Increasing Exports**

1. Performing efforts to improve the image of Turkey and Turkish goods
2. Support for strengthening the image of Turkish machine brands
3. Providing logistic support in maritime and rail transportation of exports
4. Allocating more resources for buyers' credit and receivables insurances and providing 5-6-7-year loan opportunities in Eximbank
5. Granting loans to leasing companies working in the CM Sector
6. Applying competitive interest rates for the machinery sector on buyer credit by Eximbank compared to rival banks
7. Supplying low-interest loans from Turkish banks or leasing institutions abroad to foreign customers who will purchase Turkish machinery
8. Continuation of Global Supply Chain Support
9. Continuation of SICDP Supports focusing on increasing competitiveness rather than promotion in exporting companies.

**3. Decreasing Raw Material Prices**

1. Promoting high quality steel production in the iron and steel sector. Focusing on producing alloy flat, stainless, coated and more special steels that the sector needs, investing in products with high added value with advanced engineering knowledge, technology and government support
2. Investing in the metal sector with high added value, advanced engineering knowledge, technology and government support

**4. Increasing R&D Structure**

1. Establishment of institutes developing R&D for SMEs

Employing graduate and doctorate engineers, getting support from universities, establishing institutions that develop applied technology R&D to contribute to the industry (Example: Fraunhofer Institute - Germany)

**5. Directing SMEs to efficiency increasing activities**

1. Model factories giving practical lean production training in the workshops of SMEs
2. Result-oriented promotion of consultancy services related to lean applications in the production line

6. **Promoting Environmental Regulations**
    1. Activating energy efficiency incentives for SMEs
    2. Preparing policies for harmonization with the European Green Deal
7. **Developing Human Resources**
    1. Conducting comprehensive training organizations to increase the technical capacity of companies on e-commerce, Export / Import, Management, Human Resources, Market Research, Customer Relationship Management, Purchasing, Marketing and Sales, Digital Marketing, Intellectual Property, Design, Language.
    2. Regional differentiation of the coordination between vocational, technical high schools and industry, based on the sub-sector
    3. Developing the concept of a "Producing University" and budgeting universities according to their production in areas such as Social, Economic, Cultural, Artistic, Industry, allocating staff and benchmarking the production potential of universities
    4. Supporting the training initiatives implemented by the Chamber of Industry and OIZs in the region
8. **Developing a direct policy towards the machinery sector**
    1. Developing participatory legislation on the specified issues to bring order to the activities of the sector and to facilitate and control commercial processes
9. **Developing of export-oriented transportation**
    1. Having the opportunity to compete with China based on product price, via government support in exports, especially in maritime shipping
    2. Supporting the export to the markets which are not attractive due to transportation costs
    3. Facilitating the use of the rail for export
    4. Establishment of rail transportation with Asian markets, Russia and Turkic Republics
    5. Facilitating access to the maritime
    6. Development of intermodal transportation alternatives from Ankara
10. **Establishing Internet infrastructure**
    1. Supplying internet access and 5G infrastructure to keep up with the developing technology
    2. Providing government support for ERP and IoT software

## 8.2 Short, Medium and Long-Term Strategy Recommendations

Sub Strategy 1.

**Making a Move Towards Branding**

Without understanding and applying modern marketing techniques and product marketing strategies that highlight product characteristics and brand, achieving success and competitiveness with product pricing is still used.

Branding is one of the biggest hurdles of the industry. Although some companies in our country manage to create a strong brand for foreign markets, in general, most industry representatives cannot effectively use their post-production capabilities, such as marketing and branding.

Success can be achieved with the development of TURQUM, which is an alternative sectoral solution for branding.

Sub Strategy 2.

**Fast completion of the transition to operational efficiency and lean production**

Establishment and dissemination of smart factories covering multi-functional production processes including lean production applications and production bands are among the expected developments.

In the sector, all production operations should be reviewed with lean production techniques and a systematic and general approach should be carried out for continuous development, increase in value addition, total efficiency improvement, cost reduction and processes of localization.

Sub Strategy 3.

**Training strategic human resources**

The need for qualified human resources that can carry out applications and processes for adapting to R&D and innovation-enhancing studies and digitalization processes is deepening. Individuals who follow innovations in technology, make an effort to adapt to them and effects of innovation can be observed in their lives, are individuals that demand and direct innovation and development. Therefore, companies that internalize the R&D culture and select their new employees from these technology-compatible individuals and invest in the necessary processes to train their human resources will be competitive in the sector.

Sub Strategy 4.

**Ensuring localization**

The importance of reducing the external dependency in the supply chain of the industry have once again demonstrated itself with the Covid-19 Crisis. Continuity and sustainability of sales, logistics cost advantage, being aware of product changes, reducing imports and increasing exports are issues that need to be studied at every opportunity for our country to close its current account deficit.

The insufficiency of domestic production diversity, deeply felt with the Covid-19 Crisis makes it difficult or impossible to complete the production process of the final product not only in times of crisis, but also in any logistic setback, policy changes, exchange rate fluctuations, supplier strike and embargo. For these reasons, the prerequisite for increasing the resilience of the sectors against crises and setbacks is to increase the proportion of domestic goods in manufactured products.

Sub Strategy 5.

**Focusing on alternative markets**

The sector should focus on the China-Pakistan economic corridor connecting China and Central Asia, or the modern Silk Road Corridor, RCEP, Russia, South America and Africa markets. In Asian markets, the sector should benefit from the fact that Turkish goods have the image of "Made in Europe".

Sub Strategy 6.

**Developing intra and inter-sectoral cooperation**

In addition to manufacturing within the industry's own internal structures, inter-sectoral cooperation is also becoming more important every day. In this sense, technology transfer, product development and joint business opportunities from both inside and outside the sector should be investigated. The machinery sector should enter into close cooperation with defense, energy and automotive industries.

Sub Strategy 7.

**Providing financial support for export**

Sales financing and loans that competitors obtain from abroad are the most effective reasons in sales where our companies cannot be competitive. Sector representatives will be more competitive by expanding the Sales Finance alternatives and opportunities to be provided to potential investors at a competitive level compared to foreign examples such as Hermes and Coface. The financial product alternatives should be defined in the financial system and then offered to all SMEs in an easily accessible manner.

Sub Strategy 8.

**Supporting Export Shipment**

Reducing shipping costs, which is an important source of cost when exporting from provinces far from the port and increasing competitiveness is an important condition for the increase and development of the export potential of Anatolian provinces.

Identifying intermodal transportation alternatives and supporting transportation costs for exporters will be an important milestone for regional development.

Sub Strategy 9.

**Adapting to innovative technologies**

Industry 4.0 Applications started to be implemented in the sector. Computer and Information Technologies make a great contribution to the efficiency of the sector. However, vertical and horizontal integration technologies such as ERP, Big Data, Cloud Technologies, Internet of Things (IoT), Artificial Intelligence and Cyber Security Technologies, and the level of use of Industrial Digital Technologies contain great development potential.

What is desired to be achieved with Industry 4.0 is productivity, quality, security, economic growth, easy manageability and improvement in employment. The advantages of Industry 4.0 applications can be listed as follows: tracking the system from input to end product and thus making diagnosis easier, self-awareness of systems and components, sustainability of resource-saving systematics, ensuring high efficiency, increasing flexibility in production, reducing costs and developing new service and business models.

Sub Strategy 10.

**Developing innovative production models in accordance with environmental policies**

Production capacity in accordance with current and renewed domestic and international regulations regarding environmental policies should be developed. This requirement will prevent a decrease in machinery exports, especially to developed markets, and has the potential to contribute significantly to paving the way for export growth.

Innovative technologies should be used to protect nature and support sustainable living, respecting both domestic and international environmental standards. The sector should reduce the environmental impact of both its factories and products day by day. Besides this requirement, compliance with the new environmental standards that will be demanded in the future markets of developed countries, especially the European Green Deal, will be a proof of both the infrastructure and competence of the sector in compliance with these standards and it will make an unaffordable contribution to the rise of the brand image.

Sub Strategy 11.

**Optimizing operational processes with new technologies**

Supply chains and inventory management should be optimized, risk and safety management and project planning processes should be improved by using new technologies. Examples include implementing digital purchasing, adapting to digital logistics channels, and adapting ERP systems to operations management in a value-added way.

Sub Strategy 12.

**Technology transfer from start-ups**

Major players in the sector should improve their existing technologies by recruiting technology-developing start-ups. The implementation of this strategy, which is very common in the world, will save a lot of time in terms of gaining the ability to catch up with high technology and develop new products.

Sub Strategy 13.

**Leaving the follower status in technology and producing more innovative products**

In most of the sector representatives, the motivation to develop a brand new product that works with different systematics in different technologies instead of existing products is weak or does not work. One of the reasons for this deficiency is that industrialists focus on short-term solutions rather than producing long-term R&D strategies. This understanding will only allow a progress towards working with a similar technology and imitating a new product when released by competitors. Currently, product prices are also much lower than European competitors due to lack of branding and the earnings will not allow the companies to endure long-term R&D studies.

For these reasons, the goal of companies should be to move from the "follower" status in technology to the "leader" position by turning to more innovative products, together with branding and sales-increasing strategies. It is also important to start production of critical components such as engine and powertrain in terms of reducing dependency on suppliers.

Sub Strategy 14.

**Establishing a joint after-sales organization abroad**

This structure should be supported by creating a new model in public-private sector cooperation for international after-sales service. In the focus group meetings held with the sector representatives, it was determined that the companies had difficulties in fulfilling their after-sales services due to the high costs. Each company tries to create its own after-sales service model. Some of the leading exporter companies of the sector create after-sales support offices abroad, and some assign technical personnel. Both the establishment of an office and the assignment of personnel do not constitute a sustainable structure for companies. An abroad organizational structuring should be established that will provide after-sales service for the products of companies which want to participate, keep spare parts inventory, and support assembly works.

## 8.3 Sectoral Action Plan

The Estimated Budget of the Actions of the Plan prepared below include the budget figures envisaged for the relevant study to be carried out for 1.245 Machinery Sector Firms in TR51 Region. Actions within the sub-strategies have been increased or decreased in TR51 Region, depending on the industrial structure and requirements of the region.

Strategy and sub-strategies are colored as follows, according to their status as National, Regional and Global Vision Developers: : **National**/**Regional**/**Global Vision Developer.**

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 1: **NATIONAL AND REGIONAL STRATEGIES** | Strategy **1.1. Making a Move Towards Branding** | Action 1.1.1. **Conducting research to raise awareness about patents, trademarks and design** | • Increasing the number of patents, utility models, brands and designs<br>• Ensuring production of high technology product alternatives, encouraging R&D, increasing competitiveness | 3-10 Years<br>(Long Term) | Micro Investment (<100 Million TL) |
| | | Action 1.1.2. **Promoting the TURQUM brand and supporting participation** | • Sectoral branding with quality standards certificate | 1-3 Year<br>(Medium Term | Micro Investment (<100 Million TL) |
| | | Action 1.1.3 **Increasing awareness and diversity of consulting services for international brand identity development** | • Increasing international image and awareness<br>• Increasing the capacity to export<br>• Raising awareness of the need for coaching, mentoring and consultancy | 1-3 Year<br>(Medium Term) | Micro Investment (<100 Million TL) |
| | | Action 1.1.4. **Incresing the participation to Turquality program** | • Increasing international image and awareness<br>• On company base, developing branding in the market, organization and brand management issues, strategically and export-focused | 3-10 Years<br>(Long Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.1.5. **Developing the capacity to export with E-commerce** | • Developing international brand identity<br>• Providing companies with the ability to export via e-commerce | 3-10 Years<br>(Long Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.1.6. **Raising awareness of the need for development-oriented HR in companies** | • Employing HR with the ability to develop international brand identity<br>• Employing or training HR capable of exporting with e-commerce | 3-10 Years<br>(Long Term) | Meso Investment (>100 Million & <1 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 1: **NATIONAL AND REGIONAL STRATEGIES** | Strategy **1.2. Fast completion of the transition to operational efficiency and lean production** | Action 1.2.1. **Awareness Raising Activities on Productivity** | • Understanding the operational efficiency potential<br>• Understanding operational efficiency alternatives<br>• Understanding alternatives of quality improvement studies | 0-1 Years<br><br>(Short Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.2.2. **Ensuring Company-Specific Operational Efficiency Analysis** | • Understanding the production methodology and creating development potential<br>• Understanding cost-effective alternatives<br>• Seeing the potential for improvement in productivity | 1-3 Year<br><br>(Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.2.3. **Ensuring that the Company-Specific Operational Efficiency Studies are Made in the Production Lines** | • Improvement in Production Methodology<br>• Cost reduction (Labor, Consumables and Natural Resources)<br>• Productivity improvement<br>• Guidance, mentoring and practical lean trainings in the factory, especially Kaizen training | 1-3 Year<br><br>(Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.2.4. **Performing Company-Specific Energy Efficiency Analysis** | • Increasing awareness of energy costs in production<br>• Cost reduction in energy, providing understanding of alternatives<br>• Raising environmental awareness<br>• Supporting the analysis of EVD companies, increasing participation in free analysis support | 1-3 Year<br><br>(Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.2.5. **Supporting Energy Efficiency Efforts** | • Reducing the energy cost share in production<br>• Cost reduction (Labor, Consumables and Natural Resources)<br>• Reducing the carbon footprint | 3-10 Years<br><br>(Long Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 1 : **NATIONAL AND REGIONAL STRATEGIES** | Strategy **1.3. Training Strategic Human Resources** | Action 1.3.1. **Training Intermediate Staff, Putting Special Workshops for the Machinery Sub-Sector and Lessons Determined by the Industrialist in Vocational High Schools, Applying Internship Programs** | • Tracking qualified intermediate workforce from the first stage of education, training and monitoring in school and industry, and ensuring adequate and competent development,<br>• Increasing the institutionalization levels of companies<br>• Increasing HR competitiveness<br>• Training operators who can use the machines produced in the region<br>• Opportunity to anticipate labor deficits and take measures | 3-10 Years (Long Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | Strategy 1.4. **Focusing on alternative market**s | Action 1.4.1. **Helping Companies Take Advantage of Marketing Opportunities Designing, Collecting, Interpreting and Reporting Market Information** | • Awareness of Asia, Silk Road, RCEP (Regional Comprehensive Economic Partnership), Russia, South America and Africa Markets<br>• Marketing awareness<br>• Enabling companies to understand their position in international markets<br>• Raising awareness of preparing a marketing plan and designing a roadmap | 0-1 Years (Short Term) | Micro Investment (<100 Million TL) |
| | Strategy 1.5. **Developing intra and inter-sectoral cooperation** | Action 1.5.1. **Clustering Support and Developing Clustering Strategies for Existing and New Companies** | • Creating export and expansion opportunities<br>• Determination of cluster location and organization<br>• Setting up the necessary infrastructure<br>• Cost reduction, increasing the attractiveness of the industry<br>• Joint supply, sales, R&D and marketing training | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL)) |
| | Strategy 1.6: **Providing financial support for export** | Action 1.6.1. **Ensuring that companies get the maximum benefit from Incentives and Supports in Marketing and Exports** | • Increasing entry to new markets abroad<br>• Increasing the foreign marketing activities of companies<br>• Increasing the brand image | 3-10 Years (Long Term) | Mega Investment (>5 Billion TL) |
| | | Action 1.6.2. **Regulating Buyer Financing Terms According to Competitors and Providing More Convenient Access to Financing** | • Defining a competitive grace period in buyer's credit<br>• Long Maturities in buyer's credit<br>• Cash loans, export creation, guarantees etc. under more favorable conditions<br>• Increasing competitiveness | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 1 : NATIONAL AND REGIONAL STRATEGIES | Strategy 1.7. **Increasing of Localization** | Action 1.7.1. **Preparing the List of Imported Products on Provincial Basis for the Sector** | • Identification of sector-based imported products to encourage the production of substitutes | 0-1 Years (Short Term) | Micro Investment (<100 Million TL) |
| | | Action 1.7.2. **Ensuring the Understanding that Imported Products for the Sector Can Be Produced Locally** | • Increasing the use of imported substitute products | 0-1 Years (Short Term) | Micro Investment (<100 Million TL) |
| | | Action 1.7.3. **Ensuring the Understanding that Imported Products for the Sector Can Be Available Locally** | • Ensuring the production of imported substitutes | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | | Action 1.7.4. **Localization by Simplifying Imported Products** | • Reducing the rate of imported products | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.7.5. **Establishing a Company-Specific Localization Mechanism** | • Accelerating the use of substitute products | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 1.7.6. **Establishing Internal Supply Mechanisms** | • Reducing import dependency on intermediate goods and facilitating the access of industry to alternative domestic producers | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | Strategy 1.8. **Strategy 1.8. Development and Supporting of Export Transport** | Action 1.8.1. **Developing Intermodal Transportation Alternatives from Ankara and Relieving Costs** | • Development of transportation alternatives from Ankara to ports | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 2: **GLOBAL VISION DEVELOPING STRATEGIES** | Strategy 2.1: **Adapting to innovative technologies** | Action 2.1.1. **Engaging in Industry 4.0 Awareness Raising Activities** | • Ensuring that the details of Industry 4.0 are understood<br>• Internalizing the Industry 4.0 specific to each company and implementing alternatives specific to the company<br>• Ensuring that the added value to be produced by the company with Industry 4.0 is recognized | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 2.1.2. **Making Sectoral Diagnostics Study and Industry 4.0 Needs Analysis** | • Ensuring that the details of Industry 4.0 are understood per company<br>• Ensuring that Industry 4.0 is internalized and implemented on a company-specific basis.<br>• Ensuring that the value-increasing effect of Industry 4.0 can be calculated. | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 2.1.3. **Increasing Value with Industry 4.0, Reducing Costs, Increasing Productivity (IoT, Autonomous Robots, Additive Manufacturing, Artificial Intelligence, AR, VR, Big Data, Machine Learning, etc.)** | • Increasing the added value<br>• Developing competitive technologies<br>• Responding to technology-based requests from customers<br>• Providing customers with ease of use<br>• Reducing costs, increasing productivity<br>• Reducing the carbon footprint<br>• Increasing the resilience of companies to crises | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |
| | Strategy 2.2: **Developing innovative production models in accordance with environmental policies** | Action 2.2.1. **Making Environmentally-Friendly R&D, Production and Establishing Organization, Transforming Production Processes** | • European Green Deal<br>• Energy efficient production<br>• Energy efficient product<br>• Reuse of waste<br>• Zero waste factory | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 2: GLOBAL VISION DEVELOPING STRATEGIES | Strategy 2.3. **Optimizing operational processes with new technologies** | Action 2.3.1. **Increasing Awareness of the Digitalization of Processes with New Technologies** | • Ensuring that the details of Industry 4.0 are understood<br>• Internalizing the Industry 4.0 specific to each company and implementing alternatives specific to the company<br>• Ensuring that the added value to be produced by the company with Industry 4.0 is recognized | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | | Action 2.3.2. **Analyzing Digital Transformation Opportunities in Processes** | • Ensuring that the details of Industry 4.0 are understood per company<br>• Ensuring that Industry 4.0 is internalized and implemented on a company-specific basis.<br>• Ensuring that the value-increasing effect of Industry 4.0 can be calculated. | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | | Action 2.3.3. **Digitalizing Processes with New Technologies (Cloud Systems, Digital Twins, Digital Call Center, Digital Logistics, Virtual Fair etc.)** | • Increasing the added value<br>• Reducing costs (Labor, Consumables and Natural Resources)<br>• Increasing productivity<br>• Reducing the carbon footprint | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |
| | Strategy 2.4. **Technology Transfer from Start-Ups** | Action 2.4.1. **Transferring Technology Through the Purchase of Start-ups** | • Transferring technology<br>• Saving time in developing technology<br>• Establishing the R&D infrastructure | 3-10 Year (Long Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 2: GLOBAL VISION DEVELOPING STRATEGIES | Strategy 2.5. Leaving the Follower Status in Technology and Producing More Innovative Products | Action 2.5.1. Establishing R&D organizations for SMEs to develop applications in the region Example: Franhaufer Institute | • Providing ready, applied R&D support to SMEs through an autonomous R&D Development Institute<br>• Ensuring an R&D structure for the sector<br>• Increasing commercial R&D activities<br>• Performing practice-oriented research<br>• Shortening product development processes | 3-10 Years (Long Term) | Mega Investment (>5 Billion TL) |
| | Strategy 2.6. Technology Transfer from Start-Ups | Action 2.6.1. Establishing a Special Incubation Center for the CM Sub-Sector | • Strengthening the CM Sector<br>• Creating a company for needs<br>• Better fulfillment of supply<br>• Technological product and process supply | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | Strategy 2.7. Establishing a joint after-sales organization abroad | Action 2.7.1 Reducing the Need for abroad Sales and Aftersales Structuring by Using New Technologies Specific to the CM Sector | • Increasing exports<br>• Increasing customer satisfaction<br>• Increasing the brand image<br>• Reducing after sales costs | 1-3 Year (Medium Term) | Meso Investment (>100 Million & <1 Billion TL) |
| | | Action 2.7.2. Establishing Special abroad After Sales Centers for the CM Sector | • Opening the way for exports<br>• Capturing the after-sales effect in machine sales<br>• Increasing the brand image<br>• Establishing and benefiting from an organization that cannot be established by companies alone | 3-10 Years (Long Term) | Mega Investment (>5 Billion TL) |
| | Strategy 2.8: Making a Move Towards Branding | Action 2.8.1. Arranging the Content of the TURQUALITY Program and Making it Suitable for the CM Sector | • Promoting the CM Sector<br>• Increasing the brand image<br>• Reaching new markets<br>• Increasing exports | 3-10 Years (Long Term) | Mega Investment (>5 Billion TL) |

| Main Strategy | Sub Strategy | Action | Explanation | Term | Estimated Budget [TL] |
|---|---|---|---|---|---|
| Strategy 3: REGIONAL STRATEGIES | Strategy 3.1. Training Strategic Human Resources | Action 3.1.1. Training of University Graduates in Institutions such as ASOSEM and SİMEP with 6 Months of Training According to the Needs of the Machinery Sector | • Training of strategic and / or qualified HR<br>• Increasing HR capacity in the region | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | Strategy 3.2. Focusing on alternative markets | Action 3.2.1 Designing the Necessary Actions for the Selected Markets and Segments for the CM Sector and Sharing them with the Companies in the Sector | • Marketing according to company and market dynamics<br>• Determination of target positions for companies in national and international markets<br>• Draft marketing plan and roadmap design | 0-1 Years (Short Term) | Micro Investment (<100 Million TL) |
| | | Action 3.2.2. Determining Empty Segments in CM Market, if any, and Making Product Definition according to These Segments | • Increasing market share with current technology and production competence<br>• Filling the segments where there are no competitors<br>• Increase profitability | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | Strategy 3.3. Developing intra and inter-sectoral cooperation | Action 3.3.1. Establishing a Private Virtual Hub for the CM Industry | • Increasing cooperation between institutions<br>• Determining Strategic Direction for the Sector<br>• Providing consultancy services to the sector and members | 1-3 Year (Medium Term) | Micro Investment (<100 Million TL) |
| | | Action 3.3.2. Cooperating with Defense, Automotive and Medical Sectors | • Developing hybrid technologies and products with primarily Defense, Automotive and Medical sectors<br>• Accelerating technological adaptation and staying up-to-date through collaborations to be established with the software industry | 1-3 Year (Medium Term) | Mega Investment (>5 Billion TL) |
| | Strategy 3.4. Increasing Localization | Action 3.4.1. Ensuring the Production of Replacements for Imported CM Sector Engines and Powertrains | • Reducing dependence on foreign suppliers<br>• Increasing the resilience of the industry against crises | 3-10 Years (Long Term) | Mega Investment (>5 Billion TL) |

# 9. TR51 Region Machinery Sector Analysis Summary

| TR51 Region Machinery Sector Analysis Summary |
|---|
| **THE MOST IMPORTANT STRENGTHS OF TR51 REGION** |
| Strong organization and export competence in the Construction Machinery industry |
| A company infrastructure focused on the CM sector with CCM Cluster |
| Companies with flexible production capabilities |
| Collaboration within the sector and an exemplary business distribution model of leading exporter companies |
| Strong HR potential and qualified staff stock |
| Product development competence |
| Customer orientation |
| **MAIN STRATEGIES FOR INCREASING INTERNATIONAL COMPETITIVENESS FOR TR51 REGION** |
| Branding and enhancing the country image |
| Structuring R&D organizations in the region to increase R&D capability of SMEs in developing applications for the industry |
| Supporting and increasing localization |
| Ensuring the transformation of the knowledge economy and innovation infrastructure into high value added production |
| Developing abroad after-sales services to increase customer satisfaction and sales |
| Ensuring that customer-oriented innovation is embedded in the company culture |
| **MAIN STRATEGIES FOR INCREASING INTERNATIONAL COMPETITIVENESS FOR TR51 REGION** |
| Increasing the effectiveness and awareness of TURQUM |
| Increasing participation in the Turquality program, in which CM industry pioneers are included |
| Providing R&D support to SMEs in the region within a R&D center using the knowledge and HR of regional universities, developing applied R&D studies specific to the sector |
| Increasing the localization rate of existing products to the level of 90% , which allows production even in crisis periods, development of production of CM sector-specific powertrain and engine |
| Implementing technology transfer and training activities to increase added value in products and production with Industry 4.0 and Digitalization |
| Establishment of abroad after-sales points specific to the CM sector |
| Following up customer demands regularly in a responsibility distributed organization. Reporting and standardizing innovative solutions based on these demands. |

# 10. Conclusion and Evaluation

As the first shock was experienced due the Covid-19 Crisis, the cash flows of companies were disrupted and the policies and practices aimed at solving this problem enabled companies to survive financially. However, the crisis has shown that companies that can react to the crisis and change operationally, much more than surviving, have found new customers and increased their sales during the crisis period. These companies are the ones that respond quickly to customers, realize customer demands with innovation, and easily adapt these innovations to their production and meet customer expectations with new products, these are, companies that are resilient against crisis.

Certain strategies have been developed and policy recommendations have been made in order, for all companies in the sector to gain these characteristics. Moreover, although these strategy and policy suggestions were methods foreseen before the Covid-19 Crisis, the crisis clearly revealed the necessity of these methods in order to catch up with the new industrial revolution.

The Covid-19 Crisis in the Machinery Sector in TR51 Region has caused exchange rate fluctuations, uncontrollable rise in logistics prices, contraction in logistics facilities, travel restrictions and problems in raw material supply and consequently cash flow troubles. The cash trouble was tried to be alleviated with governmental supports such as credit use and short-time working allowance, and logistical problems preventing the delivery of orders were tried to be overcome. Profitability has been sacrificed to complete the deliveries and the products have been sent to customers at high logistics prices, allowing companies to relax a bit and take the first step towards exit from the crisis. In addition, the sector representatives of TR51 Region, trying to reach new customers and markets both with their own efforts and international cooperation, have achieved new customers and sales in the Middle East, Africa, Eastern Europe and Turkic Republics. With the crisis, disinfectant tools, pressure washers and aircraft loading machines started to be sold to these new markets. Increasing the sales of garbage trucks, sprinklers and dump vehicles, which are only slightly affected by logistical problems due to their high localization has created the opportunity to reach a safer location in the crisis. This management style and flexibility in production has been the formula of providing both sufficient and rapid response to customer demands and resistance to crisis in TR51 Region.

Strategies developed in conjunction with the Covid-19 Crisis and will be developed afterwards should include both innovative and self-renewable solutions and enable local industries to switch from low-medium value-added to high-value-added and efficient production, and make it sustainable.

The machinery sector companies in TR51 Region have a common awareness that supports continuous development and innovation regarding the need for change and the necessary sectoral transformation, as is the case with all Turkish Machinery sector stakeholders. This awareness is the most important reason for the development of the Machinery Sector, which is a strategic sector for our country, to look at the future with hope. Sectoral development, which must be completed and then constantly renewed in acyclic manner, should be supported by professional management and qualified employees via going forward in exports. In order to start or progress in this transformation cycle, it is necessary to manage digital transformation, and ensure the transition to technology-based production with high value addition.

The proposed policies to achieve these goals, short, medium and long-term strategies, sub-strategies and actions under sub-strategies are shared in the relevant sections. Actions within the sub-strategies are arranged in accordance with the industrial structure and requirements of the region specific to TR51 Region.

As a result, in order to complete this transition as soon as possible, the most important Policies and related Strategies proposed for TR51 Region are summarized below. Strategic actions may vary by region and are shared in detail in the relevant section.

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**Policy Recommendations**

**1. Encouraging Purchase of Domestic Machinery**

1. Effective implementation of supervisory and regulatory practices in the sector while insisting on the choice of domestic products in government purchases

**2. Increasing Exports**

1. Performing efforts to improve the image of Turkey and Turkish goods
2. Support for strengthening the image of Turkish machine brands
3. Providing logistic support in maritime and rail transportation in exports

Allocating more resources for buyers' credit and receivables insurances and providing 5-6-7-year loan opportunities in Eximbank

**3. Decreasing Raw Material Prices**

1. Promoting high quality steel production in the iron and steel sector Focusing on producing alloy flat, stainless, coated and more special steel that the sector needs, investing in products with high added value with advanced engineering knowledge, technology and government support
2. Investing in the metal sector with high added value, advanced engineering knowledge, technology and government support

**4. Increasing R&D Structure**

1. Establishment of institutes developing R&D for SMEs. Employing graduate and doctorate engineers, getting support from universities, establishing institutions that develop applied technology R&D to contribute to the industry (Example: Fraunhofer Institute - Germany)

**5. Directing SMEs to efficiency increasing activities**

1. Model factories giving practical lean production training in the workshops of SMEs
2. Result-oriented promotion of consultancy services related to lean applications in production line

**6. Promoting Localization**

1. Prioritization of domestic goods purchases in State Supply Office

**7. Developing Human Resources**

1. Conducting comprehensive training organizations to increase the technical capacity of companies on e-commerce, Export / Import, Management, Human Resources, Market Research, Customer Relationship Management, Purchasing, Marketing and Sales, Digital Marketing, Intellectual Property, Design, Language.
2. Regional differentiation of the coordination between vocational and technical high schools and industry, based on the sub-sector

**Suggested Strategies for TR51 Region**

1. Making a Move Towards Branding
2. Fast completion of the transition to operational efficiency and lean production
3. Optimizing operational processes with new technologies
4. Focusing on alternative markets
5. Developing intra and inter-sectoral cooperation
6. Leaving the follower status in technology and producing more innovative products
7. Technology transfer from start-ups
8. Adapting to innovative technologies
9.Establishing a joint after-sales organization abroad
10.Providing financial support for export

11. Development and supporting of export transport
12. Developing innovative production models in accordance with the new regulations

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# Annexes

## Annex.1 TR51 Machinery Sector Focus Group Participant List

| Name/Surname | Organization |
|---|---|
| Zühtü BAKIR | MAKFED |
| Fevzi GÖKALP | OSTIM CFCM Cluster |
| Göktan GÜÇLÜ | ARUSDER |
| Musa ERTUNÇ | KARBA Automotive |
| Mehtap ÖNAL | MIB |
| Seda DEYER | Hidroan Machine |
| Halide RASİM | Rasim Machine |
| Merih ÖZGEN | ASO, Imder, Hidromek Makine |
| Zeynep Tuğba ŞAVLI | Ankara Development Agency |
| Onur Karakurt | Ministry of Industry and Technology |
| Arzu KARAASLAN | UNDP |
| Cihat GÖK | FSR Industry Analyst |
| Tamer ÖZTIN | FSR Project Team Leader |
| Gürol AK | FSR Machinery Sector Specialist |

## Annex.2 TR51 Machinery Sector Working Group Participant List

| Name/Surname | Organization |
|---|---|
| Ahmet Alıcı | Coordinator / Expert, T.C. Ministry of Industry and Technology |
| Onur Karakurt | Coordinator / Expert, T.C. Ministry of Industry and Technology |
| Z. Tuğba Şavli | Investment Support Expert - Ankara Development Agency |
| Halil İbrahim Ünlü | Expert – İKA |
| Zehra Betül Pekergin | Expert – MEVKA |
| Tuğba Purtul | Investment Support Expert – OKA |
| Arzu Karaarslan Azizoğlu | Inclusive and Sustainable Growth Portfolio Local Socio-Economic Development Specialist, UNDP Turkey |
| Aslı Aygün | Inclusive and Sustainable Growth Portfolio Project Assistant, UNDP Turkey |
| Cemre Arcak | Inclusive and Sustainable Growth Portfolio Project Intern, UNDP Turkey |
| Tamer Öztin | Fragile Sector Analysis Team Leader, UNDP Turkey |
| Cihat Gök | Fragile Sector Analysis Sector Analyst, UNDP Turkey |
| Gürol AK | Fragile Sector Analysis Machinery Sector Expert, UNDP |

## Annex.3 TR51 Machinery Sector Working Group Meeting Schedule

| Sector | Date, Meeting Hour |
|---|---|
| **Meeting 1** | |
| Machinery (4 regions) | 3 December 2020, 14:00 – 15:30 |
| **Meeting 2** | |
| Machinery (4 regions) | 17 December 2020, 14:00 – 15:30 |
| **Meeting 3 (Changed due to New Year)** | |
| Machinery (4 regions) | 4 anuary 2021, 14:00 - 15:30 |
| **Meeting 4** | |
| Machinery (4 regions) | 14 anuary 2021, 14:00 - 15:30 |
| **Meeting 5 (Draft Report)** | |
| Machinery (4 regions) | 28 anuary 2021, 14:00 - 15:30 |
| **Meeting 6 (Draft Report)** | |
| Machinery (4 regions) | 4 February 2021, 14:00 - 15:30 |
| **Verification Meeting** | |
| Machinery (4 regions) | 18 February 2021, 14:00 - 15:30 |

COVID-19 Crisis Response and Resilience Project

# MACHINERY SECTOR ANALYSIS REPORT and GUIDELINES

TR52 REGION