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A Research for the Textile and Composite Material Sectors. Part 1: Current Situation

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Abstract
This journal paper provided an in-depth examination of Bursa's textile sector, focusing on technical textiles and composite materials. The study was conducted using a questionnaire survey to gather detailed responses from a wide range of textile companies in the region. The survey sought to collect comprehensive information about industry practices, technical advancements, and operational issues within the fields of composites and technical textiles. Key findings showed that 38% of surveyed enterprises primarily exported their products directly. Furthermore, 34% of enterprises used both direct and intermediary export routes, while only 4.3% relied solely on intermediaries. This distribution demonstrated a strong preference for direct export methods within the sector. Overall, the study provided a detailed view of past business practices and export initiatives, along with an assessment of the institutional support offered to the industry. The findings offered valuable insights into the evolving landscape of the textile industry, highlighting trends in material utilization, export techniques, and the effects of technological advancements on competitiveness and sustainability.

Keywords
technical textiles, composite materials, questionnaire survey, Bursa

1. Introduction

The demand for technical textile products, which stand out with their specific physical and functional properties and performances in global markets, is increasing day by day [1-10] unlike products such as ready-made clothing, upholstery, and home textiles conventionally produced by the textile industry. The market continues to expand as technical textiles are used by an increasing number of end users in various industries such as agriculture, construction, healthcare, transportation, packaging, sports, environmental protection, and protective clothing [11]. Türkiye maintains its place among all the countries in the world, especially in the production and export of technical textiles and its export rates are increasing gradually [12-14]. It is predicted that the competitive power in global markets will increase as new technologies are developed in the production processes of technical textiles, which have higher added value compared to conventional textile products [15], and the increase in qualified personnel accompanies this. It is thought that the expectations that the fluctuations created by the COVID-19 pandemic in demand and supply will end as of the current year and the nature of the transformations brought about by the international agreements that are closely related to Türkiye, such as the European Green Deal [16], will become clearer and increase the search for new markets by the manufacturers.

Textile and composite material sectors are among the sectors where competition is most intense in the world compared to other sectors. For this reason, it is known that companies in these sectors are constantly trying to improve themselves. It is clear that research and university collaborations, especially in these two sectors, need to be further developed. Bursa Chamber of Commerce and Industry in Bursa is developing macro projects that will directly contribute to the development of many sectors. The textile and composite material sectors have been the most emphasized sectors. Three centers of excellence and two prototyping centers for these two sectors are some of the macro projects implemented by BCCI. With these centers, companies are supported in both basic R&D and prototyping

and commercialization stages of the sector. With these structures, these two sectors have reached structures that will form TRL 1-7 levels under the same roof from basic R&D to commercialization. BCCI has also focused on clustering activities. Currently, 25 different clusters have been established throughout Bursa, and some of these include the textile and composite industries. In our previous studies, we published articles on the activities of these sectors such as market [17-25], competitiveness, R&D and clustering [25, 26]. Numerous studies on composites have also been conducted, including an examination of the impact of hybridisation and weaving structure on woven carbon-epoxy composites [27] and the three-dimensional integrated core sandwich composites' quasi-static behaviour under compression loading, emphasising its structural integrity and mechanical performance [28].These studies were studies that showed the national and international competitive power of these sectors, specifically for Bursa. This study reveals the current situation of the textile and composite sectors. In this current situation, it is aimed to see the weaknesses and strengths of the sectors and to determine strategic intervention areas. Thus, this study also has a content that reveals Türkiye's own potential in technical textiles and composite materials.

2. Methodology

A comprehensive methodology was done for collecting the data for "Composite Material and Technical Textile Prototype Production and Application Center Technical Assistance Project". Data was gathered through conducting a survey with the enterprises in Bursa that operate in the technical textile and composites industry, using the questionnaire form in [20, 21]. The companies included in the interview were identified based on the "technical textile and composite value chain and cluster analysis" study carried out in conjunction with BUTEKOM, which is detailed in [20]. Prior to the survey, calls were placed to the companies, and the individuals who would respond to the questionnaire were decided upon in concert. The fact that there were authorized individuals who could respond to the survey questions was taken into consideration when choosing the company representatives who will take part in the interview. The interviewees were given the assurance that the material they submitted would only be utilized in the context of the project, allowing them to speak candidly. Microsoft Excel and IBM SPSS 25 were utilized in the data analysis.

Using this strategy, a complete market analysis of technical textiles and composites was undertaken for various Bursa-based enterprises. The collected data revealed which improvements needed to be made in the latter stages of technical textile and composite production.

3. Results

The analysis of the data obtained from 53 companies operating in the field of technical textiles and composites in Bursa by survey method is given below.

The field of activity of the companies participating in the research is given in Table 1. As can be seen in the table, the most active area of the companies participating in the survey was composite with 30.4%. Composite was followed by fabric technology with 30.4%, industrial textiles with 21.7%, automobile and transportation textiles and conventional fabrics with 8.7%.

The list of product groups produced by the analysed companies is given in Table 2.

In the study, it was determined that companies mostly (38%) used the direct export method while exporting their products. As can be seen in Figure 1, the rate of companies stating that they export both directly and through intermediaries is 34%, while the rate of companies stating that they export through intermediaries is 4.3%.

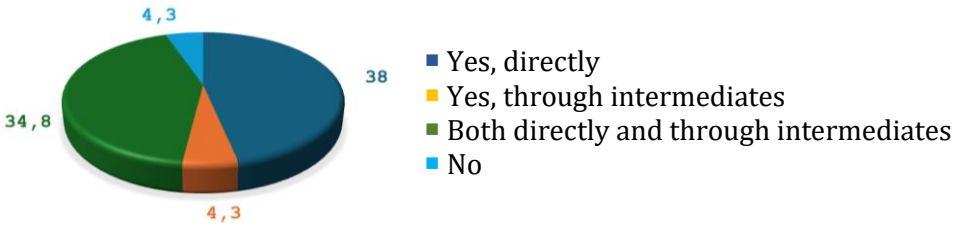

Fig. 1. How Products Are Exported by companies? (%)

Table 1. Fields of activity of companies

Sector	Percentage (%)
Composite Materials	30.4
Clothing Textiles	21.7
Industrial Textiles	21.7
Automotive and Transportation Textiles	21.7
Conventional Cloth Manufacturing	21.7
Building Textiles	8.7
Sport Textiles	8.7
Protective Textiles	8.7
Geo-Textiles	4.3
Medical Textiles	4.3
Agro-Textiles	0.0
Home Technical Textiles	0.0
Smart Textiles	0.0
Oeko-Textiles	0.0
Pach-Textiles	0.0

Table 2. Product types of companies

- Rail systems components
- Interior and exterior trim for aviation and defence industry
- Plastic Injection Parts (Automotive Industry-Aviation)
- Extrusion tubing and 3D monofilament manufacturing
- Painting auxiliaries and water repellents
- Decorative curtains
- Upholstery fabrics
- Indoor heat and light control
- Coated fabrics
- Pleated curtains
- Suitable for digital printing: Wall Covering Fabrics, Backlit, Blackout, Roller, Canvas, etc.
- Natural fiber reinforced composite material
- Upholstery and curtain fabrics
- Electric automation and machine cooling fans
- Internal combustion sports aviation engine and components design and production
- Home textile, automotive textile
- Geogrid, geomembrane, geocomposite
- Pool suspension systems
- Work clothes, outdoor and medical clothing fabrics
- Functional and technical fabrics
- Coating blackout
- Tulle and backdrop group curtain fabrics
- Conventional textile and functional textile products
- Automotive interior plastics, headlight, body plastics and assembly.
- Machinery and equipment facilitating automotive processes
- Automotive and boat composite parts production and boat design
- Knitted Upholstery Fabric production
- Knitted Mattress Fabric
- Curtain coating
- Polyethylene foam

3.1. Ratio of Exports to Turnover

The ratio of exports to turnover by years is shown in Figure 2. Accordingly, while the ratio of exports

to turnover of the companies included in the research was 34.5% in 2021, this ratio was 41.66% in 2023. The estimated value for this rate in 2024 is 43.33%.

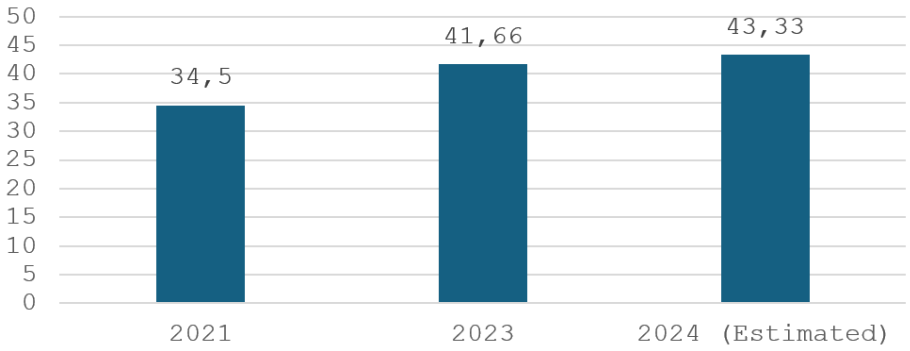

Fig. 2. Ratio of exports to turnover by years of the companies (%)

3.2. Annual Turnover

Figure 3 shows the increasing change in the turnover of the companies over the years. As can be seen in the graph, while the average turnover of the companies in 2021 was 109,251,865 TL, it increased to 223,770,210 TL in 2023 and to 398,250,000 TL in 2024 (estimated).

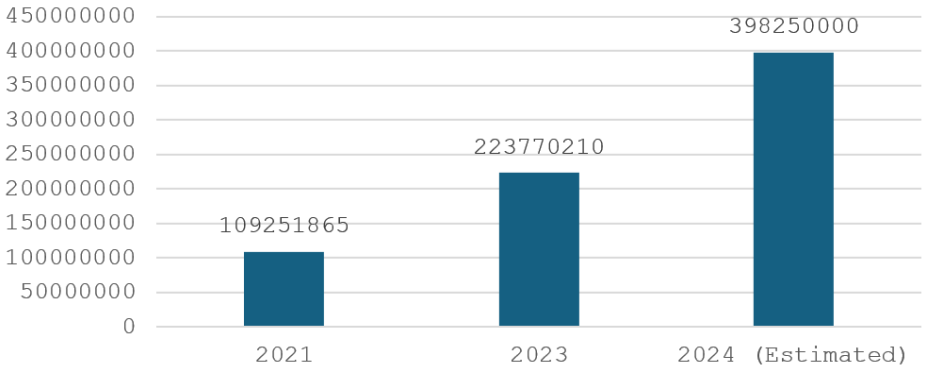

Fig. 3. Turnover by years of companies (TL)

3.3. Geographical Distribution of Sales

As can be seen in Figure 4, 39% of the sales of the companies within the scope of the research were directed to the foreign market, 32% to Türkiye and 29% to Bursa.

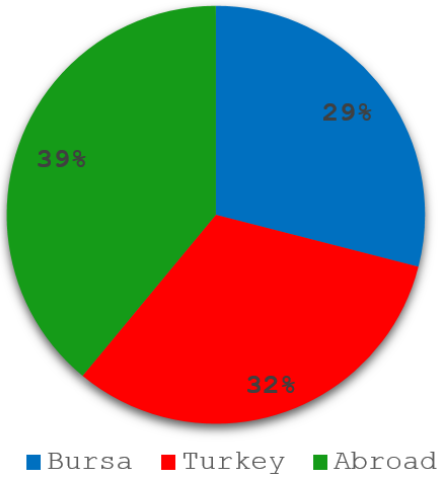

Fig. 4. Geographic distribution of sales of companies (%)

3.4. Number of Employees

The average number of employees of the companies by years is given in Figure 5. Accordingly, while the average number of employees in companies was 136 in 2021, it was 151 in 2023 and 165 in 2024 (estimated).

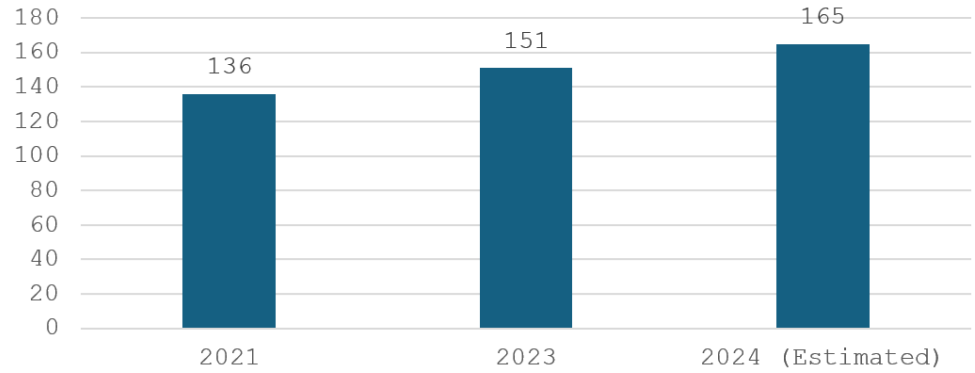

Fig. 5. Distribution of employees by years of companies

3.5. Technological Level of Products

Figure 6 gives the technological structure of the products produced by the companies. When we look at the technological structure of the products produced by the companies, it is seen that the products are mostly produced in the medium-high technology group (33.02%). The proportion of products produced in the high-tech group is 17.82%.

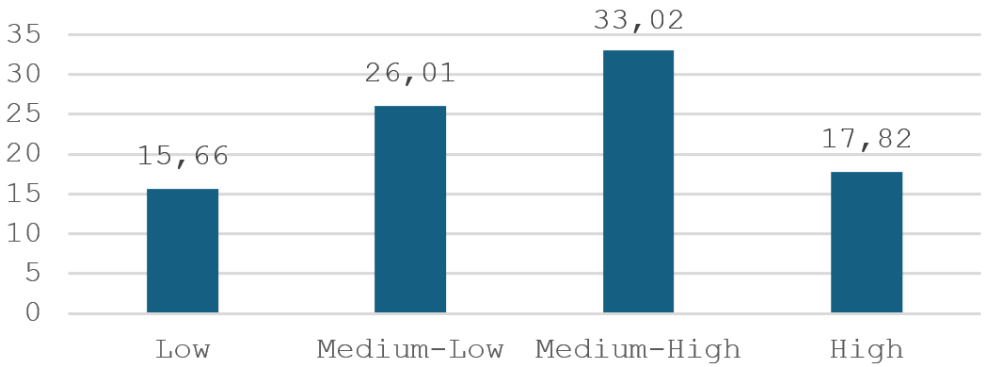

Fig. 6. Technological level of produced products of companies (%)

3.6. The Ratio of Turnover of Products in the High/Medium-High Technology Group in Total Turnover

The ratio of the turnover of the products in the high/medium-high technology group in the total turnover is given in Figure 7. Accordingly, the share of the turnover of products in the high/medium-high technology group in total turnover increased from 31.82% in 2021 to 32% in 2023 and 37% in 2024 (forecast).

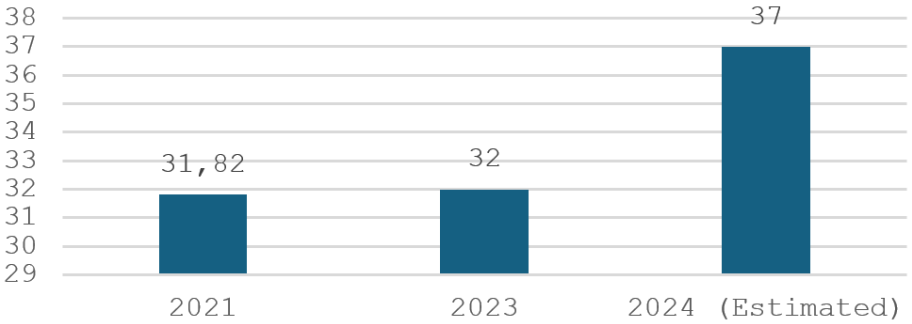

Fig. 7. Share of high/medium-high technology group products in total turnover of companies (%)

3.7. Ratio of Turnover of New Products to Total Turnover

The answers given by the companies regarding the ratio of the turnover of new products in the total turnover are given in Figure 8. According to the answers, the ratio of turnover of new products in total turnover was 22.37% in 2021, 23.41% in 2022 and 24.13% in 2024 (forecast).

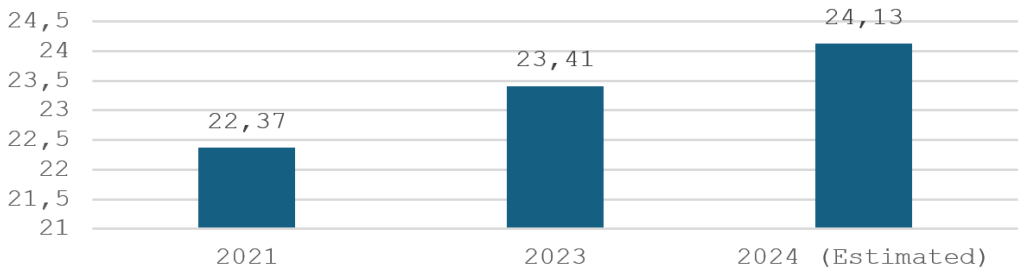

Fig. 8. Ratio of turnover of new products in total turnover of companies (%)

3.8. The Ratio of Approved Products in All Products as of Years

As can be seen in Figure 9, the share of approved products in all products increased over the years and reached 28.6% in 2021, 32.65% in 2023 and 35.95% in 2024 (estimated).

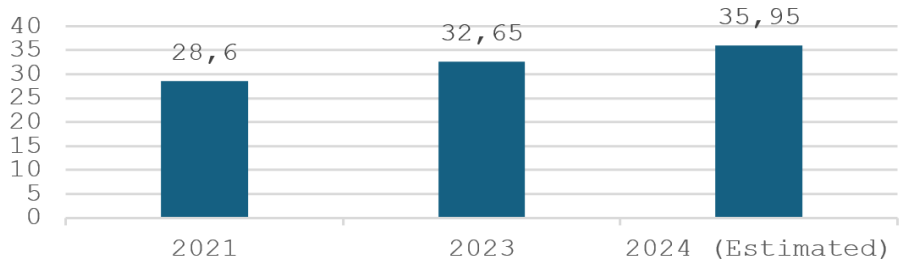

Fig. 9. Ratio of certified products of companies (%)

3.9. Ratio of Input Costs in Total Turnover

Only 10 companies answered the question of how the share of input costs in turnover has changed over the years. The results are given in Figure 10. Accordingly, the number of companies stating that the share of input costs in turnover has not changed over the years (from 2021 to 2024) is 5, while the number of companies saying "Decreased" is 1, and the number of companies saying "Increased" is 4.

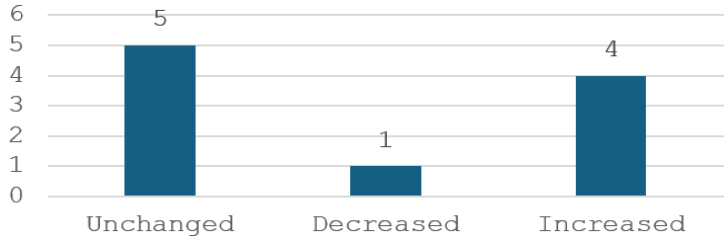

Fig. 10. Change in total turnover of input costs including energy of companies

3.10. Application to Funding Sources for Projects

It is seen in Figure 11 that the number of companies applying for funding sources for projects is at a very low level. In the graph, it is seen that the number of companies applying for funding sources for projects is 1 in 2021 and 2023, and 2 in 2024 (estimated).

3.11. Business Type

In Figure 12 the business type of the companies included in the research is given. Accordingly, 50% of the companies included in the research are small-sized enterprises, while 36.4% are medium-sized enterprises and 13.6% are large-sized enterprises.

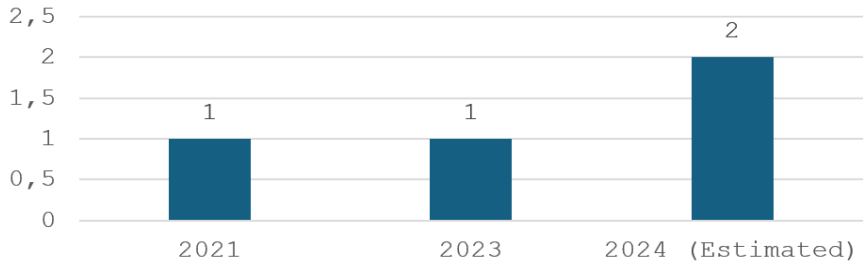

Fig. 11. Number of applications for funding sources of companies

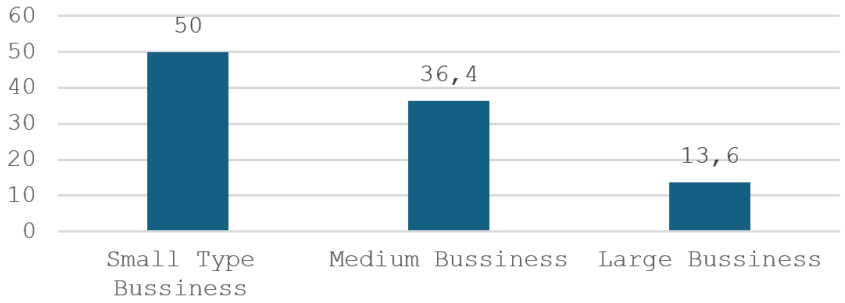

Fig. 12. Business type of companies (%)

3.12. The Goal of Large-Sized Enterprises to Establish SMEs

The distribution of the answers given to the question asked in order to reveal whether large-sized enterprises have the goal of establishing SMEs is given in Figure 13. Of the 3 large-sized enterprises participating in the survey, 1 stated that they had the goal of establishing SMEs, while 2 of them stated that they did not.

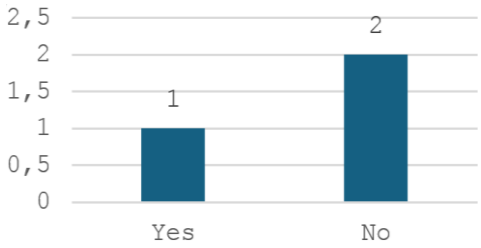

Fig. 13. Number of companies aiming to establish SMEs of companies

3.13. Progress in the Current Level of Knowledge on Technical Textiles and Composite Materials

Since the beginning of the project, the progress of the companies in the current level of knowledge on technical textiles and composite materials can be seen in Figure 14. Accordingly, 42.90% of the firms stated that there was a High level of progress in their current knowledge level, 38.10% stated that there was a Moderate level of progress, 9.50% stated that there was a Very Low level of progress, 4.8% stated that there was a Very High level of progress and 4.80% stated that there was a Low level of progress.

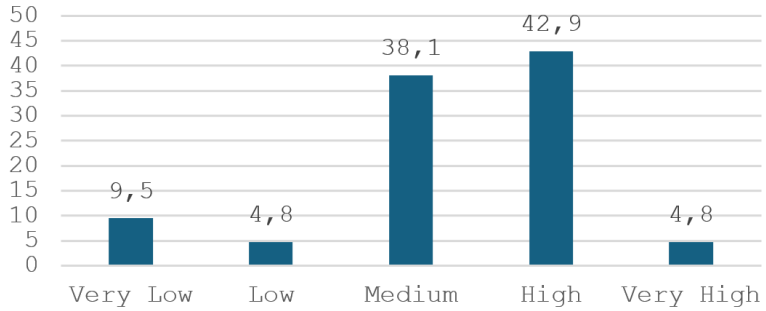

Fig. 14. Level of progress in current knowledge on technical textiles and composite materials of companies (%)

3.14. Contribution of Project Activities to Your Level of Knowledge on Technical Textiles and Composite Materials

The distribution of the answers given to the question asked in order to reveal the effect of the project activities on the knowledge of the companies on technical textiles and composite materials is shown in Figure 15. While the rate of firms that think this contribution is Moderate is 47.60%, the rate of those who think it is High is 28.60%, the rate of those who think it is Very Low is 9.50% and the rate of those who think it is Very High is 4.80%.

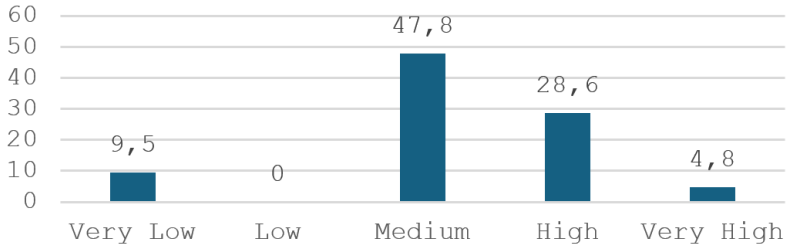

Fig. 15. Contribution of project activities to your level of knowledge on technical textiles and composite materials of companies (%)

3.15. The Impact of Project Activities on the Competitiveness of Firms

The impact of project activities on the competitiveness of firms is shown in Figure 16. Accordingly, the proportion of firms stating that the impact of project activities on competitiveness is at a medium level is 38.10%, the rate of firms stating that it is at a high level is 33.30%, the rate of firms stating that it is at a very low level is 19% and the rate of firms stating that it is at a low level is 9.50%.

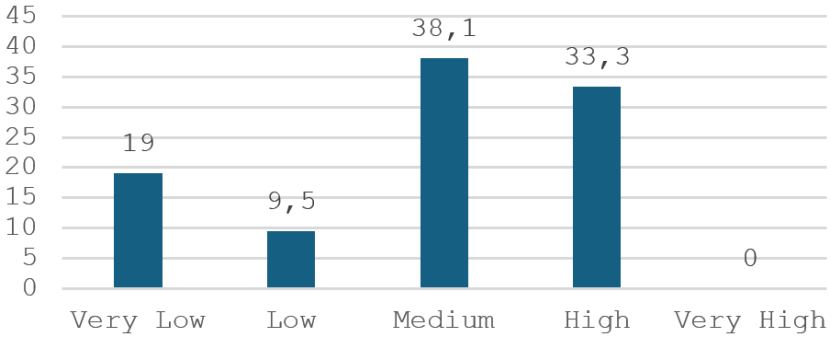

Fig. 16. The impact of project activities on the competitiveness of companies (%)

3.16. Preparatory Consultancy on Marketing, Foreign Trade, Energy, etc.

The distribution of the answers given by the companies participating in the survey about the benefits of preparatory consultancy studies on issues such as marketing, foreign trade, energy, etc. is given in Figure 17. Accordingly, 33.30% of the participating companies answered as Medium, 23.80% as High, while the rate of those who answered as Very Low, Low and Very High was 14.30%.

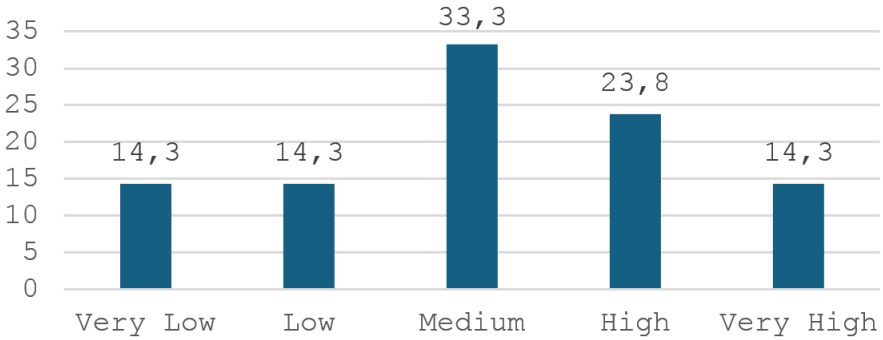

Fig. 17. Marketing, foreign trade etc. preparatory consultancy on subjects of companies (%)

3.17. Project Development and Implementation

Figure 18 shows the opinions of the companies participating in the survey on the benefits of the activities carried out in project development and implementation. Accordingly, while the rate of firms reporting Medium utility level was 47.60%, the rate of firms reporting High level of utility level was 28.60%, the rate of firms reporting Very High and Very Low utility levels was 9.50% and the rate of firms reporting Low utility level was 4.80%.

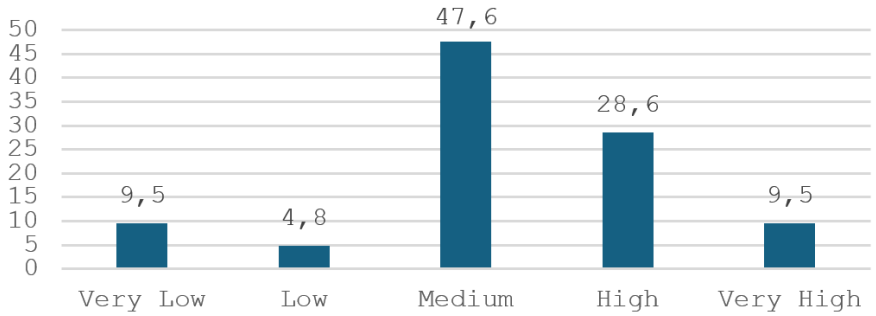

Fig. 18. Project development and implementation of companies

3.18. Cluster Activities, Networks and Collaborations Created by the Project

The distribution of the answers given by the companies participating in the survey about the benefits of clustering activities, networks and collaborations created by the project is given in Figure 19. Accordingly, 38.1% of the respondents answered High, 38.1% Medium, 14.3% Very Low and 4.8% of the respondents in terms of the benefits of clustering activities, networks and collaborations.

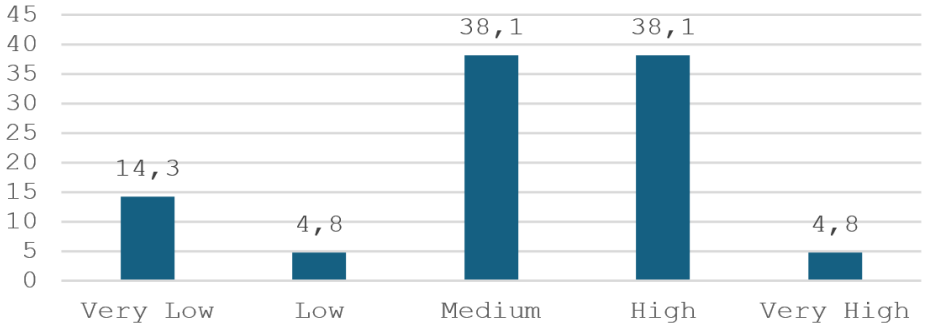

Fig. 19. Clustering activities created within the scope of the project of companies (%)

3.19. Support for Access to Financial Resources for the Initiation of New Technical Textile and Composite Products and Processes

The opinions of the companies participating in the survey on the benefit of access to financial resources support for the initiation of new technical textile and composite products and processes are given in Figure 20. As can be seen in the graph, 33.30% of the firms reported that the benefit of access to financial resources support was Low, 23.80% Very Low and Medium, 14.30% High and 4.80% Very High.

4. Conclusions

This study provides a thorough analysis of Bursa's textile sector, focusing on composites, fabric technology, and industrial textiles. The data reveal a strong emphasis on direct export strategies, with companies primarily exporting their products themselves. The sector is projected to experience a substantial 78% increase in turnover in 2024, and 39% of sales are currently generated from international markets, indicating a significant global presence.

Employment figures have consistently risen over the past three years, reflecting a robust and expanding workforce. Technologically, the sector is performing above average, with an increasing share of turnover coming from high and medium-high technology products. This trend underscores the sector's commitment to technological advancement and innovation.

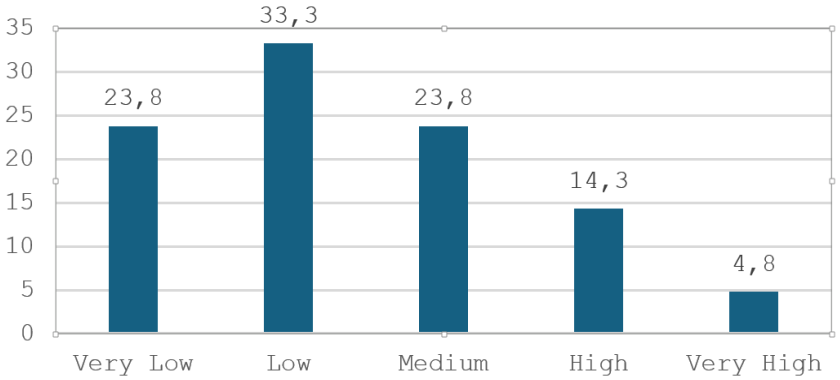

Fig. 20. Support for access to financial resources of companies (%)

The analysis also shows a steady rise in the proportion of certified products, highlighting ongoing improvements in quality and adherence to industry standards. Despite a regular increase in input costs, including energy, the number of companies reporting stable input cost ratios has remained higher than those experiencing increases, which is a positive indicator given the broader economic challenges of inflation and currency fluctuations.

However, there are opportunities for improvement in support mechanisms for market research, finding new export markets, and accessing financial resources for new product launches. The current levels of support in these areas are below expectations, indicating a need for enhanced initiatives to bolster these aspects.

In conclusion, the study underscores the textile sector's strengths in technology and direct exports while highlighting areas for growth, particularly in market research and financial support. The sector's positive trends in turnover, global sales, and technological advancements suggest a promising future, provided that efforts to improve support mechanisms are pursued.

References

1. Park H. (2022): *The Current State of the Korean Technical Textile Industry and Tasks for Policy*. KIET Industrial Economic Review, ISSN 1598-947X, Vol. 27, is. 2, pp. 19-29, Paper No. 22/IER/27/2-2, http://dx.doi.org/10.2139/ssrn.4190717
2. Shabaan Shahata Hassan N., Ahmed Sadek M., Said Shamandy E. (2019): *The use of glass technology and technical textiles in the production of printed textile hangings to increase the awareness of the aesthetic side in medical institutions*. مجلة العمارة والفنون (Journal of Architecture and Arts), eISSN 2357-0342, is. 19, doi: 10.12816/mjaf.2019.13553.1198, https://mjaf.journals.ekb.eg/jufile?ar_sfile=179106&lang=en
3. Holderied P., Mutschler T., Tresp S., et al. (2023): *Development of a new yarn supply for weft knitting machines to produce innovative knitwear*. Communications in Development and Assembling of Textile Products, ISSN 2701-939X, Vol. 4, is. 1, pp. 51-60, https://doi.org/10.25367/cdatp.2023.4.p51-60
4. Mishra S.S., Mohapatra A.K. (2021): *Revisting handloom industry after COVID 19 pandemic 2020*. Turkish Online Journal of Qualitative Inquiry (TOJQI), eISSN 1309-6591, Vol. 12, is. 5, pp. 4201-4208.
5. Azam F., Ahmad F., et al. (2022): *The Role and Applications of Aerogels in Textiles*. Advances in Materials Science and Engineering, eISSN 1687-8442, Vol. 2022, art. ID 2407769, https://doi.org/10.1155/2022/2407769
6. Emmanuella K.T. (2022): *A Comparison of financial performance in textile industry: KPR Mill Ltd vs Arvind Ltd*. Business dissertation report, Pandit Deendayal Energy University, School of Petroleum Management, Gandhinagar, Gujarat, India, http://localhost:8080/xmlui/handle/123456789/539
7. Mushtaq B., Ahmad A., Ali Z., et al. (2022): *Core Spun Based Helical Auxetic Yarn: A Novel Structure for Wearable Protective Textiles*. Journal of Natural Fibers, ISSN 1544-0478, Vol. 19, is. 16, pp. 15058-15070, https://doi.org/10.1080/15440478.2022.2070322
8. Cardoso A.C. (2021): *Potencial de própolis no desenvolvimento de têxteis com propriedades funcionais* (*Potential of propolis in the development of textiles with functional properties*). Master thesis, Universidade do Minho, Brasil, Dissertacao-PG37988.pdf, https://hdl.handle.net/1822/79512 (in Portuguese)
9. Mezrea P.E., Ispir M., Balci I.A., et al. (2021): *Diagonal tensile tests on historical brick masonry wallets strengthened with fabric reinforced cementitious mortar*. Structures, eISSN 2352-0124, Vol. 33, pp. 935-946, https://doi.org/10.1016/j.istruc.2021.04.076
10. Vora P.N. (2021): *Design & Development of Surgical Gowns to Enhance Its Performance*. PhD thesis, Maharaja

Sayajirao University of Baroda, Gujarat, Vadodara, India, https://www.proquest.com/openview/d9737ec12f0e8400220f384321d9e9e0/1?pq-origsite=gscholar&cbl=2026366&diss=y
11. Ahmad S., Rasheed A., Nawab Y. (Eds.) (2020): *Fibers for Technical Textiles*. Springer, ISBN 978-3-030-49223-6, DOI:10.1007/978-3-030-49224-3
12. Bayar G. (2022): *Türkiye's sectoral exports: A competitiveness approach*. International Journal of Finance and Economics, eISSN 2146-4138, Vol. 27, pp. 2268-2289, https://doi.org/10.1002/ijfe.2272
13. Karabay G., Sarıçoban K. (2021): *Research on Competitiveness in Technical Textiles: Comparison of Countries Having the Lion's Share of Technical Textile World Exports and Türkiye*. Fibres and Textiles in Eastern Europe, eISSN 2300-7354, Vol. 29, is. 6(150), pp. 22-31, DOI:10.5604/01.3001.0015.2718
14. Küçük P.O., Atilgan T. (2019): *Innovative Competency Analysis of the Turkish Technical Textile Sector Based on AHP and FCE Methods*. Tekstil ve Konfeksiyon (Textile and Apparel), ISSN 1300-3356, Vol. 30, is. 1, pp. 20-28, https://doi.org/10.32710/tekstilvekonfeksiyon.506237
15. McCarthy B.J. (2016): *An overview of the technical textiles sector*. Chapter 1, pp. 1–20, https://doi.org/10.1016/B978-1-78242-458-1.00001-7. In Horrocks A.R., Anand S.C. (Eds.): *Handbook of Technical Textiles*, Vol. 1: *Technical Textile Processes*, ISBN 978-1-78242-458-1, https://doi.org/10.1016/C2015-0-01011-5
16. Hägglund M. (2020): *Rebuilding Sweden's crisis preparedness : Lack of clarity impedes implementation*. FIIA (Finnish Institute of International Affairs), ISSN 1795-8059, Vol. 5, https://www.fiia.fi/wp-content/uploads/2020/05/bp283_sweden_crisis-preparedness.pdf
17. Ahrari, M., Karahan, M., Karahan, N. (2023): *Competitiveness Factors in Textiles and Composites Industry and Transformation into Value-Added Products*. **RECENT** journal, Vol. 24, is. 2(73), pp. 132-141, https://doi.org/10.31926/RECENT.2023.70.132
18. Ari A., Karahan M., Karahan N. (2024): *Competency Mapping of Textile and Composite Industries: A Regional-Global Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 1(72), pp. 20-39, https://doi.org/10.31926/RECENT.2024.72.020
19. Karahan M., Ahrari M., Karahan N. (2023): *Composite Materials Market Research and Export Potential Analysis: A Regio-Global Case Study*. **RECENT** journal, Vol. 24, is. 2(73), pp. 113-121, https://doi.org/10.31926/RECENT.2023.70.113
20. Karahan M., Ari A., Karahan N. (2024): *Examination of R&D Capacity in the Technical Textile Sector: A Regio-Global Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 1(72), pp. 4-19, https://doi.org/10.31926/RECENT.2024.72.004
21. Karahan, M., Ahrari, M., Karahan, N. (2023): *Technical Textiles Market Research and Added Value Analysis: A Regio-Global Case Study.* **RECENT** journal, Vol. 24, is. 3(74), pp. 162-180, https://doi.org/10.31926/RECENT.2023.71.162
22. Karahan M., Karahan N., Ari A. (2024): *Market Trends of Türkiye Textile and Composite Industries: A Regional-Global Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 1(72), pp. 40-54, https://doi.org/10.31926/RECENT.2024.72.040
23. Karahan M., Ari A., Karahan N. (2024): *Cluster Governance Analysis in Technical Textiles and Composite Materials Sector: A Regional Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 2(73), pp. 92-100, https://doi.org/10.31926/RECENT.2024.73.092
24. Ari A., Karahan M., Karahan N. (2023): *Preliminary Analysis in Clustering and Supply Chain Creation: A Regional Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 2(73), pp. 80-91, https://doi.org/10.31926/RECENT.2024.73.080
25. Karahan N., Karahan M., Ari A. (2024): *Cluster Strategy in Technical Textiles and Composite Materials Sector: A Regional Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 2(73), pp. 101-113, https://doi.org/10.31926/RECENT.2024.73.101
26. Ari A., Karahan M., Karahan N. (2024): *Cluster Networking and Business Development of Composite and Textile Industries: A Regional-Global Case Study*. **RECENT**, eISSN 2065-4529, Vol. 25, is. 3(74), pp. 155-173, https://doi.org/10.31926/RECENT.2024.74.155
27. Karahan M., Karahan N. (2014): *Effect of Weaving Structure and Hybridization on the Low-Velocity Impact Behavior of Woven Carbon-Epoxy Composites*. Fibres and Textiles in Eastern Europe, eISSN 2300-7354, Vol. 22, is 3(105), pp. 109-115,
28. Karahan M., Karahan N., Gul H., Ivens J. (2013): *Quasi-static behavior of three-dimensional integrated core sandwich composites under compression loading*. Journal of Reinforced Plastics and Composites, eISSN 1530-7964, Vol. 32, is. 5, pp. 289-299, doi: 10.1177/0731684412471091