

# Sectoral analysis of textile and composite industries for value-added manufacturing: a regional study

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## ABSTRACT – REZUMAT

### Sectoral analysis of textile and composite industries for value-added manufacturing: a regional study

*This study aims to determine the main competitive features of the textile and composite industry in the Bursa region, the centre of Türkiye's composite and technical textile production, analyse its development, and define, evaluate, and explore how it can be transformed into value-added elements to increase its efficiency. Adding value to textiles and composites using these competitiveness traits is key to the industry's continued development and prosperity. Value-added products' unique qualities, capabilities, and benefits set them apart from commodity items. The study determined that traditional textile producers would face the most difficulties in the transformation. Textile companies whose technical textile production is below 50% of their total production make up the second group. Companies producing composite materials stated that Research and Development opportunities and quality and technical competence are the two biggest challenges. However, companies producing composite materials are considering transforming their applications in the fields of automotive, renewable energy, defence industry, aviation, and space. As a result, organizations wishing to succeed in the highly competitive and ever-changing composites market must prioritize various aspects of competitiveness.*

**Keywords:** composite materials, technical textiles, competitiveness, Bursa

### Analiza sectorială a industriei textile și a compozitelor pentru producția cu valoare adăugată: un studiu regional

*Acest studiu își propune să determine principalele caracteristici competitive ale industriei textile și a compozitelor din regiunea Bursa, centrul producției textilelor tehnice și a compozitelor din Turcia, să analizeze dezvoltarea acestora și să definească, să evalueze și să exploreze modul în care poate fi transformată în element cu valoare adăugată, care să-i sporească eficiența. Adăugarea de valoare textilelor și compozitelor folosind aceste caracteristici de competitivitate este cheia dezvoltării și prosperității continue a industriei. Calitățile, capacitățile și beneficiile unice pe care le oferă produsele cu valoare adăugată le deosebesc de articolele de bază. Studiul a stabilit că producătorii tradiționali de textile s-ar confrunta cu cele mai multe dificultăți în procesul de transformare. Companiile de textile a căror producție de textile tehnice este sub 50% din producția totală reprezintă a doua grupă. Companiile producătoare de materiale compozite au declarat că oportunitățile de cercetare și dezvoltare, calitatea și competența tehnică sunt cele mai mari două provocări. Cu toate acestea, companiile producătoare de materiale compozite iau în considerare transformarea aplicațiilor lor în domeniile auto, energie regenerabilă, industria de apărare, aviație și spațiu. Prin urmare, organizațiile care doresc să reușească pe piața compozitelor extrem de competitivă și în continuă schimbare trebuie să acorde prioritate diferitelor aspecte ale competitivității.*

**Cuvinte-cheie:** materiale compozite, textile tehnice, competitivitate, Bursa

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## INTRODUCTION

When nations invest in their composite industries, they help spur economic growth and development. The composite business has evolved and changed throughout the years, from the dawn of hand weaving to the present day, when it is incredibly mechanized and technologically advanced, to suit the ever-changing demands of customers and market conditions. Businesses are under increasing pressure to differentiate themselves from competitors, reduce expenses, and provide customers with high-quality items that meet their demands and expectations as the industry has experienced unprecedented levels of competition in recent years [1–4].

Innovation is a critical component of success in the composite industry. The key to success in a cutthroat market is coming up with ground-breaking new products that not only satisfy but also exceed customer expectations. Innovations can take several forms, such as providing funding for research and development, collaborating with designers and other industry experts, or showcasing the most recent trends and technology [5, 6]. Businesses can differentiate themselves from competitors and carve out a unique position in the market by focusing on innovation. Innovations in the textile sector include new fibres and materials, cutting-edge production methods, and sophisticated digital technology. Examples of newly

produced fibres that provide improved sustainability and performance attributes include Tencel and recycled polyester [7–9]. Innovations in digital printing have allowed designers to create intricate and detailed patterns and designs, and developments in automation and robotics are transforming manufacturing processes by making them faster, more effective, and cheaper [10–12].

One of the most important factors in staying competitive in the composite industry is speed-to-market. Since customer tastes and market circumstances are always evolving, businesses that can introduce new items efficiently stand a better chance of succeeding [13–15]. This might be accomplished with the help of investments in supply chain optimization, methods for quick product development, and efficient production processes. Quick action and adaptation to changes in demand and market conditions put businesses in a better position to win market share and sustain an advantage over rivals [16–18].

The main objective of this research is to identify, evaluate and investigate how the important competitiveness features of the sector can be transformed into valuable products to promote the growth and progress of the textile and composite industry. These efforts will include a comprehensive approach to identify and evaluate potential opportunities in the sector, thereby enabling the identification of strategic steps and innovative solutions that are critical for industrial development. In this context, in-depth research will be conducted in various areas to analyse both technological and market-oriented changes and increase the industry's future growth potential. This study will be an important step in increasing the competitiveness of the composite and technical textile industries and moving towards sustainable success. Additionally, this research will explore ways of collaboration and partnership in the industry. In an increasingly connected world, collaboration is key to unlocking new opportunities and accelerating innovation. A synergistic ecosystem has been created in the Bursa region of Türkiye that encourages creativity, efficiency, and sustainable growth by encouraging partnerships between manufacturers, suppliers, researchers, and policymakers. The findings of this study will serve as a road map for industry stakeholders and guide them towards sustainable success in the dynamic environment of the textile and composite industries. By identifying key competitiveness characteristics and translating them into actionable strategies, we can move the industry forward, stimulating economic growth, job creation, and technological advancement. This research effort is not merely an academic exercise; it is a call to action to unite all stakeholders in the pursuit of a vibrant, resilient, and competitive textile and composites industry.

## METHODOLOGY

The diagnostic study into the needs of the companies that are the Centre's potential customers consisted of two phases. In the first phase, 140 companies were

visited by 3 Junior Non-Key Experts to fill out a questionnaire, while in the second phase, 50 companies selected from the 140 using two objective scoring tools were visited for deep diagnostic interviews by 2 Senior Non-Key Experts and the Key Expert 2 who are experts in Technical Textiles and Composites.

## Questionnaire

A draft questionnaire was prepared first, in close cooperation with the End Recipient of Assistance (ERA) (i.e. BTSO, formally, BUTEKOM in practice). It was tried out during a pilot phase with leading companies in the textile and composite sectors. The questionnaire was then fine-tuned for effective data collection. The long questionnaire for the screening phase consists of nine modules with a total of 91 questions:

- Activity/Production (8 questions)
- Supply/Sales (17 questions)
- Human resources (10 questions)
- Research and Development (R&D) (24 question)
- Quality (5 questions)
- Sustainability (2 questions)
- Value chain (8 questions)
- Transformation (7 questions)
- Clustering (10 questions).

Due to the high non-response rate and time limitations, a shortened version was adapted from the long version with 73 questions.

The definition of organizations mentioned in the study is given below:

- Bursa Chamber of Commerce and Industry (BTSO): BTSO aims to meet the common needs of its members, facilitate their professional activities, ensure the development of the sector, ensure the superiority of honesty and trust in the interaction of members with each other and with the public, and maintain professional discipline and harmony (Türkiye).
- Bursa Technology Coordination and R&D Centre (BUTEKOM): To lead the work in national and international organizations (fairs, seminars, R&D project markets, etc.) and to convey the information in the organizations to corporate and expert members (Türkiye).
- Bursa Technical Textile and Composite Materials Cluster (BUTEXCOMP): Bursa Technical Textile and Composite Materials Cluster is an innovation cluster that brings together companies producing textiles, technical textiles and composite materials, sub-industry companies, academic and research institutions and public institutions, reflecting the entire sectoral value chain (Türkiye).

## Sampling

The companies to be visited for the first phase study were selected using rational sampling strategies from a database of 2734 companies from the company register provided by BTSO. The companies were established in Bursa, with at least one staff on the payroll.

A pilot sample of 20 companies was selected to try out the questionnaire. Selection was skewed towards larger companies, as those are more likely to engage in technical textile and composite production. A first sample of 175 companies was then randomly selected using a stratified method. However, when it was found that the non-response rate was much higher than expected, a second (144 companies) and third (80 companies) sample were taken to which a turnover threshold was applied. The high non-response rate of the first sample was attributed to the busy schedules of company owners or related high-level managers and the larger number of companies of smaller sizes included in the first sample that had already ceased their activities or showed no interest in transformation and participation in the project activities. In the second and third samples, smaller companies with a low turnover were not included.

### Execution of the study

The TAT backstopping team took care of the first step of a successful company contact. It was found that filling out the questionnaires was very time-consuming, such that questionnaires could usually not be completed in a single visit. Different departments of larger companies (Research and Development (R&D), Human Resources, financial, etc.) were needed to complete the questionnaire to complicate matters further. It was thus often necessary to leave the partially filled questionnaire at the company to be completed later. Considerable efforts were spent on follow-up to retrieve the filled-out questionnaires, which was not always successful. As a result, the visits to 140 different companies resulted in 102 questionnaires that could be used for statistical analysis and an additional 18 partially filled questionnaires.

### Scoring schemas

Two scoring schemas for the selection of companies to be visited in the second phase were developed in close collaboration with ERA. The first scoring schema focuses on companies that are likely to be the best customers for the centre, with reasonable R&D capability for the production of medium-high tech products of the company that fit in the BUTEXCOMP project's focus on prototyping and new production development skills. This scoring schema focuses on production/export (Technical Textile (TT)/Composites, target sector, production technology, export, and attendance to fairs), general structure of human resources (educational attainments, availability of engineers), R&D (ideas, R&D, Product Development and design centre or units, innovation outputs, application or use of scientific funds), and cooperation readiness (quality, transformation, cooperation and clustering intention). The second scoring schema, derived from the first, targets companies that are most interested in transforming more high-tech products but do not have such capabilities yet. The main difference between the schemas is that the second schema does not take into account existing skills in R&D and

Technical Textiles/Composites, but only the potential and willingness to obtain such skills (i.e. to transform).

### Execution of the second phase study

The semi-structured questionnaire for the second phase is made up of questions to diagnose companies' limitations and challenges regarding prototyping and new product development. It focuses on companies' needs and plans for prototyping and new product development considering their technology levels, the decision-making process for new product development, obstacles for developing new ideas and challenges in R&D processes, new product development projects, project teams' needs, their skill and knowledge gaps and needs, marketing strategies, transforming to technical textile and composites, clustering perceptions etc. The questionnaire is a tool to explore the companies' needs related to the purpose of the Project.

## ANALYSIS OF QUESTIONNAIRES RESULTS

### Firmography

102 fully completed questionnaires were collected despite 140 companies being visited as part of the diagnostic study's initial phase (18 partially filled questionnaires were also received). The companies visited were divided into 4 groups: those of companies only active in classical textiles (26 companies), companies that produce technical textiles, but less than 50% of their total turnover (24 companies), companies that obtain more than 50% of their turnover from technical textiles (18 companies) and companies active in the production of composites (34 companies). Some companies (6) produce both technical textiles and composites; these were considered textile companies. This group was too small to give statistically significant results so was not studied as a separate group.

While exactly two-thirds (66.7 percent) of the companies that visited and completed the survey produced textile products, about 9 percent of these companies also produced composite materials (figure 1).

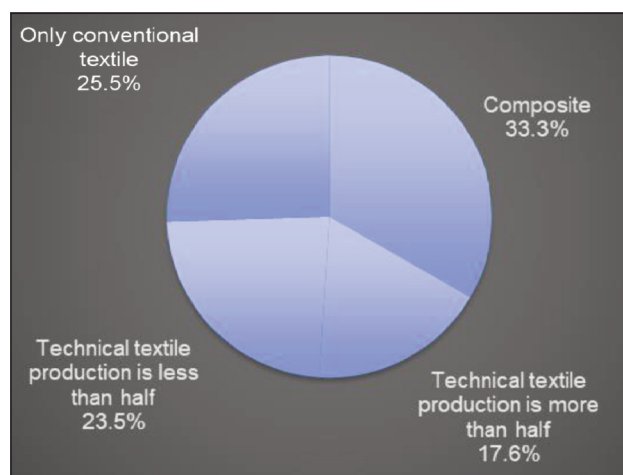


Fig. 1. Distribution of companies by production areas (%) [19]

One-fourth of the companies said they only make traditional textiles. The proportion of enterprises producing technical textiles among all those visited is 40.9 percent.

The majority of technical textile manufacturers claimed that technical textiles accounted for less than half of their total output. Regardless of size, the technical textile production rate among the companies that visited and produced technical textiles was calculated to be 28 percent.

### Development and Transformation

The companies claimed that they intended to expand their current capacity but they also appeared to be highly keen to invest in new sectors (figure 2). They thus pursue possibilities to simultaneously preserve the current status and get access to the advantages and income of new areas. More than three-quarters of the visited companies emphasized that they intended to change and make investments in the new fields. Due to the need for new technologies and composite materials, intentions for investment and transformation in new areas are higher especially in companies producing technical textiles and composite materials than in companies that only produce traditional textiles. Additionally, it is intended to increase

production capacity in businesses that only create traditional textiles and composite materials.

Uncertainty and high investment costs are used by companies as excuses and justifications for not planning investments or transformations yet. Additional factors have been put forth as the lack of knowledge about the industry that will be investing in and the laws, particularly for businesses making technical textiles and composite materials.

More than three-quarters of the companies assert that, with adequate support, they can produce a product with higher quality and high added value (figure 3). This rate is higher in businesses that produce more than half of their output as technological textiles and composite materials.

Companies declared their intentions to invest or change in practically every sector (table 1). While investment or transformation to clothing items are at the forefront in companies that manufacture only traditional textiles, home textiles and automotive and transportation textiles are at the forefront in companies that produce less than half of their production in technical textiles, and automotive and transportation textiles and industrial textiles are at the forefront in companies that produce more than half of their production in technical textile. In addition, companies

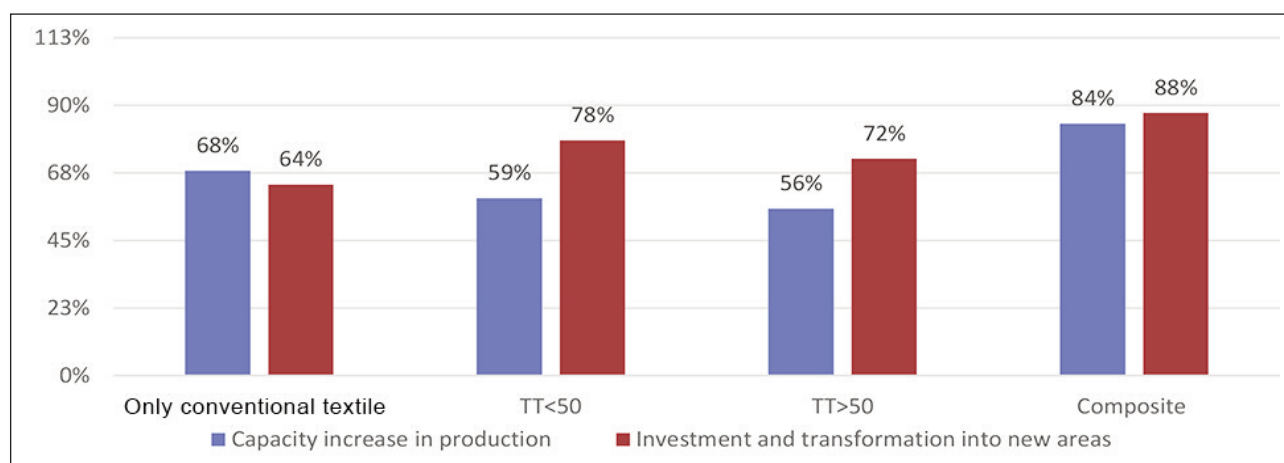


Fig. 2. Capacity increase in production, investment in new areas and transformation plans of companies (%)

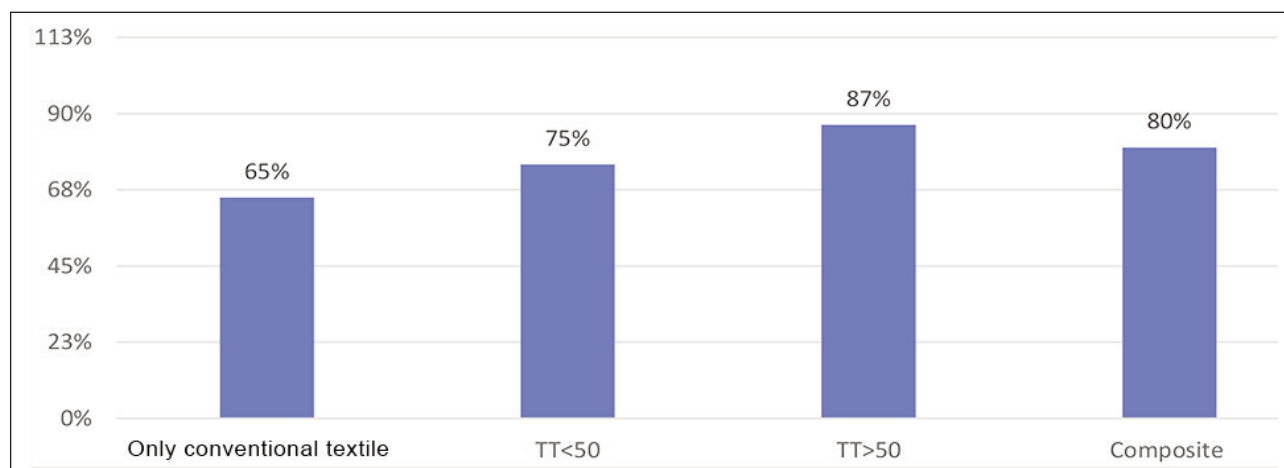


Fig. 3. Ownership of qualified and high added value products

Table 1

SECTORS WHERE INVESTMENT OR TRANSFORMATION IS PLANNED (TECHNICAL TEXTILES)				
Sector	Traditional textile only (%)	TT<50 (%)	TT>50 (%)	Composite (%)
Agrotech	15.8	0.0	14.3	0.0
Medtech	21.1	23.8	28.6	0.0
Hometech	36.8	66.7	21.4	0.0
Oekotech	31.6	23.8	28.6	0.0
Clothtech	63.2	23.8	21.4	0.0
Geotech	10.5	4.8	14.3	0.0
Packtech	0.0	0.0	7.1	0.0
Protech	26.3	33.3	14.3	0.0
Indutech	21.1	23.8	35.7	14.3
Sportech	31.6	19.0	21.4	0.0
Mobiltech	31.6	47.6	42.9	42.9
Buildtech	10.5	14.3	28.6	0.0

have reported that they are planning investments or transformation in the fields of health and environment. Those who create technical textiles said they planned to invest in home textiles, even though traditional textile companies intend to invest in technical textiles used in clothing. Investment or transformation is desired in the automotive, transportation, and environmental textile industries by businesses that make composite materials.

Companies are considering investment or transformation in the areas of automotive and transportation applications, renewable energy applications, the defence industry, and aerospace industry applications related to composite materials (table 2). Technical Textiles used in these areas are often used in composite material. Therefore, investment or production increase in technical textile production will bring about an increase in composites.

Although it changes by sub-sectors, the most significant hurdles in transformation are access to qualified human resources, entry into new markets, and funding (figure 4). Besides most companies reported

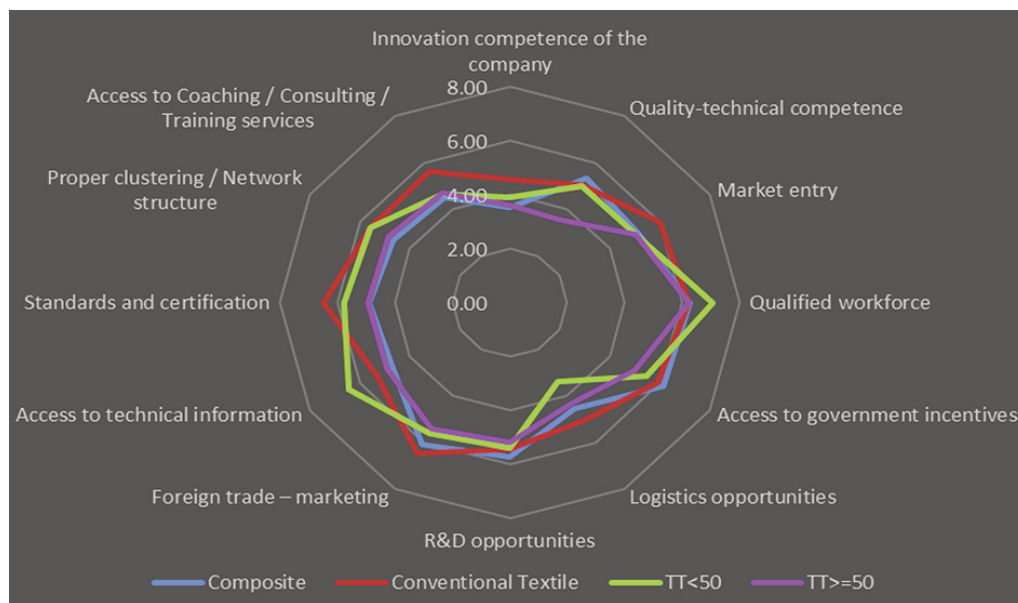


Fig. 4. Challenges in transformation by sectors (out of 10)

Table 2

SECTORS WHERE INVESTMENT OR TRANSFORMATION IS PLANNED (COMPOSITE)				
Sector	Traditional textile only (%)	TT<50 (%)	TT>50 (%)	Composite (%)
Electrical and electronic applications	0.0	20.0	33.3	11.1
Infrastructure/pipe/tank applications	0.0	20.0	33.3	7.4
Construction applications	16.7	40.0	16.7	0.0
Automotive and transportation applications	16.7	60.0	50.0	70.4
Marine applications	16.7	0.0	33.3	14.8
Renewable energy applications	66.7	80.0	33.3	7.4
Defence industry	16.7	60.0	50.0	37.0
Aerospace industry applications	16.7	0.0	50.0	48.1
Sports and entertainment equipment	16.7	40.0	16.7	11.1

about difficult access to coaching, consultancy and training services on the subject matter. It has been noted that conventional textile manufacturers would experience the most difficulty in transformation. The second group is textile companies with technical textile production of less than 50% of their whole production. While conventional textile manufacturers claim that the most significant obstacles are a qualified workforce and access to technical knowledge; technical textile producers below the 50% threshold reported that difficulty in marketing, standards and certification, entrance to markets, and access to coaching, consultancy, and training services are most challenging issues. It shows that they

are currently in the transformation phase. Even though the problems are evaluated similarly in enterprises that produce more than half of their output in technical textiles, however, their levels are lower. Companies that make composite materials stated that R&D opportunities and quality & technical competence are the two biggest challenges. Challenges were also evaluated specifically for sub-sectors of the Conventional Textile sector (figure 5). The most important three challenges were reported as access to a qualified workforce, access to technical information, and standards and certification. The first three most challenging sub-sectors are workwear fabric and apparel, followed by garment and upholstery fabric manufacturing companies. For the workwear fabric and apparel sub-sector, the ranking for the sector is similar to the overall ranking. However, for the garment sub-sector foreign trade and marketing were reported as being the most significant challenge.

Figure 6 shows the challenges for the technical textile sub-sectors. Almost the same challenges are valid for the sub-sectors of the technical textile manufacturers. Access to a qualified workforce was reported to be the main challenge by all sub-sectors, especially Mobiltech and Clothtech. The difficulties for marketing and exporting come second for all sub-sectors. Specifically, Clothtech and Protech subsectors reported these challenges too. The challenge for access to technical information was reported by Medtech and Protech sub-sectors.

The great majority of businesses want to collaborate with companies outside their industry (f). The businesses whose main product is technical textiles showed the most desire for cooperation, followed by the companies that produce composite materials. Overall, 88 percent of the enterprises visited expressed a desire to be a part of the projected Technical Textile and Composite cluster in Bursa (figure 8). Once more,

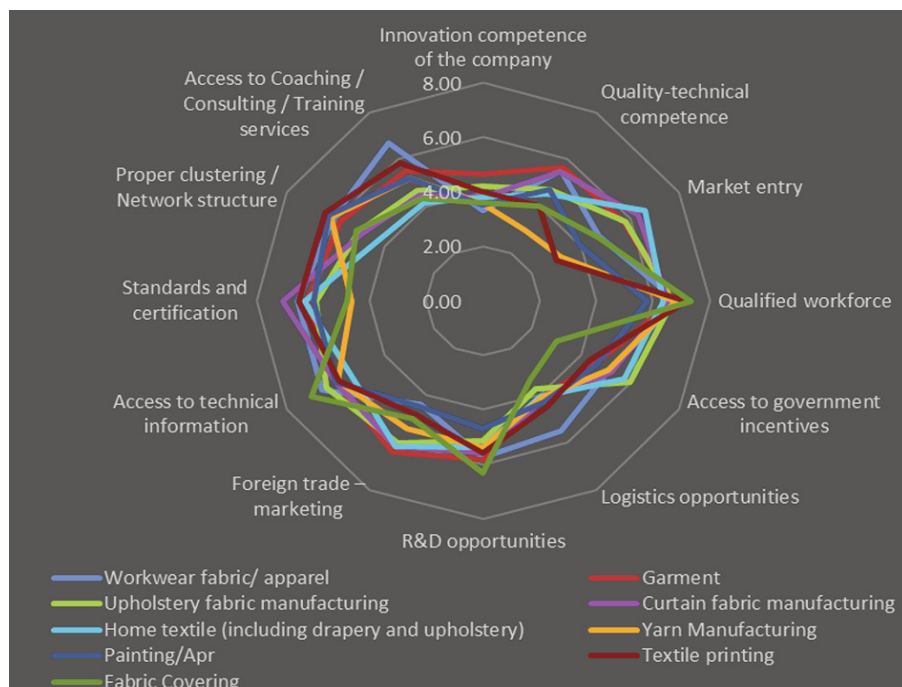


Fig. 5. Challenges in transformation for sub-sectors of conventional textile (out of 10)

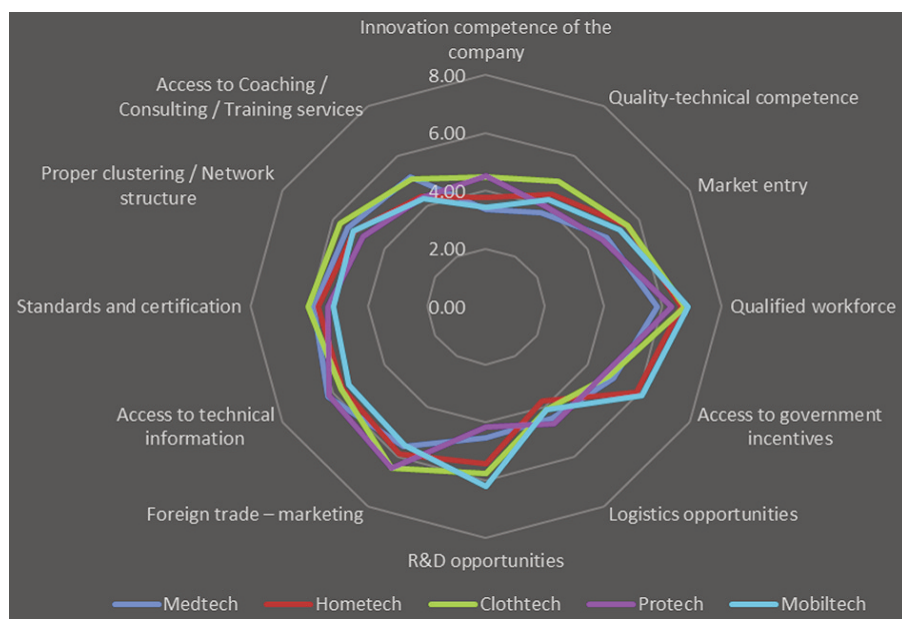


Fig. 6. Challenges in transformation for sub-sectors of technical textile (out of 10)

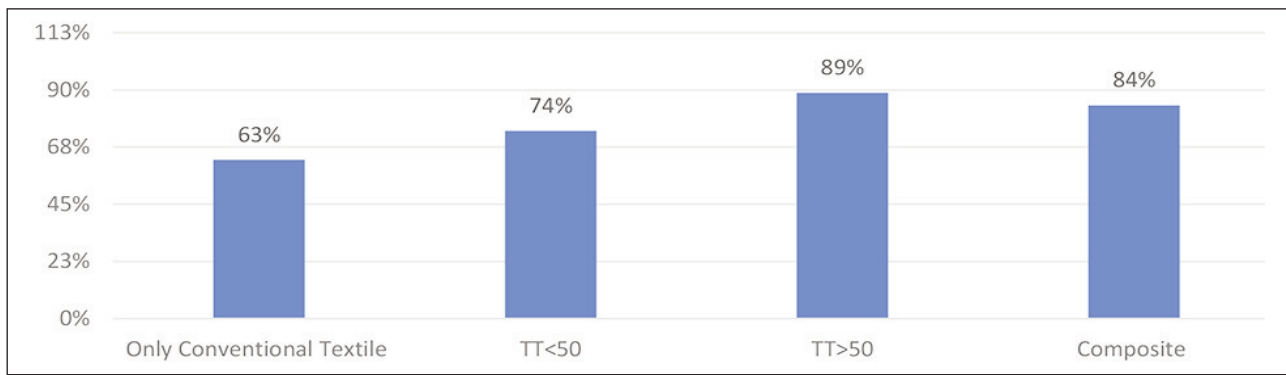


Fig. 7. Desire for commercial cooperation with companies outside their field

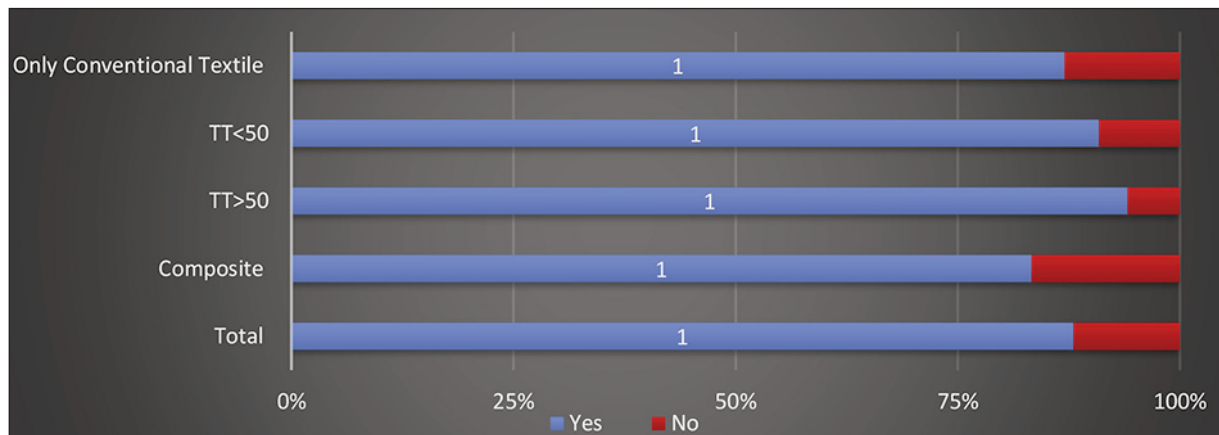


Fig. 8. Desire to be included in the cluster to be established in Bursa (%)

the rate is highest in companies that manufacture technical textiles. Companies that make traditional textiles have also expressed an interest in joining this cluster. This point demonstrates the desire for change as well.

Companies mainly agreed that the clustering plan would deliver benefits such as testing and R&D facilities, incentives and support, and joint sales marketing (table 3). In terms of benefits, business partnership venture capital comes to the fore in companies that only produce traditional textiles. Companies that

produce more than half of their products as technical textiles discussed receiving incentives, whereas those that produce less than half of their products as technical textiles discussed receiving technical support, consulting, testing, and R&D facilities. Companies that make composite materials are also highly motivated to benefit from post-clustering technical support and consulting. At the same time, this situation will enable the companies to act more easily in this regard towards the raw material suppliers or representatives in the cluster.

Table 3

BENEFITS OF A CLUSTERING STRATEGY				
Sector	Traditional textile only (%)	TT<50 (%)	TT>50 (%)	Composite (%)
Joint sales-marketing	63.6	54.5	55.6	55.2
Input/raw material supply	36.4	50.0	50.0	34.5
Technical support consultancy	50.0	72.7	66.7	65.5
Shared centres	31.8	59.1	50.0	41.4
Testing / R&D facilities	72.7	72.7	72.2	48.3
Incentive support	68.2	68.2	77.8	44.8
Publicity/promotion	50.0	54.5	38.9	34.5
Joint venture/joint venture capital	72.7	45.5	44.4	41.4
No benefit	4.5	4.5	11.1	10.3
Other (please specify)	4.5	9.1	16.7	10.3

## CONCLUSIONS

Research on the key competitiveness characteristics of the textile and composite industry and their development potential towards value-added products has reached the following conclusions:

- Fully two-thirds (66.7%) of the companies that visited and completed the survey produce textile products, while approximately 9% of these companies also produce composite materials. One-quarter of the companies said that they only produce traditional textile products. The rate of enterprises producing technical textiles among those visited was 40.9%.
  - Companies expressed their intention to augment their current capacity, while also displaying a strong inclination to invest in emerging industries. Over 75% of the companies assert that they are capable of manufacturing superior quality and higher value-added products with adequate assistance.
  - Companies have declared their intention to invest or modify operations in nearly every industry. The objective is to enhance the production capacity of enterprises exclusively engaged in the manufacturing of conventional textiles and composite materials.
  - Companies often employ uncertainty and high investment costs as rationales for deferring investment planning or transformation initiatives. It has been observed that traditional textile producers would face the greatest challenges in terms of transformation. Companies in the textile industry that produce less than half of their goods as technical textiles are classified as the second group.
  - Composite material manufacturers are contemplating investing in or transitioning to various sectors, including automotive and transportation, renewable energy, defence, and aviation and space industries, specifically composite materials.
  - The primary barriers to transformation, which may differ across sub-sectors, include limited availability of skilled personnel, challenges in entering new markets, and difficulties in securing financing.
- Traditional textile producers are expected to encounter the greatest challenges during the transformation. The second group consists of textile companies whose production of technical textiles accounts for less than 50% of their overall production.
  - 88% of the businesses visited expressed their desire to be part of the Technical Textile and Composite cluster envisaged in Bursa.
  - Composite material manufacturers have identified research and development opportunities, as well as quality and technical competence, as their primary challenges.
  - The sub-sectors of technical textile manufacturers face similar challenges. The main issue across all sub-sectors, particularly mobile technology and fabric technology, is the reported lack of access to skilled labour.
  - Composite material manufacturers are also strongly inclined to seek advantages from post-cluster technical assistance and consultation. This will also facilitate companies in taking prompt actions towards raw material suppliers or representatives within the cluster.
  - Innovation, rapidity to market, cost competitiveness, product quality, branding and marketing, sustainability, social responsibility, and talent management are some of the ways a business can cut costs, differentiate itself from competitors, meet customer needs and expectations, and avoid falling behind the competition. By prioritizing these traits, companies can create profitable and long-lasting businesses that can thrive in the fast-paced, highly competitive textiles industry.

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