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Analysis of Detailed Diagnostic Study Results on Textile and Composite Materials Sectors: A Regional Study

Nevin KARAHAN
Bursa Uludag University, Türkiye, nkarahan@uludag.edu.tr
Mehmet KARAHAN
Bursa Uludag University, Türkiye, mkarahan@uludag.edu.tr
Ali ARI
Ostim Technical University, Türkiye, ali.ari@ostimteknik.edu.tr

Abstract
The Technical Assistance for the Composite Material and Technical Textile Prototype Production and Application Centre (BUTEXCOMP) study aims to improve the capabilities of Small and Medium-sized Enterprise in the composite materials and technical textile sectors in Bursa (Türkiye). The project's first activity is a diagnostic study and needs analysis, which was conducted in two stages. The Desk Review report describes the current state of textiles and composites sectors, including market conditions, technology trends, and previous reports. The study also describes the industrial policies of five EU governments, including the European Commission, and a list of important applied R&D centers and cluster organizations in Textiles and Composites in three countries. The Diagnostic Study and Needs Analysis was conducted in two stages, with 140 companies visited to fill out a standard questionnaire. 50 companies were selected for in-depth semi-structured interviews by senior experts in Technical Textiles and Composites. A Market Research study was conducted, analyzing current and future markets, promising export markets, and technology trends affecting the future market. Recommendations for services to be provided by the new Centre are given. Stakeholder involvement was studied through meetings with existing institutions and stakeholder mapping.

Keywords
Composite Material, technical textile, market analysis, Bursa, cluster strategy

1. Introduction

The textile industry plays a fundamental role in the economic growth and progress of nations, evolving from traditional hand-weaving practices to a sophisticated, technology-driven sector. Today, the industry faces unprecedented competition, requiring businesses to differentiate themselves by reducing costs and delivering high-quality products that cater to rapidly changing consumer preferences. As customer expectations continue to evolve, so too must the textile industry adapt to remain competitive and relevant in the global marketplace [1–3].

One of the central pillars of competitiveness in the textile sector is innovation. In a market driven by rapid shifts in demand, companies that invest in research and development, collaborate with designers, and leverage new technologies often lead the industry. Innovations encompass diverse areas, from novel fibers and materials to advanced manufacturing techniques and digital solutions. Recently introduced materials such as Tencel and recycled polyester, for instance, emphasize sustainability while offering superior performance. Similarly, advances in digital printing enable intricate designs, while automation and robotics are enhancing production efficiency and reducing costs [4–8].

A swift response to market demands, or "speed-to-market", has also become a critical factor for success in textiles. As consumer tastes and market conditions change swiftly, companies that can develop and launch products rapidly gain a competitive advantage. Achieving this often necessitates investments in optimizing supply chains, refining product development processes, and adopting efficient manufacturing practices [9–11].

Maintaining cost efficiency is equally essential in a sector where profit margins are often narrow. Companies must continuously explore cost-cutting measures without sacrificing quality. Investments in automation, supply chain simplification, and strategic sourcing of materials and components are

strategies commonly employed to achieve this. Cost competitiveness allows companies to offer attractive pricing while sustaining profitability in a competitive landscape [12–15].

Product quality remains a cornerstone of competitive advantage. As consumers increasingly seek durable, high-quality products, companies that consistently meet or exceed these expectations build a loyal customer base and stand out in the market. Quality assurance programs, staff development, and continuous supply chain improvement are essential components in achieving these high standards [16–19].

Branding and marketing have gained strategic importance in recent years. A robust brand identity, coupled with effective marketing, can significantly enhance a company's position in a crowded marketplace. Companies that convey their unique value propositions and reach new customer segments through well-executed branding and marketing strategies benefit from increased visibility and customer loyalty [20–22].

Sustainability has emerged as a defining component of competitiveness in textiles. With a growing awareness of environmental and social issues, consumers now demand products made with sustainable practices. Companies that incorporate eco-friendly processes and materials into their operations gain a distinct market edge by aligning with these values [23–25].

Social responsibility is also an increasingly relevant factor. As awareness of labor rights and ethical production practices rises, businesses that prioritize ethical production processes attract conscientious consumers, further enhancing their competitiveness [26–29].

The textile industry is currently undergoing a significant digital transformation. Digital tools are reshaping product design, research and development, and supply chain management. The adoption of e-commerce and multi-channel sales approaches has also enabled companies to strengthen customer relationships and expand their market reach [30, 31].

Lastly, talent management has become a strategic priority. The availability of skilled labor and an engaging work environment are critical for innovation and operational success. By fostering professional growth, providing a positive workplace culture, and offering work-life balance initiatives, companies can attract and retain the talent necessary to thrive in an evolving industry [32, 33].

The Technical Assistance for the "Composite Material and Technical Textile Prototype Production and Application Centre" (BUTEXCOMP) Project aims to enhance the capabilities of Small and Medium-sized Enterprise (SMEs) operating in the composite materials and technical textile sectors in Bursa on prototyping, design, and modelling. The first activity of the BUTEXCOMP Project is to conduct a diagnostic study and needs analysis. Further activities in the BUTEXCOMP project will be based on the learnings from this activity. Later, a business plan for the Centre and service delivery manuals will be prepared, laboratory, consultancy and training services will be developed, and the Centre's staff will be trained to deliver these services (figure 1). The findings of the diagnostic study and needs analysis will also be used as input for the clustering activities in the project and clustering activities will be developed based on the learnings. A part of this project was discussed in our previous studies [34–39].

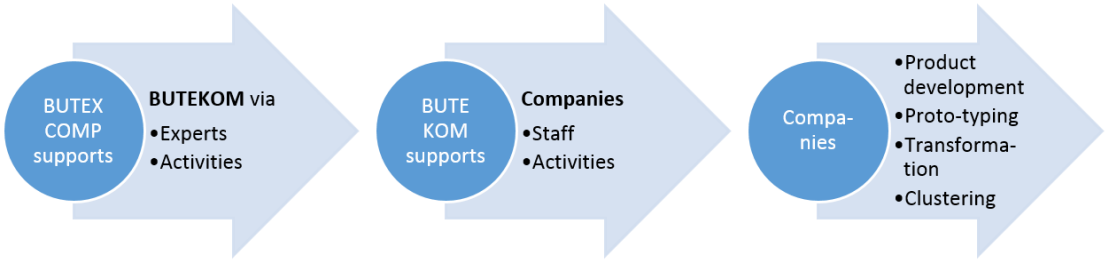

Fig. 1. BUTEXCOMP Process

Technical Assistance Team (TAT) started performing the diagnostic studies and needs analysis to ensure that the BUTEXCOMP project results fulfil the actual needs of the industry. The main objective of the Diagnostic Studies and Needs Analysis is to understand the needs of the potential customers of the Centre. The secondary aim is to understand challenges and bottlenecks regarding prototyping and new product development and companies' readiness and enthusiasm for cooperation with Bursa Technology Coordination and R&D Centre (BUTEKOM) under the BUTEXCOMP Project.

Composite Material and Technical Textile Prototype Production and Application Centre (the Centre) then will serve the actual needs of these customers and fulfil their expectations as well as possible.

TAT will use the results to adapt all the other activities in the BUTEXCOMP project to the needs of the SMEs. Secondary aims of the study are to get to know the SMEs better (their capabilities, competitiveness, ambitions and clustering needs, and their potential as the Centre's customers) and to ensure BUTEKOM can carry out similar studies in the future.

2. Methodology

Detailed diagnostic study interviews were held with 50 selected companies among 140, on different topics such as new product development processes, technology levels, innovation approaches, training and consultancy requirements, sustainability activities, interests in clustering, and digitalization, which were conducted by Senior technical textile and composite experts and Junior Non-Key experts. Subjects related with the first study were discussed in the second phase and interviews were held to learn the expectations and suggestions of the companies from BUTEKOM and BUTEXCOMP under different headings. The feedback received from the companies has been compiled and reported in this document, no filtering has been done. Solution suggestions regarding the feedback are then presented in the relevant sections.

These interviews were found to take much time even though the contents and aims were complementary. The interviewed company employees had difficulty in allocating time for these interviews due to the intensity of their daily work. In the interviews conducted as free format in the second stage, it was tried to gather as many different opinions as possible. They gave feedback that sharing information with experts is more effective compared to non-expert junior interviewers. It has been observed that companies have high expectations of the project.

3. Analysis of Detailed Diagnostic Study Results

3.1. R&D structures and R&D culture of companies

The Bursa region has developed Ministry-approved R&D Centre structuring for companies, with 128 R&D centres and 29 design centres operating in the textile sector. However, integrating these structures requires significant cultural change for companies. Firms with matured R&D cultures are more likely to focus on market gaps rather than R&D activities. The expectations of companies from BUTEKOM R&D centres change according to their R&D maturity levels.

The establishment of R&D and design centres has increased the sector's knowledge level and educational expectations. However, issues such as potential, survival concerns, resource allocation, long return times, and daily activities hinder the spread and acceptance of this culture. Companies adopting R&D culture can carry out projects in their own structures, but must create infrastructure for R&D organizations and provide necessary training.

Global companies with head offices abroad require central R&D approval, and domestic rules and legislations can reduce enthusiasm for projects. Solution proposals include providing training and consultancy to SME's on establishing an R&D culture, R&D project idea generation, literature research, customer needs analysis, and budgeting.

3.2. Approaches in new product development processes

Textile and composite companies differ in their new product development processes. In the textile sector, companies adapt to customer demand or fashion, while in the composite sector, they focus on engineering activities related to their new products. The market is price-oriented and competitive, with companies willing to pay additional costs for innovation. However, companies in the composite sector are more focused on survival and maintaining their current situation, focusing on product development (PD) activities instead of R&D.

The level of market competition determines the spread of innovative products, with most textile manufacturers expressing little demand for innovations. They aim to produce special products for high technology and profitable segments. R&D units are becoming harder due to economic conditions and strong competition, with companies focusing on survival and maintaining their current situation.

The developing defence industry is an attractive market for technical textile and composite manufacturers, but some face political barriers and require different approaches to business with public institutions. Products made with natural fibers and environmentally friendly composite products are preferred, but limited product demand in these sectors can cause difficulties.

In the composite sector, product developments are mostly carried out on customer orders. Companies are looking forward to BUTEKOM taking the lead in tackling these problems and offering integrated development services from R&D to approval stages.

Solution proposals include training and workshops on innovation management, problem-solving approaches, product development methodology and design engineering, design thinking approaches, joint projects with companies equipped within EU projects, articles and presentations on innovations in composites, new composite products, and composite production technologies, studies supporting engineering services, and development of new projects, especially lightweight materials, for the new generation of electric vehicles.

3.3. Creation and financing of R&D projects

Companies in the textile industry have unique project creation practices, which can arise from various sources such as fairs, meetings with customers and suppliers, and market observations. The approval process for projects takes about two years, and financing is covered by equities of companies, apart from opportunities provided to R&D centers. TÜBİTAK is one of the main public institutions supporting R&D centres' projects, but companies express concerns about inflexibility in regulations and intensive bureaucracy.

Companies benefit from R&D investment support given by the ministries under different headings, such as BEBKA and KOSGEB supports. However, companies have different levels of expectations from BUTEKOM in creating R&D projects and accessing finance. They expect BUTEKOM to act as an information center for the Bursa industry, sharing information on new technologies, materials, and environmental protection.

Companies with R&D and design centres ask BUTEKOM to lead consortia in European Union (EU) projects, taking an active role in administrative affairs and leaving detailed technical, scientific, and technological studies to the companies. The integration of lab scale R&D studies and the implementation of outputs are critical by the companies, as results from lab-scale projects may not be enough to implement them in production areas.

Solution proposals include establishing a project pool, providing consultancy and mentoring services, establishing an external experts pool, establishing a database of TT and Composite Materials properties, improving project proposal writing skills, providing financial management services, offering consultancy expert services on KOSGEB R&D and PD projects, establishing contact with other European financial institutes and angel investors, developing an information center for Bursa on Intellectual Property Rights, participating in EU projects, providing support on product design, engineering design, engineering materials, nano materials, FEA, AutoCAD, ANSYS, MathLab, testing, and certifications, and running product development projects with continuous involvement from companies.

3.4. Change in market and customer demands

Companies are experiencing faster market changes, increasing product diversity and shortened product lifetimes. The Green Deal may change this, focusing on longer product use lifetimes. Companies with an infrastructure ready for innovative product demands can keep up with changes and realize customer demands faster. Chemical manufacturers play a significant role in developing functional products in textiles, but they prefer customers to use existing products instead of developing customer-specific products. High-performance synthetic and natural fibers can improve functionality in textiles, but they are not considered worth the price increase. The rise in petroleum prices has led to the use of lighter materials, particularly in transportation and automotive sectors. Composite manufacturers are turning to glass, carbon, and organic fibers for their light, environmentally friendly, and recyclable features. However, small quantities requested make stock management difficult, production difficulties, and cost increases.

Solutions include introducing "open innovation" as part of BUTEXCOMP services, establishing open innovation teams, organizing workshops, providing training, informing composite manufacturers, providing equipment, making BUTEXCOMP prototyping centers more attractive, involving chemicals suppliers and customers, and training on market analysis and marketing department involvement.

3.5. Transformation to technical textile from conventional textile

Textile companies are increasingly transitioning from conventional production to technical textiles, aiming to differentiate their product range, increase value, and produce in a standardized ecosystem. However, these companies face challenges in gaining comprehensive information about the technical textile area and how to sell it. Some companies are planning to produce fiber and fabric for the composite market, while others are not interested in either. Some companies are also considering entering technical textiles in combination with composites. The use of bio-based, environmentally friendly, and lighter materials in technical textiles and composites has led to initiatives in Europe and Türkiye. To address these challenges, solutions include researching market information, creating information and training programs, organizing conferences on entering the technical textiles and composites industries, and organizing product development projects for established textile and composite companies in Bursa.

3.6. Textile production technologies development level

Bursa's textile industry has advanced production technologies compared to Europe, but these fabrics lack a strong brand reputation in Europe. The Türkiye automotive industry and supply industry in Bursa have their own standards, which the textile industry is trying to introduce. To improve the Türkiye textile industry's reputation abroad, BUTEKOM should develop a promotion program, assist companies in investing in up-to-date production technologies, and offer consultancy services to help companies make informed investment decisions and select equipment suppliers. This will help Türkiye gain a better brand image and benefit from its advanced technology.

3.7. Composite production technologies and innovations

Bursa's composite industry uses various methods to produce materials, including injection technology for the automotive industry and thermoplastics like nylon6, 66, ABS, and PC/ABS. The introduction of bio-organic-based raw materials has led to the potential replacement of conventional polymers like PET in the future. However, thermoset materials are still produced using methods such as SMC, BMC, and hand lay-up.

High-performance composites are being developed with resistance to high temperatures, and polymers like PPO, PPS, PPA, PAEK, and PEEK are being used in the electrical/electronic and automotive sectors. Long fibre (LFT) products have started to appear in the markets since 2000, and BUTEKOM should lead a joint project to introduce these new materials to Bursa's composite and intermediate product manufacturers.

Hybrid technology in composite manufacturing offers advantages that traditional techniques cannot provide, such as co-mingling different fibers for homogeneous distribution. High-performance lightweight composites are crucial in aerospace, aeronautics, military, and automotive industries. BUTEKOM should promote the use of nanomaterials like Nanotube, Nano clay, and Graphene in the composite sector.

Energy consumption is an important cost factor in the composite product supply chain, and BUTEKOM should establish an energy and production consultancy unit to support companies with consultancy and development projects for energy efficiency. Glass fibre reinforced plastics (GRP) are used in water and wastewater infrastructure pipelines in big cities, as they are light, resistant to corrosion, and highly resistant to deformation. However, only a few individual initiatives have taken place in Bursa and Türkiye. Solution proposals include providing seminars and trainings on recycling and reusing materials, establishing development projects on recycling, creating training packages on basic composite and polymeric materials, designing energy efficiency projects, raising awareness in municipalities, initiating projects with industrial organizations about new composite applications, starting R&D projects on automated lay-up technologies, providing research services for universities and industries, and providing information on new composite applications.

3.8. Textile and composite industry chemical raw material dependency

Textile raw material manufacturers and manufacturers have a symbiotic business model, with raw material manufacturers supporting textile manufacturers in chemical processing and final fabric testing. However, textile manufacturers argue that this does not increase their technological competence. They also face challenges in obtaining specific solutions from chemical producers, which may require polymer chemistry and polymer chemists. Textile companies heavily depend on foreign sources of raw materials, which can be influenced by economic fluctuations and unexpected shortages. Composite manufacturers also suffer from foreign source dependency, with epoxy resin being a key component in high-tech products. However, introducing new epoxy sources may increase resin consumption by domestic consumers. To address these issues, solutions include developing strong relations with organizations like the Composites Manufacturers' Association, establishing communication with foreign associations and institutes, leading domestic chemical development, developing a business model and project management system, and forming a cluster for specialties chemical companies.

3.9. Using the patent system

Textile production often avoids patent protection due to the two-year application and approval process, which can lead to outdated products and competition. Companies with Ministry-approved R&D or design centers often apply for patents to monitor their performance. However, companies without these centers often find textile patents insufficient. In BUTEKOM projects, patent owners are preferred, often outsourcing their activities. To address this, BUTEKOM should establish a patent consultancy office, organize patent awareness and writing training, collaborate with a patent law firm, and organize courses on intellectual property protection strategies.

3.10. Cooperation with Start-ups

The number of connections between start-up companies and SMEs or large enterprises is low, with few companies developing joint studies with start-ups. The Bursa Technological Textiles start-up challenge aims to raise awareness and exploit this potential. BUTEKOM can provide services attractive to start-ups, including space, equipment, and consultancy. However, these activities should be coordinated with other start-up services providers. Only one start-up company was interviewed, making it difficult to draw conclusions. Solution proposals include mediation, considering spin-outs based on BUTEKOM's technology, considering start-ups as customers in service development, and developing close connections with incubation centers.

3.11. Clustering Potential

Bursa companies are eagerly anticipating clustering activities, which are seen as a way to increase cooperation and attract new competitors. However, some companies find clustering unnecessary and argue that it is unnecessary. The BUTEKOM clustering model aims to create a cluster of around 30-40 companies, forming a complete supply chain. Some companies suggest shared use of production or laboratory devices to avoid inefficient investments. However, some companies view clustering negatively, expressing expectations of common benefits, learning from each other, raising awareness, and cooperation.

Ethical behavior is a significant challenge in clustering, and organizations must actively work to ensure its effectiveness. Textile and composite manufacturers have different ideas about cluster participation, with textile companies preferring clusters composed of only Bursa companies and composite manufacturers arguing that non-Bursa participants are necessary due to the lack of developed and qualified composite industry in Bursa. Clusters should focus on specific areas where cooperation makes sense, and start-up companies can be beneficial partners in clusters.

To avoid competition and promote cooperation, standards of cluster cooperation should be established, including clear descriptions of objectives, activities, limitations, and working rules. Mini clubs can be established to create an open discussion environment between BUTEKOM and companies. Information sharing seminars and workshops can help create joint project opportunities. A database showing current company profiles and clustering possibilities should be created. Subjects for clusters include elastane, technical fibers, high tenacity yarn production, viscose production, and environmental issues.

3.12. Development of Human Resources

The textile and composite sectors face significant challenges in human resources due to a shortage of well-equipped, experienced personnel, economic conditions, and insufficient education. Companies often transfer competent personnel between sectors, which discourages investment in their employees. However, the composite industry is still in its development stage, and companies prefer to train their own staff. BUTEKOM can help develop human resources for both sectors by providing theoretical and practical education. Access to experienced and expert human resources is difficult, and BUTEKOM can build relations with experts who have established consulting firms.

Companies have different experiences with consulting from outside sources, with some hesitant due to past experiences and others seeking broad advice. However, BUTEKOM should be seen as the first address for appropriate consultancy services, with approved consultants preferred in the market.

Solutions include foreseeing the need for new professional qualifications, creating a consultant pool, organizing seminars, and creating a new training program with BUTEKOM, vocational schools, MESYEB, and companies. The program should be monitored annually, with an annual target set and the number of trained people transferred from BUTEKOM to the industry compared to the target as a management performance index.

3.13. Digitalization Trend

The Desk Review report highlights the impact of the third and fourth industrial revolution on market development. However, the textile and composite sectors are currently labor-intensive and not highly automated, making the transition difficult. Companies are using conventional systems like ERP and MRP, and the Internet of Things (IoT) is not on their agenda due to high investment costs. Digitalization is mostly needed for mass production and is not considered applicable by many companies. Solutions include raising awareness about digitalization, monitoring automation developments, and forming a cluster or "mini club" with companies interested in digitalization.

3.14. Sustainability and Green Deal Awareness

The textile and composites industry is increasingly aware of sustainability and the green deal, with European customers demanding environmental responsibility from suppliers. The textile sector faces cost increases due to increased environmental awareness. The composite sector is focusing on waste valuation, particularly thermoset composites, and the transition from thermoset to thermoplastic materials. The demand for recycling composites from thermoset materials is expected to increase, with biodegradable materials becoming more important. Companies are preparing for sustainability and green deal initiatives, with some participating in programs like Bursa Uludağ University. They are also studying waste management, water and energy saving, using recycled products, and flue gas controls. However, many companies struggle with environmental protection projects and carbon footprint calculations. Solutions include supporting the composite industry in Türkiye, providing sustainability-related services, offering consultancy services, and informing medium and small-scale companies and the public on environmental awareness and protection.

3.15. Technology Readiness Level (TRL)

A study surveyed companies on their Technology Readiness Level (TRL) level, focusing on the process from product generation to market introduction and commercialization. The TRL rating system measures the maturity level of a technology under 9 levels, with 1 being the lowest and 9 being the highest. Most companies are unfamiliar with the system and need time to internalize it. Most assess themselves as TRL-9 (40%), TRL-8 (25%), TRL-7 (10%), and TRL-4 (5%). However, 20% did not make an assessment. The study suggests that BUTEKOM should encourage companies to participate in university/industry collaboration projects and provide training in innovation management and methodologies to increase their technology readiness levels to TRL 5-8 levels.

3.16. Awareness and recognition of BUTEKOM by companies

BUTEKOM, an R&D center for technical textiles and composites in Bursa, is seen as a significant opportunity for the industry. However, its recognition and competencies vary among companies,

depending on factors such as location, size, test requirements, R&D level, and customer satisfaction. Both textile and composite manufacturers in the Demirtaş Organized Industrial Zone (Bursa, Türkiye) area know BUTEKOM well, with larger companies being aware of its capabilities due to cooperation. However, some companies outside the Demirtaş Organized Industrial Zone are not as familiar with BUTEKOM, and some are using BUTEKOM for testing facilities and trainings. Some small emerging companies with limited R&D capacity are also using BUTEKOM facilities. Some companies are dissatisfied with the service received, while others are located in remote areas and have not developed their R&D activities yet. To increase awareness, BUTEKOM should intensify communication activities, increase collaboration with other European Textile and Textile Related Institutes, and become a member of the Textile ETP.

The BUTEXCOMP project is gaining attention from companies, but its awareness is low and slowly growing. Prototype studies are crucial for verifying projected products and creating foresight about production problems. However, the probability of using the prototype center for conventional textile manufacturers seems low. To improve BUTEKOM's knowledge on prototype production, presentations and training should be provided to companies, and instruments should be developed for pilot scale production.

The BUTEKOM institutional structure should evolve into an independent, collaborative R&D model, supported by advisory boards and commissions. This would expand BUTEKOM's power and field of activity. Resource allocation should be created through a budget in line with the partnership structure, considering the payback period of devices purchased for accredited tests.

Solution proposals include institutionalization of BUTEKOM's structure, creating an independent technology platform, and conducting regular customer satisfaction surveys. Companies believe that the impressive vision of BUTEKOM creates expectations, but it needs to develop human-based competencies and become a center for technical issue consultancy. Focusing on progress instead of perfection will increase efficiency and functionality.

To continue BUTEKOM's participation in fairs, it is recommended to conduct regular customer satisfaction surveys. The project's success depends on its ability to maintain its importance and power in the textile and composite manufacturing sector.

BUTEKOM has a rich laboratory equipment, including a prototype center, which can meet the needs of organizations. However, companies have expressed concerns about the quality of the testing results and the lack of communication. Some companies have expressed high scores for the adequacy and reliability of BUTEKOM tests, while others have expressed dissatisfaction with the testing process. The ease of use of BUTEKOM laboratories varies depending on the company's relationship with the institution. Some companies prefer to use BUTEKOM as a test center and database, while others prefer to use the facility for their own testing. However, BUTEKOM is not expected to perform all textile and composite tests, and it should monitor which standards companies need and set up laboratory orders accordingly.

Companies obtain test studies and engineering services from various locations, such as The Scientific and Technological Research Council of Türkiye, Bursa, Istanbul, or abroad. However, there is confusion on test pricing, with some finding it economical, others at the level they should be, and others at a higher cost.

Despite Butekom's 70 accreditation certificates, there is a need for accreditation and certification services from BUTEKOM. Accreditation is seen as a matter of prestige and prestige, and some companies have started to accredit their own tests and laboratories. However, just being accredited is not enough to meet the testing needs of companies from accredited centers.

Companies are concerned about BUTEKOM's instrument investments and the need for proper selection of instruments. They suggest that BUTEKOM should collect their opinions on future instrument purchases before making investments, as improper specifications can lead to instruments being idle for device-demanding companies. Technical training for companies involved in injection, pressing, or thermoforming can also encourage cooperation with BUTEKOM.

Solution proposals include improving communication about testing services, reviewing the test system, increasing collaboration with other organizations, developing a test portfolio, accreditation, and offering a database service. Collaboration with universities and R&D centers can help share instruments and utilize existing knowledge.

Companies are interested in using tape weaving machines for carbon fiber weaving and other technical fabrics. There is a demand for VOC analysis services, flame retardancy and non-flammability tests, light transmittance tests, visibility tests, electromagnetic shielding tests, biodegradable product tests, and CNC turning machines.

BUTEKOM lacks sufficient expertise, which can be developed by hiring competent people or making special agreements with competent people. Trainings provided by BUTEKOM are generally seen as first-step and not advanced, and companies benefit from external resources for specialized training courses. However, some suggest that BUTEKOM should offer trainings from a pool of experts with academic and industrial experience instead of employing experts or breeding them within BUTEKOM staff.

The text discusses the challenges faced by companies in BUTEKOM, a textile company in the country. Some companies are willing to invest in advanced training, while others expect affordable prices. The proposed solutions include updating trainings according to the needs of the companies, improving collaboration with universities, institutes, and consultancy companies, and establishing a network of experts from industrial establishments.

There is a demand for trainings on accreditation, waste disposal, composite and its sector training programs, and competence development. However, some companies express dissatisfaction with communication with BUTEKOM, feeling that it is like a tax office. They also suggest that BUTEKOM should be able to anticipate the potential working potential of companies and guide them.

The physical space in BUTEKOM needs improvement, with companies expecting protected environments and small meeting rooms for discussing their demands. However, they also suggest the establishment of Account Managers for each market segment, a constantly updated database, regular visits by account managers, and spaces emphasizing confidentiality.

Additional ideas include providing technical support for acoustic performance enhancement, developing mould materials for high temperatures, analyzing material behavior in different ambient conditions, shaping ability in composites, performing technical and market entry studies, developing conductive fabrics, and creating a Research Unit on Digitalization (RUD) and Industry 4.0. These ideas aim to address the challenges faced by BUTEKOM and ensure customer satisfaction.

Additional suggestions include providing technical support for acoustic performance enhancement, developing mould materials for high temperatures, analyzing material behavior in different ambient conditions, and developing finishing chemicals for permanent fireproofing. Additionally, BUTEKOM should focus on recycling materials, biodegradable materials, and developing textiles and coatings for reinforcement in composites.

4. Conclusions

The detailed diagnostic study and needs analysis conducted within the scope of the BUTEXCOMP Project has comprehensively revealed the current status, needs, and potential development areas of SMEs operating in the composite materials and technical textile sectors in Bursa. The findings indicate that BUTEKOM can support the widespread adoption of R&D and innovation culture in the region by providing more effective support and guidance services for companies in these sectors.

This study has shown that companies in Bursa face challenges in investing in R&D projects, developing innovative products, adapting to digitalization, ensuring sustainability, and achieving international competitiveness. It is essential for BUTEKOM to support SMEs in critical areas such as R&D project development, access to project financing, rapid adaptation to changing market demands, and transformation into the technical textile field. Raising awareness and producing innovative solutions in the areas of digitalization and sustainability are particularly important for enhancing the competitive power of companies in these sectors.

Other areas where BUTEKOM can contribute to the sector include supporting the development of SMEs in advanced production technologies in technical textiles and composites, providing training in innovation management to increase competitiveness in global markets, promoting environmentally friendly production methods, and fostering potential for collaboration among sector firms. Encouraging clustering activities within the sector and establishing BUTEKOM as a platform for inter-company knowledge sharing are also strategically important for regional economic development.

Overall, the BUTEXCOMP project presents concrete solutions to address the capacity development needs of SMEs operating in the composite and technical textile sectors in Bursa, contributing to the positioning of BUTEKOM as a pioneering R&D center in the industry. These findings will enable BUTEKOM to expand its service range, strengthen R&D and innovation capacity in the sector, and support Türkiye in achieving a more competitive position in the international market.

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