

Cluster Strategy in Technical Textiles and Composite Materials Sector: A Regional Case Study

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Abstract

Strategic priorities were determined by taking into account all the data and findings collected within the scope of this study, and the cluster vision and mission were presented together with the cluster strategy. It is built on three key strategic pillars of innovation, productivity, and internationalization and is complemented by three supporting strategies: skills and knowledge development, network development, and cluster promotion and branding. This study, which is one of the building blocks of the Technical Textile and Composite Materials Cluster, can be used not only as a road map but also as one of the basic documents of clusters and as a source for the development of new cluster projects and actions. The Bursa Technical Textile and Composite Materials Cluster has great opportunities, and it has been seen that it is possible to achieve its goals with the determined implementation of the cluster action plan.

Keywords

technical textiles, market analysis, composite materials, cluster strategy, Bursa

1. Introduction

Over the past three decades, the concept of clustering has garnered significant attention across economic policy agendas, academic spheres, and corporate landscapes. Clusters, denoting groups of closely situated businesses and organizations within the same industry sharing common features and distinctions, have emerged as potent catalysts for synergy and competitive advantage. This surge in interest is evident from the substantial online presence dedicated to topics such as 'Cluster Competitiveness,' as exemplified by a Google search yielding millions of results from reputable institutions like the World Bank and advocacy groups like the US Cluster Mapping Project and the European Foundation of Cluster Excellence [1-3].

Central to the popularization of clusters and their nexus with competitiveness is the seminal work of Michael Porter, whose insights underscored the pivotal role of clusters in driving competitive prowess. Notably, esteemed organizations like the World Economic Forum (WEF) have recognized clusters as pivotal components of national competitiveness, as evidenced by their inclusion in the Global Competitiveness Report (GCR) under the pillar of 'business sophistication.' This acknowledgment underscores the growing acknowledgment of clusters' significance in enhancing economic vitality [4-6].

Moreover, clusters have emerged as a potent remedy for the pervasive 'missing middle' challenge faced by small and medium enterprises (SMEs) in developing economies, offering a framework for regional innovation and globalization. Governments worldwide are increasingly embracing cluster development as a strategic imperative, evident in the burgeoning literature exploring cluster dynamics in both advanced and emerging economies [5-7].

China's meteoric economic ascent over the past four decades stands as a compelling testament to the efficacy of industry clusters, with the nation's prominence in cluster development underscored by its ranking in the Global Competitiveness Report. However, despite the growing discourse surrounding clusters, there remains a notable dearth of research on their competitiveness, signalling an area ripe for scholarly exploration [8-11].

At its core, the World Economic Forum defines a nation's competitiveness as a fusion of institutional frameworks, regulatory environments, and various factors shaping productivity. Porter's conceptualization of clusters as the linchpin for heightened productivity resonates strongly within this framework, positioning clusters as microcosms encapsulating a nation's competitiveness. Consequently, assessing the competitiveness of clusters becomes imperative in gauging a nation's overall economic vigour [12-13].

Against this backdrop, our research delves into the burgeoning markets of technical textiles and composite materials, elucidating their value propositions and global market dynamics. Our findings underscore a burgeoning demand for high-value-added products like technological textiles, precipitating a shift in production paradigms worldwide. Similarly, the composite materials sector has witnessed exponential growth, with countries like Turkey positioning themselves strategically to capitalize on this trend [14-15].

Critical to the success of industries like technical textiles and composites are competitive factors encompassing production costs, technological prowess, product quality, innovation, and sustainability. By leveraging these attributes, businesses can transform raw materials into value-added products, thereby enhancing competitiveness and profitability [16-19].

Our study further extends to the establishment of cluster strategy within the Bursa Technical Textile and Composite Materials Cluster ecosystem, laying the groundwork for strategic planning and implementation. By delineating regional factors shaping cluster development, our research provides a robust foundation for advancing cluster strategy initiatives, facilitating sustained growth and competitiveness within the Bursa region and beyond.

2. Methodology

Cluster governance refers to the process of identifying and establishing an organizational structure, as well as implementing organized efforts to manage relationships, communication, information flow, and the execution of tasks in order to achieve a collective vision of the cluster. There is no universally agreed-upon or acknowledged set of guidelines for identifying the cluster organizational structure when reviewing cluster cases. Furthermore, the success and effectiveness of organizational structures are influenced by a multitude of elements. It is crucial to provide detailed information on the cluster's maturity level and its operating capability and resources.

In the majority of instances, the organizational structures or governance models of clusters are associated with the ability and skills required for cluster administration. In essence, the establishment of an effective cluster governance framework is closely associated with the presence of a proficient cluster coordination unit, commonly referred to as the cluster management team. This team assumes the responsibility of overseeing the overall representation of the cluster profile.

The determination of a suitable organizational structure for the Bursa Technical Textile and Composite Materials Cluster holds significant significance in ensuring the cluster's development. The cluster has a diverse range of actors, including major, medium, and small-scale firms, original equipment manufacturers (OEMs), prestigious universities, open innovation centers (OIZs), stakeholders, and public organizations. Each actor has their own distinct expectations, inputs, and organizational principles. Hence, the development and initiation of a cluster are crucial for the ongoing operations and effective implementation of the cluster strategy in a collaborative and institutionalized manner. The term "formal" does not imply the creation of a formal entity at the outset of cluster development stages. Rather, it pertains to the coordination of cluster activities in order to implement the strategy. This coordination is carried out by an organization and a cluster coordination unit, which consists of a full-time team(s) who work on a daily basis to coordinate the identified actions for the cluster.

In the action plan section of the document there are responsibilities attributed to BTSO, BUTEKOM and BUTEXCOMP:

- BTSO: Preparation and implementation of a project to determine typical buildings in selected pilot provinces and to develop solution examples and alternative approaches for reinforcement, especially composite materials and technical textiles, by establishing a scientific committee and working groups,
- BTSO: Increasing public awareness about the importance, effectiveness and efficiency of building strengthening in reducing loss of life and property in earthquakes,

- BTISO: Creation of reinforcement cluster with fibrous polymers,
- BUTEKOM: Preparation and publication of publications showing correct and incorrect practices regarding composite materials or technical textiles,
- BUTEKOM: Establishing R&D collaborations on composite materials and technical textiles in buildings in cooperation with industry, civil society and universities,
- BUTEXCOMP: Organizing training courses (application-oriented) in certified international standards by BUTEXCOMP in the existing center,
- BUTEXCOMP: Quality Control Testing of materials to be used in building reinforcement at international standards,
- BUTEKOM: Initiating sustainable collaborations by establishing joint working groups with the relevant professional institutions and R&D Centers of the countries that have fully achieved empowerment, to conduct training, awareness-raising, seminars on legislation, study visits and R&D studies.

3. Cluster Strategy

3.1. Grounds Constitutes Bases for the Cluster Strategy

Under this heading key issues driving for a tailor-made cluster strategy has been summarised. Main arguments in relation with current status of the products, industry trends were briefly elaborated.

Industrial Scope

- Industrial scope of the cluster comprises distributed in two main areas, technical textiles and composite materials. In terms of application areas; mobiltech is the current industry in which intermediate products are demanded from both technical textiles and composite materials manufacturing companies. With relation to this fact; automotive interior and exteriors constitutes one of the main product groups of the cluster. Without leaving room for discussion, in general mobiltech; automotive, railway and aviation constitutes specific target segments of the cluster. Developed home demand is also one of the most important driving forces for companies to specialise in their products in mobiltech. Number of companies and products within the cluster manufacturing composite materials and technical textiles has to be increased.

- Along with mobiltech industry, there are two other main application areas shaping cluster companies' competences in terms of industrial focus. Due to historical background and presence of textile and clothing as well as furniture industries, companies are manufacturing textile and clothing products with functions offering variety of solutions for customers,

- Based on the analysis and studies undertaken within the scope of the Project, products for buildtech and protech has key importance in terms of wide application areas and needs.

Rivalry and Trends

- Due to growing demand in end markets, need for composite materials and technical textile products, there are fast emerging opportunities for the cluster companies. However compared with traditional industries, technical textiles and composite materials sectors are highly innovative. When international trends and key players are reviewed it is seen that industry is innovation driven and there is high level of competition among players.

- It is seen that companies in the cluster ecosystem has innovative approach and business models, where establishments of R&D Centres within the companies observed at a high level. However as it has been stated by the companies during the interviews and seen in findings of the analysis that innovation is undertaken as internal efforts rather than interaction with universities and start-ups. In the cluster ecosystem open innovation has to be promoted. Collaboration between companies, universities and start-ups has to be increased. In relation with open innovation, improving entrepreneurial culture has to be also one of the priorities for the cluster ecosystem.

- Network structure within the cluster ecosystem especially among OEMs and companies enabling cluster to develop towards a more customer-oriented structure, however due to business model level of company branding and at certain level R&D and innovation studies, product diversification can be shaped by the buyers. Another fact is companies are manufacturing products mainly in the form of intermediates, as a reason why number of "finished products" or "branded products" is low. It is important to underline that, this fact has not been stated as a weakness, it is rather stated to picture structure of the business model.

- In composite materials and technical textile industries, performance and sustainability will continue to be key determinants which will play role in shaping industries future. From trends analysis it can be concluded that, innovation in the industry starts with materials, which are durable, environment friendly and functional.

- There are still essential steps to be taken especially for improving specialization in the industry. There is need for improving knowledge on technical textile and composite materials among companies and workforce. There is need for improving and up skilling both current workforce and students in line with the increasing needs of the companies for entering and manufacturing technical textile and composite materials.

- Sustainability is extremely important and use of plastics will be a threat for the company's manufacturing parts and components made of plastics. In Europe and in globe, there is a lot of work going on replacement of plastics with biodegradable and/or recycled input materials.

- Additionally, sustainability is one of the top priorities driving demand conditions, especially from demand of customers and OEMs shaping industry structure. Two aspects in line with Green Deal purposes of the EU, less carbon footprint and use of sustainable materials in production have to be among priorities of the cluster. Use of biomaterials in technical textile and composite products has to be planned in related cluster activities. Cluster has to follow sustainability-oriented approach as well as the cluster companies. Sustainable materials have to be among innovation and research areas of the cluster.

- There are a lot of research and innovation studies going on in composite market. It is seen in many resources that there is a huge trend and work; thermoplastic components. This area has to be among top innovation and product development priorities of the cluster.

- The global composites market is mainly driven by the increasing demand for lightweight materials from the automotive and aerospace industry. Moreover, the market growth is fuelled by a rise in the utilization of glass-fibre composites in various end-use industries. The higher utilization rate of glass fibres in end-use industries such as wind energy, construction, sporting goods, and marine has broadened the scope of glass fibre composites.

- When the kilogram prices in Türkiye's imports and exports are analysed, it is seen that the prices in imports are higher than the prices in our exports. This situation can be explained in two ways; a) the production costs in EU countries, which are our biggest trade partners, and therefore the high prices of the products we buy from there, b) the lower added value and low brand value of the products produced and exported in Türkiye.

Value Chain and Materials Development

- In Bursa natural and synthetic fibers present however there is very limited manufacturing and/or on-going studies on manufacturing high performance fibers –glass fiber, carbon fiber etc. – based yarns which constitutes any level of market scale yet. On the other hand, carbon fiber is purchased from other regions. Additionally, bio-based fibers also gain importance in textile industry and related industries. Upgrading “manufacture of high-performance fibers” within the value chain can bring opportunities in Bursa. To conclude: i) developing bio-based fibers, ii) manufacture and innovation on high tenacity synthetic fibers, iii) studies on reinforced materials can bring competitive advantages to Bursa can be considered among priority areas for cluster actions.

- Manufacture of fibers such as glass, carbon etc. needs certain level of investment and may need specific infrastructure. At this stage lack of players manufacturing glass or carbon fiber cannot be accepted as a key weakness for cluster development. However, suppliers of such critical input materials keep power of bargain, price decision and may limit access to materials. Dependency especially on glass and carbon or aramid fibers may put pressure on competitiveness of the companies. Based on the desk review study undertaken over the course of the analysis study, it is seen that “sustainability” will continue to be the determining condition for competitiveness. Since innovation starts from material, studies on alternative and bio-based materials for bio-based fibers to be used in technical textile and composites seem to be one of the key strategic upgrades for the value chain.

- Since majority of technical textile companies also manufacturing textile products for home and furniture use, fabrics made of synthetic yarns is widely seen. However, analysis reveals that there is need for increasing both number of companies manufacturing high tenacity yarns and increasing capacity to manufacture technical and high tenacity yarns, including conductive yarns.

- Technical textile manufacturing technologies and finishing applications are directly linked to needs and areas of use. It is therefore highly important to understand and identify target sectors and application areas for Bursa, to invest, adapt and innovate in fabric manufacturing and finishing processes. For instance, it is known that for mobiltech, warp-knitting capabilities constitute substantial place, electro spinning in medical use products. As an early conclusion before developing cluster strategy and roadmap, having strong automotive industry in Bursa, companies should be supported for developing their manufacturing technologies including fabric manufacturing, applications, materials and know-how on how to apply innovative solutions.

- In the light of detailed value chain analysis, perception of raw materials and intermediate products within Bursa technical textile and composite materials comprises “high performance and environmental materials”. From this point of view, improving capacity of companies to manufacture technical yarns with use of new materials, biomaterials and reinforcement materials is considered as improvement of quality of raw materials and intermediate materials. Same condition applies for composite materials manufacturing. Input materials to manufacture composite materials in Bursa such as pre-pregs, type and other materials subject to manufacturing processes considered as improvement of raw materials in the cluster. There is need for developing and improving capacity of the cluster in materials.

3.2. Cluster Vision

Where we are:

Apart from technical textile manufacturers, within the cluster, companies related with composite materials are mainly manufacturers and suppliers of automotive industry in Bursa and abroad. Currently main product groups of the cluster are parts made of plastics and metal, automotive seating systems where technical textiles in other words automotive textiles are used. In this regard companies in the cluster developed a lot of competence in manufacturing processes in automotive parts design and manufacturing. In technical textiles, textile products are mainly functional fabrics used in clothech, protech and hometech, in which functions such as flame retardancy, UV protection, etc. acquired by chemical applications.

In both areas, manufacture of products made of reinforcement materials such as carbon, glass and aramid are relatively low. Companies are running innovation and R&D studies and level of companies using Ministry of Science and Technology R&D Centre support is high. However, nature of innovation is closed, level of innovation-based collaboration among with the value chain and with university is relatively low. Supplying industry companies such as chemical providers, plastics and metal input materials, high tenacity yarns, rubber, resin are essential for increasing quality and volume of products in the light of demand needs. Bursa cluster environment is diverse and provides infrastructure for reaching supplying industries, however there is especially need for eliminating risks and power of foreign suppliers in critical input materials. Bursa cluster environment is strong with test and analysis institutional infrastructure; however, it is observed that there are companies in need of test services starting from automotive industry. Improving testing and analysis in line with specific needs of end markets would help companies integrating in national and global value chains.

Although there is a developed manufacturing competence in Bursa, province is not globally recognized. Bursa can be better positioned with areas of specialization, which can result with export and technology transfer thereby growth and prosperity.

Where we have to be?

Cluster has to better position with clearly defined areas of specialization. Cluster has to be known with its key products and/or competences, which will make province known as the first address of the solution. Instead of trying to develop competence in many and different areas, focusing on certain application areas and developing competence in those areas can be a smart starting point.

In this sense Bursa Composite Materials and Technical Textile Cluster can be positioned as the centre for solutions and technology development for automotive, aviation, clothtech and hometech as well as builtech. Generating industrial knowledge and applied research has to be among primary goals of the cluster.

Number of intellectual properties, patents, and product licenses has to be increased. Main goal of the cluster has to be increasing capacity of companies in developing innovation and new products for the industry.

With the clear scope and vision, cluster has to follow internationalisation strategy, which will lead for a better global recognition. Industrial trends and changing needs of the customers has to be continuously followed. Cluster has to offer sustainable, digital and need oriented innovative solutions for the markets.

In the light of above perception, below statement is recommended as the cluster vision. Key priorities and recommended cluster vision statement will be shared with cluster members through a workshop and final version will be integrated in the report.

Vision Statement

“Bursa technical textile and composite materials cluster one of the best-known clusters in the world providing advanced products and solutions for mobiltech, hometech and other application areas through its digital and sustainable approach.”

Mission Statement

“Bursa technical textile and composite materials cluster through its professional cluster management capabilities, supports cluster companies and cluster ecosystem with continuous innovation, productivity and internationalisation. Cluster works in close collaboration with key stakeholders for up-skilling workforce and improves competences of the companies in line with changing needs of the industry.”

3.3. Cluster Strategy Context

With the comprehensive analysis carried out within the scope of clustering studies, basic issues have been identified for the cluster to be successful in the medium and long term. Steps that need to be taken strategically can be summarized as follows; first of all, the focus of the cluster has been set as “innovation”. Bursa Technical Textile and Composite Materials Cluster is an innovation cluster.

Although cluster products have a wide range, cluster resources should be optimized by clarifying the main areas of specialization. The transformation vision put forward with the project and BUTEKOM should continue with the cluster development and implementation stages. In addition, sectoral transformation of the cluster based on “innovation” and “efficiency” and “growth by internationalization” are among the main strategic priorities.

In technical textiles and composite materials industries, Bursa should be positioned as one of the first production and solution centre that come to mind in Turkey and the in the world, especially with high performance materials. With its production infrastructure and capabilities, Bursa will also have a say in fields such as automotive materials, home and office technical textiles, strengthening of buildings with reinforced innovative materials and protective textiles.

Bursa technical textiles and composites cluster will strengthen its position in the world market as the address of high performance and sustainable materials of future especially in the areas of automotive materials, aviation, home and office technical textiles, construction and areas where technical textiles and composite materials used.

It is only possible to achieve the set goals with a strong strategy and road map. As briefly mentioned above, the main strategies are the development of open innovation in the cluster ecosystem, increasing specialization and efficiency to accelerate sectoral transformation, and internationalization of the cluster for technology and market development. These main strategies are supported by strategies of strengthening skills and know-how infrastructure, strengthening network and cooperation structure, and strengthening national and international recognition of the cluster. Another key pillar of the cluster strategy is sustainability and digitalisation, which will be going hand in hand in all strategic pillars and actions of the cluster.

Cluster governance has a critical role in achieving the cluster goal. In this regard, the target and work plan of the cluster management and coordination team, which will continue its operations within the cluster governance structure, is highly important. A frequently encountered issue in the cluster development process is that the relationship between “the cluster vision and goals” and “the goals and services” of the cluster management teams is not established strong enough. This report clearly reveals this relationship in the following sections and its relevant appendices.

3.3.1. Core Strategies

Innovation Strategy

“Empowering open innovation for new product development and product diversification towards high performance and sustainable products”

The cluster innovation strategy is based on the development of an open innovation culture in the cluster ecosystem. Although the companies in the cluster have R&D and innovation studies and collaborations with universities, it has been determined that innovation-oriented studies undertaken within the companies and have a closed structure. From this point of view, the aim of the cluster is to support collaborative innovation among cluster actors in the light of the needs and trends of the priority target sectors in the field of technical textiles and composite materials. The aim of the cluster with its innovation strategy is to improve research infrastructure through carrying out studies throughout the technology readiness levels and to support collaborations starting from the product idea to the commercialization stage. With the cluster innovation strategy, it is aimed to transform the cluster into a structure that facilitates increase in innovative products, new patents and licenses.

Key idea of innovation strategy in Bursa Technical Textile and Composite Materials cluster can be interpreted as “paradigm shift from close innovation to open innovation” which can be enabled through collaboration. In other words, strategy of the cluster can be summarised as “maximizing research and innovation efficiency through collaboration towards new innovative ideas and products”

The term open innovation means a situation where an organisation doesn't just rely on their own internal knowledge, sources and resources (such as their own staff or R&D for example) for innovation (of products, services, business models, processes, etc.) but also uses multiple external sources (such as customer feedback, published patents, competitors, external agencies, the public, etc.) to drive innovation.

Cluster's innovation strategy is composed of three action areas; which supports improvement of factors conditions of the cluster

- i) improving research and innovation environment,
- ii) improving innovation capacity of cluster companies, and
- iii) improving entrepreneurship and formation of start-ups.

i) Improving research and innovation within the cluster

It is aimed to empower research infrastructure and improve cluster environment in research and innovation studies especially for eliminating barriers from fundamental research to applied research, from applied research to market uptake stages. This aim attributes with open innovation approach where, innovation process is considered from open research to open innovation.

In relation with manufacturing aspect, one of the reports supported by the EU states that; although the innovation process is nonlinear, in the manufacturing domain two main gaps can be identified at European level (and in many national or regional subsystems). The first between fundamental research and applied research and the second between applied research and market uptake. In the manufacturing domain, these gaps pose specific challenges and should be addressed with specific instruments and funding mechanisms (Figure 1).

First area of innovation strategy of the cluster will contribute promoting the necessary fundamental and applied research and its diffusion to the relevant stakeholders, in the domains identified within this report. Following the overall approach of the innovation strategy, this area is based on improving clusters capacity to undertake studies through an open innovation process in close collaboration with research environment, universities as well as promoting establishment of new start-ups and entrepreneurs.

At cluster level steps foreseen to be taken towards aforementioned scope:

- I) Development of Innovation Map of the cluster: Mapping TRL of companies and review of innovation levels,
- II) Developing fundamental research, applied research concepts and supportive cluster services to eliminate barriers for starting research and prototyping studies, bringing relevant cluster actors and decisions taken,
- III) Developing themes, project concept notes, national and international partnership pool for innovation projects.

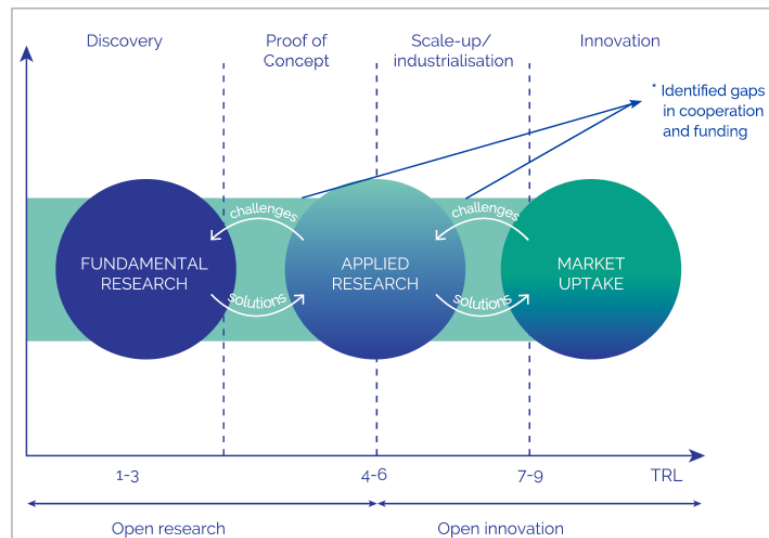


Fig. 1. The innovation process [20]

ii) Increasing innovation capabilities of cluster companies

It is aimed to increase number of SMEs within the cluster with improved innovation capacities and number of new product ideas and products developed. To this end it is aimed to facilitate and develop collaboration projects between companies and universities, techno parks and research centres as well as improving cluster environment for establishment of start-ups.

Core idea of this strategic area is to identify innovation capacity levels of companies and develop innovation roadmaps with the help of knowledge and network accumulated over the course of the Project. Based on the road maps, research studies, prototyping and product development activities can be undertaken by the companies through utilizing national funds, facilities of BUTEKOM and network of the cluster. Areas for research, developing new ideas and projects thereby improving innovation capacity of companies, especially SMEs can follow below steps with the support of the cluster collaboration unit and relevant cluster services;

- Identify innovation and manufacturing capabilities level,
- Develop innovation roadmaps by the help of cluster services in line with prioritised cluster themes,
- Support for developing projects,
- Developing informatory tools, documents and publications especially in the areas of trends, research areas etc.

iii) Improving entrepreneurship and formation of start-up companies

In Bursa Technical Textile and Composite Materials Cluster, innovation strategy covers supporting cluster environment for improvement of entrepreneurship culture and establishment of new start-ups. Especially in new product development and commercialisation stages, entrepreneurs can play vital role at cluster, national and international level. To this end through its services and joint projects cluster will supports entrepreneurs with their project ideas in collaboration with related cluster stakeholders.

Research and Product Development Areas

In terms of research studies and empowering research and knowledge environment undoubtedly, there is need for a shift to high performance and more sustainable products. Over the course of the cluster strategy development studies, below areas have been identified for undertaking research studies and accumulating knowledge:

- Developing know how and competence in sustainable materials,
- Developing knowhow and undertaking studies in thermoplastic composites especially for automotive industry,
- Works on advanced materials, semi-conductors, bio materials, smart materials, nano-engineering materials,
- Carbon and glass reinforced plastic composites, technical textile materials,

- Studies on CO2 reduction,
- Bio-based flame-retardant composites,
- Natural fibre reinforced technical fabrics, carbon and aramid fabrics,
- Conductive yarns, mixtures and coatings, especially ones made of metal, copper etc.
- Supporting basic and applied research studies in advanced materials and their usage in cluster products,
- Use of waste materials in composite production,
- Hi-tenacity and heat balance providing fabrics,
- Carbon tape production and products made of carbon tapes,
- Need for improving in resin manufacturing capacity,
- In composites, matrix materials are purchased from abroad and these input materials are expensive, there is need for investing in engineering plastics, polymers, advanced plastics etc.
- Electromagnetic, capsulation lamination, plasma, metal coating,
- Environmental studies in thermosets, thermoplastic studies should take place,
- Developing lightweight products (i.e. seating systems) with lightweight materials; thermoplastics,
- Need for increasing capacity in warp knitting and fabrics such as spacer fabrics,
- Research studies on materials, products and application methods for reinforcement of buildings and use of technical textiles and composite materials in builtech.

Productivity Strategy

“Continuous industrial transformation through adaptation, development and uptake of sustainable manufacturing solutions”

The second pillar of core cluster strategy is productivity. It is aimed to ensure continuation of industrial transformation approach, which has been started with the BUTEXCOMP Project. Key idea behind this strategic area is to improve manufacturing competences and productivity of the companies for manufacturing technical textile and composite materials to meet demand from the market at technological, quality and quality aspects. Productivity strategy is formed of X sub-components.

In terms of products cluster aims to manufacture high value-added products in technical textiles and composite materials for mobiltech, homotech, clothech industries and other areas such as builtech and medtech etc. Some of the possible products raised by the cluster actors over the course of cluster analysis and strategy development are; interior and exterior materials for automotive, railways and aviation, under bonnet and filtration components, technical textile and composite materials for passenger and off high way vehicles, composite materials for buildings and construction reinforcements.

i) Adopting new manufacturing processes and technologies

In the manufacturing domain, a single new technology might take long time to mature to an industrially relevant level, and years to complement and finally replace old methods and technologies in the industry. From this point of view, linkages between innovation and productivity strategy has to be carefully examined. Innovation, the process of translating an idea, an invention or a technology into a new product or service that creates value for which customers will pay can be measured by the “time-to-profit”. To be a real and solid source of competitive advantage, innovation must be both disruptive and replicable at an economical cost and must satisfy a specific need. To this end under this strategic pillar, cluster companies will be accompanied by related industrial information, possibilities of better technology and manufacturing processes. Additionally, cluster will develop recommendations and work with relevant public authorities, review funding sources to support companies to upgrade their manufacturing capabilities towards manufacturing value added technical textile and composite materials products. In brief, the aim is to adopt process and technologies that improve the value chains’ efficiency in the use of resources, open markets for green technologies and services and uptake of digital solutions. Under this strategic action below priorities have been identified:

- Supporting companies in design needs of composite material products,
- Supporting companies with information, trainings, coaching and project development in technology, process and manufacturing adaptation, in the identified industrial areas of the cluster and in the specific areas of research,

- Supporting companies in developing new products and prototypes,
- Increasing competences of cluster companies in design, manufacturing, test and integration,
- Increasing collaborations between technology leader companies and relatively traditional companies to accelerate industrial transformation.

ii) Resource Efficiency, Digitalisation and Sustainability

Sustainability and digitalisation are undoubtedly inseparable parts of the productivity strategy of the cluster. Cluster will help improvement of cluster environment and companies to increase sustainability and digitalisation. To this end below areas will be supported through cluster services:

- To accelerate the green transition, the cluster will contribute resource efficiency and sustainability,
- To support cluster actors, mainly cluster companies in their digital transition including automation and industry 4.0. Cluster will help its members in the uptake of digital solutions, adopting digital instruments and developing a digital component in their business models.

iii) Improving cluster capacity in industrial tests, analysis and certification

In relation with demand conditions improving test, analysis and certification capabilities of the cluster has vital role in cluster competitiveness. In consideration with industry trends and raised issues by the cluster actors, integration with cluster services and BUTEKOM is highly important with special focus given to tests and analysis in automotive materials, automotive textiles and other sectoral areas of the cluster. Within this scope below steps envisaged to be taken:

- Collaborations with international test, analysis and research centres and organisations,
- Development of cluster test and analysis services portfolio for communicating competences of cluster at cluster internal and external environment,
- Test and analysis services with specialised service and communication language focused on prioritised industrial areas of the cluster.

Internationalisation Strategy

“Maximizing effectiveness of commercialization”

Internationalisation strategy of the cluster aims to generate value for cluster companies at their internationalization purposes and aims to internationalize the cluster as a whole. Through internationalization strategy it is aimed to increase export market and technology partnerships of the cluster and cluster companies thereby support for integrating global value chains, exchange of knowledge and technology. It is aimed by internationalisation strategy to enter new export markets and/or integrate with global supply chains, establish linkages with actors in targeted countries. Within the scope of internationalisation strategy; business relations will be established with other clusters, actions will be taken to generate business opportunities for cluster members, cluster members will be supported in their international goals including export development and technology collaborations, collecting and disseminating information on market opportunities and cooperation possibilities, cooperation will be established with research institutions and academic environment. Internationalisation strategy is closely linked with network development strategy of the cluster. The strategy has two main action areas:

i) Cluster Export Development

Export development is one of the key areas to be developed for the cluster members through related cluster services. As part of the internationalisation strategy Export Development Action targets both EU markets and markets in overseas. In EU main export destination for internationalisation purposes are Germany and UK. In terms of overseas markets USA and Canada can be considered as target markets. However, design and development of export focused project-based cluster activities has been envisaged in which detailed market analysis and export development actions can be undertaken. Sectorial focus of internationalisation strategy will follow identified sectorial areas of the cluster in relation with critical supporting industries.

ii) Technology Partnership Development

Second action area of internationalization strategy is facilitating technology collaboration and partnerships among cluster members, cluster and related actors in EU and in third countries. It is expected that technology-oriented collaboration agreements at international environment will lead

cluster companies to market access and accelerate sectorial and inter-sectorial opportunities. It is expected that technology development action will help companies to improve and/or re organize their value chains to better integrate in global supply chains or strengthen their position in the current supply chains. Cluster will support companies mostly through applying EU Projects such as ELITT, COSME and Horizon Europe as well as internationalization efforts of the cluster coordination unit.

4.3.2. Supporting Cluster Strategies

Skills and Knowledge Development

Improving skills and knowledge in line with research, innovation, specialization, technology and market needs of the cluster will be one of the key supporting strategies of the cluster. The strategy is directly related with factor conditions parameters and aims to contribute improvement of the cluster environment more in the form of collaborative actions with universities, vocational schools and cluster companies. Through this strategy it is also aimed to increase level of industrial knowledge, facilitate know-how transfer and contribute formulation of related regional policies.

Implementation of the strategy will be through cluster services, which are in the form of trainings, consultancies and project development. Skills and knowledge development strategy is interlinked and support all core strategies of the cluster.

As a two-folded strategic area, it is aimed to increase level of knowledge within the cluster environment; second aim is to contribute improvement of related skills identified by studies on manufacturing future products of technical textiles and composite materials for primary end markets. Dissemination of information and knowledge has vital importance for the cluster to achieve its goals. In this regard below main steps foreseen to be taken:

- Supporting cluster actors through collaborative projects and enabling accumulated information for academicians to increase number of papers and publications on technical textile and composite materials in Bursa,
- Facilitating national and international partnership and collaborations among research institutions and universities with the aim of industrial transformation,
- Improving necessary skills for design, development, manufacture and marketing for the industry, especially at technicians and engineer's level.
- Developing and providing information on industry, trends, markets, technology and processes.

Network Development

Network development is second supporting strategy of the cluster aiming to increase relations among cluster companies and establish linkages with related actors in internal and external environment of the cluster to achieve clusters goals and vision. Network development provides cluster actors, specifically cluster companies to collaborate and work with companies or cluster to improve competences, technologies, and competitive collaborations towards a common market. Network development strategy is related with and supporting core strategies of the cluster and covers establishment of linkages at regional, national and international level.

In terms of conceptual scope, clusters and networks are different yet linked phenomena. Clusters are agglomerations of interconnected companies and associated institutions. Firms in a cluster produce similar or related goods or services and are supported by a range of dedicated institutions located in spatial proximity, such as business associations or training and technical assistance providers. Vibrant clusters are home of innovation-oriented firms that reap the benefits of an integrated support system and dynamic business networks. Networks are alliances of firms that work together towards an economic goal. They can be established between firms within clusters but also exist outside clusters. Networks can be horizontal and vertical:

- Horizontal networks are built between firms that compete for the same market, such as a group of producers establishing a joint retail shop,
- Vertical networks, particularly supplier development schemes, are alliances between firms belonging to different levels of the same value chain, such as a buyer assisting its suppliers for upgrading.

Network development of Bursa Technical Textile and Composite Materials Cluster has two sub areas as network development in cluster internal environment and network development in cluster external environment.

In line with the strategic goals of the cluster and specifically in the areas of innovation, productivity and internationalisation, the strategy aims to strengthen cluster profile through getting new members in the cluster. As stated in cluster context section of the report, it is aimed to increase number of specialised companies in composite materials manufacturing and technical textiles. The cluster management team in the light of cluster action plan will undertake internal network development activities.

Cluster network development in the external environment of the cluster aims to establish linkages for cluster members to generate business opportunities. External network development strategy of the cluster targets other clusters, companies, research institutions and supply chains at regional, national and international level.

Cluster Internal Network Development: It is aimed to strengthen ties and facilitate exchange of experience and know-how transfer among cluster members and increase number of specialised companies within the cluster. To achieve this specific goal internal cluster actions including meetings envisaged taking place periodically in every three months with a specific thematic agenda.

At regional and national level cluster network development activities will include establishment of relations with related clusters at regional and national level. Relations will be established firstly by initiating inforatory meetings through visits paid to clusters and related business support organisations. Network development strategy also aims to establish linkages between cluster companies and OEMs located in Bursa and other regions of Türkiye. Apart from aforementioned actions, Supplier Development Programme started within the activities of BUTEXCOMP project envisaged to continue.

At international level cluster network development activities will be mainly linked with internationalisation strategy of the cluster including developing relations with clusters, companies and possible actors and platforms and related supply chains, research institutions and international organisations. At international level below organisations can be considered to start establishing linkages at the short term.

Cluster Promotion and Branding

Cluster promotion and branding is one of the most important supporting strategies of the cluster which can help both cluster and cluster members to be nationally and internationally recognised and positioned as centre of technical textile and composite materials centre in EU and in globe for the needs of specific targeted markets. Cluster promotion and branding strategy aims to contribute cluster's strategic positioning through a solid communication and branding of the cluster in line with a well-established cluster communication strategy.

4. Conclusions

Technical textiles and composite materials is a growing and highly innovative industry with opportunities for innovative regions. When specialised regions in the EU and in the world is analysed it is seen that development of technical textiles and composite materials are related with developing industries such as aviation, automotive, medical and other advanced industries. From this point of view Bursa has unique competitive advantages if presence of developed automotive and textile competences can be used as opportunities to transform textile and automotive suppliers of Bursa into specialised providers of advanced technical textile and composite materials. To achieve this strategy is clear. There is no other way than that the cluster has to be positioned and develop its capabilities for innovation. Applied research has to be in the centre of competitiveness strategy, which is empowered with productivity and commercialisation activities. For the cluster managers, cluster companies and regional decision makers and stakeholders, it is key to contribute and support cluster environment with resources as much as possible. As the last word, Bursa BUTEXCOMP Cluster has great opportunities and it is possible to reach its goals through dedicated implementation of the cluster action plan. In the changing environment of the industry, cluster strategy and actions plans have to be continuously developed and cluster coordination unit has to be continuously empowered. Not only companies but also clusters are learning systems with their coordination teams.

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