

A Success Story about Clustering in Technical Textile and Composite Material Sectors: Bursa Model

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Abstract

This study summarizes the cluster activities carried out in Bursa province in the field of technical textiles and composite materials. The article actually summarizes the steps of a success story in clustering and shows how to carry out such activities in the most efficient way for similar structures. This article is inspired and compiled from previous studies [17-26]. Within the scope of cluster development roadmap studies, a Cluster Coordination Unit (CCU) was established by the BCCI. Cluster expert support to Cluster Coordination Unit started after completion of the Cluster Strategy and Roadmap. Support to CCU has started with two full day "Cluster Development and Management" training specially designed for cluster management team. Training provided by CCU team, ensuring the team to understand key concepts of cluster phenomenon, cluster development stages and role of cluster coordination in the success of the clusters. Overall, the study provided a detailed view of past business practices and export initiatives, along with an assessment of the institutional support offered to the industry. The findings offered valuable insights into the evolving landscape of the textile industry, highlighting trends in material utilization, export techniques, and the effects of technological advancements on competitiveness and sustainability.

Keywords

technical textiles, composite materials, clustering, Bursa

1. Introduction

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

Textile and composite material sectors are among the sectors where competition is most intense in the world compared to other sectors. For this reason, it is known that companies in these sectors are constantly trying to improve themselves. It is clear that research and university collaborations, especially in these two sectors, need to be further developed. Bursa Chamber of Commerce and Industry in Bursa is developing macro projects that will directly contribute to the development of many sectors. The textile and composite material sectors have been the most emphasized sectors.

Three centers of excellence and two prototyping centers for these two sectors are some of the macro projects implemented by BCCI. With these centers, companies are supported in both basic R&D and prototyping and commercialization stages of the sector. With these structures, these two sectors have reached structures that will form TRL 1-7 levels under the same roof from basic R&D to commercialization. BCCI has also focused on clustering activities. Currently, 25 different clusters have been established throughout Bursa, and some of these include the textile and composite industries. In our previous studies, we published articles on the activities of these sectors such as market [17-25], competitiveness, R&D and clustering [25, 26]. Numerous studies on composites have also been conducted, including an examination of the impact of hybridisation and weaving structure on woven carbon-epoxy composites [27] and the three-dimensional integrated core sandwich composites' quasi-static behaviour under compression loading, emphasising its structural integrity and mechanical performance [28]. These studies were studies that showed the national and international competitive power of these sectors, specifically for Bursa. This study actually summarizes the steps of a success story in clustering and shows how to carry out such activities in the most efficient way for similar structures. This article is inspired and compiled from previous studies.

2. Methodology

A team of Cluster conducted an analysis study within both sector representatives and stakeholders. The approach of the team was to build upon intensive and effective cooperation between the stakeholders who are representatives of three legs of Cluster Initiative: Industry, Universities/Research Centres, and Institutions (governmental and non-governmental). Cluster team conducted a value chain analysis [23-26] (VCA) to understand the positioning of each potential cluster member on a value chain in terms of competency matrix [17, 18], supply capacities, and potential synergies.

Within the framework of the Cluster Analysis, including a value chain analysis, SNKEs further analysed internal factors of the Bursa Technical Textile and Composite sector basis from different perspectives, complementing the previous studies, i.e. Diagnostic Studies and Needs Analysis [17-19], Market Research [19-22], Development of Business Plan and Service Delivery Manuals which is in full harmonization with the terms of reference that requires the cluster analysis to take into account the findings accrued from the diagnostic study report.

During the conducting this activity, the experts applied: (i) Diamond Framework Model [23], (ii) Cluster Map [24] (Macro Scale Value Chain Configuration), (iii) Networking Analysis methods, in order to have a fully accurate picture of the technical textile and composite cluster basis. A Value Chain Analysis report was produced [25, 26].

Based on the cluster value chain analysis Cluster Expert prepared a cluster development roadmap covering and establishing relations of both sectors (composite materials and technical textiles). **The Cluster roadmap** will be a strategic guide for determining the vision and strategy of the Cluster Initiative, and for identifying the relevant activities and activity groups, in other words, Cluster's actions/activities.

The cluster development roadmap was developed which includes performance indicators, linkage formations with international clusters, functional strategies, and a five year Action Plan.

Within the scope of cluster development roadmap studies, a Cluster Coordination Unit (CCU) was established by the BCCI. Cluster expert support to Cluster Coordination Unit started after completion of the Cluster Strategy and Roadmap. Support to CCU has started with two full day "Cluster Development and Management" training specially designed for cluster management team. Training provided CCU team, ensure team to understand key concepts of cluster phenomenon, cluster development stages and role of cluster coordination in the success of the clusters.

Under the supervision of the cluster expert, in order to initiate cluster implementation activities, CCU prepared one-year business plan based on the Cluster Strategy and Five -Year Action Plan. Along with the strategy and action plan, three cluster service manuals, i) communication manual, ii) networking and business development and iii) innovation manual, were prepared to support CCU while they start cluster activities. The CCU continues its activities with great interest.

3. Results

3.1. Analysis and Strategy Building for Clustering Initiative

3.1.1. Conducting a Cluster Value Chain Analysis

A team of non-key experts (NKEs) on Cluster Analysis was established to conduct this activity. A kick-off meeting was held with the relevant experts and Key Expert-2 (KE2) to initiate the activity.

The Experts worked on desk research, reviewing the project documents and reports. Also, a detailed methodology on the implementation of the activity has been drafted.

At the planned time, cluster experts presented the methodology, work plan and content of the questionnaire to Bursa Chamber of Commerce and Industry (BCCI/BTSO). After the approval of methodology by BCCI, backstopping started to communicate to the target group for interview meeting, in order to start the visits.

The experts prepared the questionnaire for the Cluster Value Chain Analysis for the target group which are companies and Institutions. Due to replacement of Cluster NKE, a delay of few weeks occurred for the completion of visits. 57 companies and 13 institutions were visited by the NKEs.

Based on the interviews with the target group, individual reports of each visit and a consolidated report were prepared. After this analysis was finalized, NKEs started to work on the Cluster Value Chain Analysis and a draft value chain map for Technical Textile and Composite Material sector, was developed by the Cluster NKE. After finalization of the Cluster Value Chain Analysis draft report, two strategic meetings were conducted.

First meeting was conducted with the participation of Cluster working group which consists of people from BUTEKOM and BCCI management including Coordinator of other clusters of BCCI and their project managers. In this half day meeting, Cluster senior non key experts (SNKE) has presented the content of Cluster Value Chain including Value Chain Map. Then, all participants discussed the findings, discussed some points, and validated the report.

Second meeting was conducted as a form of workshop as half day event. On 02.06.2023 workshop was held with the participation of 58 participants representing actors and stakeholders among from the industry value chain. Workshop was designed in the form of round table sessions, following the welcoming speeches and presentation delivered by the cluster expert, participants were invited to discuss and consult on key competences and areas to be developed along with each step of the value chain. A moderator facilitated each table discussion by using facilitation tools. At the end of round table discussions, each table reported their findings through using flipcharts and table notes developed during discussion sessions.

3.1.2. Cluster Development Roadmap

The Cluster roadmap is a strategic guide for determining the vision and strategy of the Cluster Initiative, and for identifying the relevant activities and activity groups, in other words, Cluster's actions/activities.

Based on the previous activities and their outputs, KE-2 drafted a roadmap for Bursa Technical Textile and Composite Cluster.

The SNKE who made the Value Chain Analysis work was assigned for this activity. The Expert has developed draft Cluster Roadmap.

Draft content of Roadmap and Action Plan was shared with BCCI and received the comments. Then SNKE has revised the content and shared it via an Information Sharing meeting conducted with the participation of relevant stakeholders and Cluster member companies.

Information Sharing Meeting on Cluster Development Roadmap and Cluster Action Plan was held to share and verify cluster strategy, vision and cluster action steps with cluster members and key stakeholders. Following headings of Cluster Roadmap was shared in the presentation:

- Summary of cluster development studies and steps,
- Insights from industry trends,
- Key priorities constitute bases for cluster strategy,
- Cluster strategy framework,
- Cluster Vision,

- Key and Supporting Strategies,
- Innovation Priority Areas,
- Cluster Action Plan,
- Early Actions for Cluster Implementation.

After the presentation was delivered to the participants, their opinions were asked on the following main topics:

- The cluster priority areas, which form the basis of the strategy, were found appropriate,
- Cluster strategic framework was reviewed by the cluster members in detail and no objection has been received, core and supporting strategies were found appropriate,
- Recommended cluster vision was presented, views of cluster members were received,
- It has been stated that instead on focusing on EU, cluster vision has to cover target at global scale. Instead of the word “solutions” it has to be “technological solutions.” Below is the cluster vision statement verified and accepted by the cluster members.

Vision Statement:

“BUTEXCOMP Cluster aims to be among the world's leading clusters with its green and digital transformation approach in the technical textile and composite materials sector, with value-added products and technological solutions in areas where sustainable and high-performance materials are used.”

Information sharing meeting has been completed at a fruitful and participatory environment where all participants provided their views and comments on the strategic framework, cluster vision and the action plan. In total 22 participants attended in the Cluster Roadmap Information Meeting.

3.1.3. Establishment of and Support to Cluster Coordination Unit

Under this activity it is expected to achieve a governance structure addressing the current and future needs in an optimum. This structure will be with KE-2 to promote the Cluster nation and international-wide. It is also expected that the Cluster is supported in benefiting from other EU funds, Cluster initiative is benefitted from and collaborate with the existing cluster projects of BCCI.

3.1.4. Cluster Coordination Unit Governance Structure

As, it was stated in the Cluster Roadmap, “Identification of appropriate organizational structure for Bursa Technical Textile and Composite Materials Cluster has vital importance for the success of the cluster. The cluster has variety of actors among from companies at large, medium and small scale, OEMs, strong universities, OIZs, stakeholders and public institutions where all actors have their own expectations, inputs, organizational rules. Therefore, establishment and launch of cluster is at formal bases important for continuation of cluster activities and implementation of the cluster strategy at collaborative and institutionalized way. Word “formal” does not mean establishment of formal body from the beginning of cluster development stages, however it is more about coordinating cluster activities for implementing the strategy has to be coordinated by an organization and cluster coordination unit with full time team(s) work at daily basis to coordinate identified actions for the cluster”.

In the Cluster Roadmap, Cluster Organization Chart was proposed as in the following diagram in Figure 1.

Within the scope of cluster development roadmap studies, support to Cluster Coordination Unit (CCU) has started after completion of the Cluster Strategy and Roadmap. Support to CCU has started with two full day “Cluster Development and Management” training specially designed for cluster management team. Training provided CCU team, ensure team to understand key concepts of cluster phenomenon, cluster development stages and role of cluster coordination in the success of the clusters.

Under the supervision of the cluster expert, in order to initiate cluster implementation activities, CCU has prepared one-year business plan based on the Cluster Strategy and Five Year Action Plan. Content of manuals has been delivered in the form of “learning by doing” through coaching of the cluster expert. CCU found opportunity to observe, examine and directly take steps for developing the cluster.

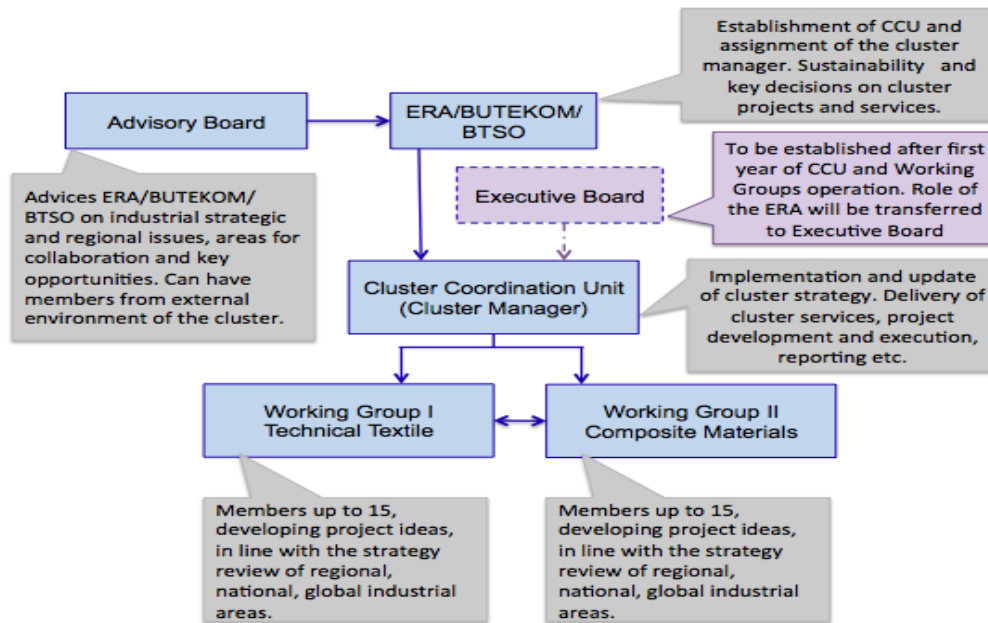


Fig. 1. Cluster Governance Structure

Another very important step has been taken in terms of cluster validation at EU level and international recognition of the cluster. Under the supervision of the cluster expert, CCU has prepared for European Cluster Collaboration Platform (ECCP) validation and BUTEXCOMP Cluster has been validated and registered in the only cluster network platform at EU and global level.

Cluster implementation actions and initial achievements over the course of day-to-day implementation support provided to CCU can be summarised as follows:

- CCU and BTSO team received Horizon Project Writing Training,
- Based on the Cluster Strategy and Five Year Action Plan, one year cluster action plan was prepared,
- CCU team received two full days cluster development and management training,
- Development of cluster web site content, fully completed BUTEXCOMP cluster web site in Turkish and English has been published,
- CCU team received day-to-day coaching for developing and writing cluster project for Cluster Support Programme of the MoIT, a comprehensive project proposal prepared and application made,
- Relations started with international clusters during the second international study tour continued, CCU has continued communication with ETP and AVK. Both organisations participated in cluster regional seminars through delivering their presentations,
- Direct communication and visits of CCU with companies and stakeholders has been started and on-going,
- Cluster committed membership studies started through collecting commitment letters from companies and institutions. As of mid of March 2024, 15 companies and 8 organisations signed cluster membership letters. Composition of the cluster represents the “triple helix” structure of the cluster. This activity will be a continuous activity along with development stages of the cluster and number of committed clusters will be increased.
- CCU Team delivered cluster presentation in Ankara and İstanbul Regional Seminars, providing information on the cluster and started establishing networks with other clusters and business networks,
- CCU Team received a half day training and coaching on how to be validated in European Cluster Collaboration Platform,
- CCU team prepared requirements and completed stages BUTEXCOMP Cluster to be registered and validated in the ECCP, cluster has been registered at EU level.

3.1.5. Organization of Regional Seminars

BCCI organized two regional one-day (seminars with the aim to increase awareness of the target groups of the Project (enterprises in the value chains of technical textile and composites, etc.) and encourage participation for clustering activities. The Seminars was held in Ankara and in İstanbul. Both seminars were delivered in hotels in the city centres.

An agenda was prepared for both events which includes the following topics and sessions:

- Bursa Technical Textile and Composite Materials Cluster Strategy and Scope of Inter-Cluster Collaborations,
- EU Sectoral Platforms, Sectoral Developments, R&D and Innovation Opportunities,
- New Product and Process Development Opportunities Focused on R&D and Innovation in the Field of Technical Textiles and Composite Materials,
- Sectoral Trends, Working Areas and Collaboration Opportunities,
- Interactive Session on Inter-cluster Cooperation Areas and Exchange of Views.

One of the most interested parts was in the "Sectoral Trends, Working Areas and Collaboration Opportunities" session which the visited clusters during the second study visit were invited for online participation.

The European Technology Platform for the Future of Textiles and Clothing (Textile ETP (Brussel)) and Federation of Reinforced Plastics (AVK (Frankfurt)) have delivered their presentation by the management level participants and answered the questions of audiences.

3.1.6. Organization of International Study Visit

For the capacity building of BCCI and the cluster coordination unit through observation of successful centres/clusters, creation of networks, and reflection of observations on the sustainment of the cluster. The purpose of the International Study tour is to support to BUTEXCOMP staff on capacity development by observing the good practices and lead to identification and utilisation of lesson learned.

To reach this purpose will enhance the experience and knowledge of BUTEXCOMP staff who will work on reaching the project objectives, by using the knowledge gained during the visits and disseminating the lesson learned from these visits.

However, in order to have better impact in the project outputs and increase the efficiency of the study tour, to separate the visit in two groups and destination, which first one would be technical oriented and second would focus to clusters.

First group has conducted a visit to Research Centres/Institutions in Germany and implementation report.

The second study visit was planned to visit clusters in Germany and Belgium. A SNKE was assigned to prepare the program and communicate with several potential Clusters related Institutions in Composite materials and technical textile sectors to be visited in Germany, and Belgium in order to request a visit and meeting with cluster management and their members.

Destinations for the international study visit were Germany and Brussels in which technical textile and composite industries are highly competitive with successful cluster ecosystems and network development platforms. Over the course of international study visit planning phase, with the support of ITA Aachen expert, meetings between BCCI and BUTEKOM took place and leading clusters and cluster ecosystems have been identified in Germany and Brussels. In Germany AVK, Composite United, DLR was visited cluster bodies while ETP and Leuven University in Belgium. In addition to clusters and network platforms participation in Horizon Europe Brokerage Event "Towards the Green Future: The European Green Deal" has been highly beneficial for the participants of the study visit.

3.1.7. Summary of Lessons Learnt and Results from both study visit

- Presence of effective management teams has been observed as common strength of all network and cluster organisations for the success of the region and the industry. **Additionally in terms of sustainability of organisations and management teams it is seen that at least for two years from start and partly as continuous support, organisations are being funded or directly supported by the government.**

- It is seen that for success and continuity of organisations commitment and voluntarily from cluster members is needed. Clusters and network organisations are membership-based communities focused on innovation starting from idea to project development.
- It is seen in AVK expertise groups and/or discussion groups constitute a lot of weight in events of clusters and network platforms. Volunteering and continuous involvement of member organisations and/or cluster actors is key for long-term success of cluster organisations.
- It is seen that cluster management teams has substantial role in cluster operations, development of cluster network, events and projects. As one of the lessons learnt it is important to invest in capacity development of cluster management teams and management operations.
- In AVK lightweight materials, sustainability, green composites, materials are among priority topics.
- Continuous and active contribution from members is the main expectation of AVK board from members.
- Exchange of information and knowledge between BUTEKOM and AVK can be in the areas of green composites, reinforced materials and applications for earthquake, sustainability and materials.
- Collaboration projects and events can be planned and organised between all visited organisations.
- Membership to AVK has to be considered by BUTEKOM and BUTEXCOMP Cluster in order to be actively involved and benefit from Expert Task Force Groups of AVK. Information on membership fees can be found in Annexes of this document and in the web site of the organisation.
- It is observed in all cluster and network development organisations that there is active formation and continuous work of experts / working groups each dedicated in different industrial focus. Although number of working groups are high (i.e. AVK has 25 working groups, CU has 45 working groups) cluster / network management coordinates working group meetings along with their other services through small number of cluster management teams. At this point presence of full time and dedicated cluster manager who can establish strong relations with industry and presence of permanent staff for project development plays vital role. Additionally, dedication and volunteer work of cluster / network companies and/or member organisations is crucial. Without ownership continuity of such networks is impossible.
- Composite United, ETP and AVK are dedicated organisations and undertaking organised efforts with relatively small teams for coordinating events such as expert talks, webinars and workshops, preparation and dissemination of communication tools and their content including platform websites and newsletters, providing services including network development, support to project development, market data and information and organising thematic events within trade fairs or as separate events,
- It is seen that clusters and network platforms generated a valuable pool of sectoral information, living and active mechanism of sectoral players. In terms of internationalisation strategy of BUTEXCOM cluster, being member of these networks will be highly beneficial both for the cluster and cluster members to follow, involve and develop industry relations and business networks.
- It is seen in AVK, CU, DLR and ETP that innovation, manufacturing, materials and process based solutions for lightweight products is one of the priority areas along with sustainability and digitalisation scope. It is expected that use of composite materials and process will last for a long time for manufacturing lightweight materials.
- For the start of relations, it is recommended from ETP that BUTEKOM can start with being a member of the community. "To find good partners, you have to expose yourself" was one their statements summarising key idea for being in an innovation network. Commitment has been also underlined by ETP, that being a member will not do much if there is not any continuous commitment and involvement.
- Visit of DLR and CU in Stade (near Hamburg) was highly beneficial to understand how government policy and programmes with large-scale investment from private sector can breed a cluster in a no-industry area. It is seen that started as part of regional development policy investment of Airbus in collaboration with government has flourished value chain in Stade for aviation sector in a very short time. It is expected that Stade will be one of the strongest areas in EU with developed excellence and advanced supply chain.

- Established relations with Leuven University has to be continued even the planned Horizon Europe Project cannot be realised in the short term. Mutual collaboration activities and agreements can take place in the industrial common areas.
- It is seen that innovation and research were at the centre of competitiveness, strategies and actions. Innovation and research focused activities are undertaken through a participatory approach with universities, experts, companies and business organisations. Stages follow a path from idea to research, project to trade fairs and specific events from this point of view, an idea raised and commonly accepted by the members follows a cascading path until it meets with market.

Below are results of the international study visit:

- Over the course of the study visit 4 clusters and network organisations visited, cluster structures and operations reviewed in detail, relations established for future collaborations,
- With Leuven University, ideas were exchanged on developing Horizon Europe Project based on competences of BUTEKOM and the University,
- Detailed information on Bursa Technical Textile Cluster and BUTEKOM competences were introduced in visited clusters,
- In AVK it is agreed that BUTEKOM with BUTEXCOMP Cluster can be part of Expert Task Force Group dedicated to develop industry solutions for earthquakes, and other expert task force groups related to composite materials if BUTEKOM becomes member of AVK,
- It is stated and underlined by ETP that an innovation hub event online or physical can be organised with Bursa Technical Textile and Composite Materials Cluster. It can be a workshop under SmartX organised with Bursa. In 2024 ETP is planning a big event in tech-textiles, it would be highly beneficial for Bursa to take place in such event in order to achieve its goals of internationalisation. Communication with ETP has to continue to clarify potential short-term collaborative events and possible sources for funding events and developing co-activities,
- For achieving internationalisation and network development purposes, visited institutions are at a leading position and relations have to be continued by the Cluster Coordination Unit of Bursa Technical Textile and Composite Materials Cluster,
- Composite United is open for developing collaborative projects and activities. To start with there is need for BUTEKOM to become member of Composite United,
- As one of the outcomes of the study visit it is seen that; research areas for product development and cluster projects should comprise rising thematic areas also observed during study visit; lightweight materials for Mobiltech and aviation, use of biomaterials, sustainability, circular economy, recycling textile and composite materials and use of recycled materials in production and digitalisation,
- More than 25 B2B meetings were held during Horizon Europe Brokerage Event and meetings and met organisations can be possible partners for future Horizon Projects,
- 2 SMEs from BUTEXCOMP cluster participated in the Horizon Europe Brokerage Event and one of them is developing Horizon Europe Project under Cluster 6 and highly benefited from the B2B meetings,
- In order to be part of the industry at international level, finding partners and accessing information, being members to AVK, CU and ETP is crucial. There are variety of opportunities for the cluster and its members towards innovative and international joint projects, commercial and technology partnerships.

4. Conclusions

This study summarizes the cluster activities carried out in Bursa province in the field of technical textiles and composite materials. The article actually summarizes the steps of a success story in clustering and shows how to carry out such activities in the most efficient way for similar structures. This article is inspired and compiled from previous studies [17-26]. Within the scope of cluster development roadmap studies, a Cluster Coordination Unit (CCU) was established by the BCCI. Cluster expert support to Cluster Coordination Unit started after completion of the Cluster Strategy and

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