LAND
BRANDENBURG

MASTER PLAN CLUSTER METAL INDUSTRY BRANDENBURG

STRONG ALONE. EVEN STRONGER TOGETHER.

THE GERMAN CAPITAL REGION
excellence in metal

Master Plan Cluster
Metal Industry Brandenburg

Contents

1 Introduction and overview

1 Introduction and overview

The Master Plan is the joint strategic working basis and design instrument of the players from business, science, administration and the economic development institutions in the Cluster. It presents contextual frameworks for the Cluster work of the coming years. The Master Plan identifies the technological and application-related research, development and innovative subjects that are currently relevant or important for the future, and presents them in relation to one another.

The framework is formed by the Regional Innovation Strategy of the State of Brandenburg, which in 2019 addressed technological, economic and societal developments and created fresh momentum with the updating of the InnoBB 2025 plus[1]. This is made especially clear by the key focal points “Digitalisation”, “Real-world laboratories and test fields”, “Work 4.0 and skilled employees”, and “Start-ups and new businesses”.

With the continual development of the Cluster since the first Master Plan was published in June 2014, the frameworks which affect work in the Cluster’s industries have continued to develop. Changes in the markets and new economic and technical developments, especially in relation to sustainability, must also be taken into account. “Sustainability” involves expanding the subjects of the Master Plan to incorporate ecological and social challenges.

This also includes current developments in the wake of pandemic-related restrictions which make it seem that changes are occurring as if in “fast-forward”. Digital communication methods, new workplace situations and simplified decision-making processes have become reality almost overnight, yet the future has also become uncertain as anticipating market behaviour has been made more difficult.

That said, it is possible to establish that the existing structure of the three fields of action Innovation Workshop, Cooperation Network and Skilled Employees Matrix and the highlighted subject areas have proven themselves to be effective in terms of initiating innovation plans and joint efforts. The Innovation Centre for Modern Industry (IMI Brandenburg) and the Digitalwerk Centre for Digitalisation in Craft Trades and SMEs, supported by the Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg, and the SME 4.0 competence centre Cottbus, supported by the German Federal Ministry for Economic Affairs and Energy, could thus be established from the Cluster Metal Industry and become effective across the industries. Other testing locations include the Industry 4.0 application centre at the University of Potsdam or the “Center for Efficient Factories Senftenberg” at the Brandenburg University of Technology Cottbus-Senftenberg, which take a close look at issues relating to process and factory planning.

Together with the other industry clusters in Brandenburg, support is given to the Brandenburg Industry Conference, which has taken place since 2014 and brings practitioners and scientists together. Since then, innovative companies have been awarded the Brandenburg Innovation Award for Metal, presented annually at the Cluster conference. Since work began, the number of projects taken on by the Cluster has continually increased. In 2019, a total of 68 projects were carried out, of which 32 had been newly initiated[2]. The majority of research and innovation projects are joint projects with the participation of scientific institutions.

The updated Master Plan thus continues the reliable structure from the three fields of action Innovation Workshop, Cooperation Network, and Skilled Employees Matrix. The ten updated key parameters are assigned to individual specialist subjects and are pooled into 37 updated subject areas. Figure 1 presents an overview of the Master Plan’s basic structure.

1 innoBB 2025 plus | Regional Innovation Strategy of the State of Brandenburg innoBB 2025 plus, as per a decision of the Government of the State of Brandenburg on 4 June 2019.

2 Cluster Metal Industry Brandenburg – 2019 Annual Report on Result and Effect Monitoring, published by the Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg (MWAE) on 15 July 2020.

Create innovations

- Innovation alignment, innovation culture
- Interdisciplinary and process-oriented thinking, consideration of non-technical innovations

Market performance

- Products with improved features
- Sustainable applications and services
- Maintenance, repair and overhaul (MRO) and product-specific services, new business models with intensified client retention

Efficient and sustainable processes

- Digitalisation of design, manufacture planning and factory planning processes
- Resource- and energy-efficient processes, decarbonisation
- Material efficiency, recycling and reusing
- Quality assurance and management, efficiency using modern components and process inspection methods
- Continuous process chains in automated production, procurement, logistics and in supply chain management
- Digitally supported sales processes
- Information security

New scientific basis and technologies

- Creation and use of insights from material technologies, new materials, component concepts
- Master and continue to develop manufacturing technologies
- Development and strengthening the application of digital technologies for the needs in the Cluster

Networked value creation

- High-performance production cooperation, expansion of regional value and supply chains
- Internal and cross-industry networking with craft trade companies

Networked development, technology transfer

- Needs-oriented transfer of knowledge and technology
- Development projects
- Real-world laboratories and test fields

Attractive location for employers and employees

- Cluster marketing and public relations work
- Support for new businesses and start-ups

Focus on people and society

- Attracting skilled employees
- Corporate social responsibility (CSR) towards clients, stakeholders, staff and society

Sustainable staff deployment

- Designing sustainable working conditions
- Development of skilled employees, leadership in modern organisations, involvement of staff in transformation processes

Training for skilled employees and executives

- Career and study guidance for technical occupations
- Dual training
- Higher education
- Further training of skilled employees and executives
- Development of up-to-date teaching material
- Management skills, soft skills, foreign languages, cultural understanding
- Establishing modern forms of learning, linked with the company's requirements
- Business succession

Figure 1: The Master Plan for the Cluster Metal Industry Brandenburg at a glance – 3 fields of action, 10 key parameters and 37 subject areas

In addition to implementing activities in the three fields of action, further success factors are necessary in order to keep developing competitive ability and future viability in the Cluster Metal Industry. Sufficient financing and the availability of an adequate infrastructure for the companies – in particular commercial spaces, transport connection for goods and people as well as a high-performance data connection – are important requirements. These aspects are designed by the economic players themselves or by EU, federal or state policy (cf. Figure 2).

The Master Plan is aimed at all players in the Cluster. It was therefore the Cluster Management's objective to give as many Cluster players as possible the opportunity to be involved in updating the plan in their subject areas. A participative process for this purpose was initiated, enabling various channels to participate. The Strategic Council of the Cluster recommended the Master Plan to be updated yet retain the three fields of action, each with two thematic levels. Based on an analysis of relevant planning documents, strategic papers of the state, the federal level and the EU, as well as recognised scientific sources, an initial subject structure was derived and discussed with the council members. With around 50 experts from the Cluster, subject-specific stakeholder interviews were carried out in order to obtain the necessary specialist depth in the individual subject areas. Due to coronavirus-related restrictions, the participation workshops could not be held as planned. Instead, almost 100 Cluster players used an online participation forum to share their opinion and a variety of specific tips and perspectives on the individual fields of action and subject areas.

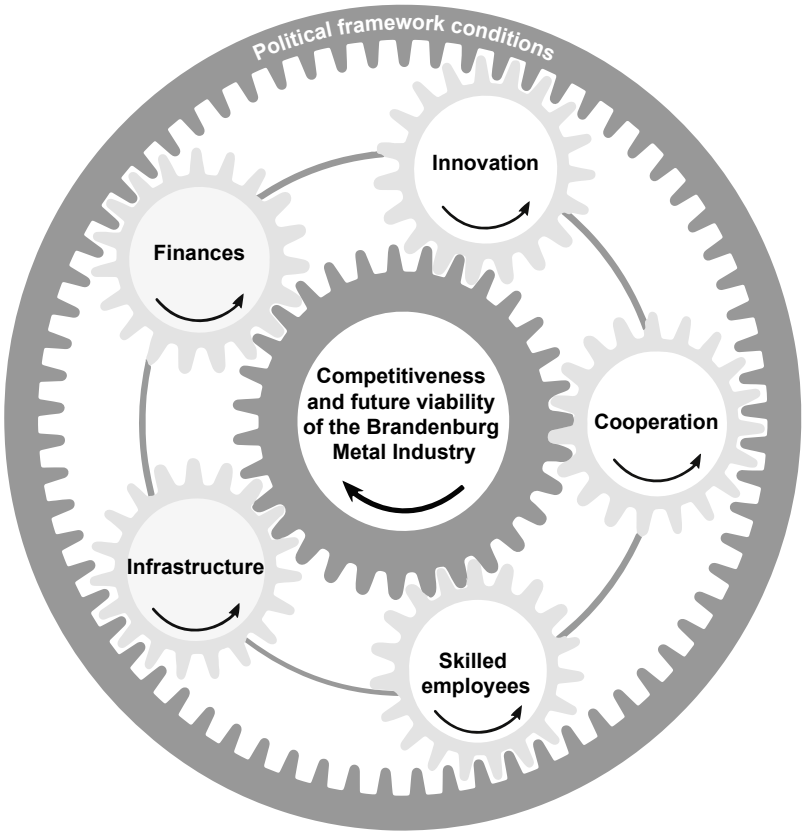
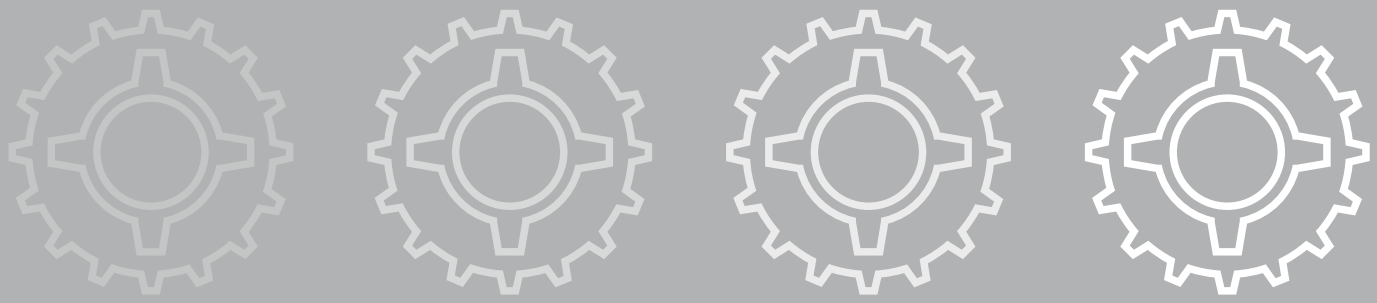


Figure 2: Joint effect of the fields of action and further success factors for competitive ability and future viability



2 The Cluster Metal Industry Brandenburg

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The Cluster Metal Industry Brandenburg comprises companies, scientific and educational institutions, chambers, associations, unions and networks, economic development institutions and players from politics and administration. They are all jointly committed to the continued positive development of the metal industry in its role as a strong pillar of the Brandenburg economic structure. The Cluster is characterised by its interrelationships with numerous industries relating to value creation and development. For example, automotive manufacturing, mechanical engineering, aerospace engineering, and the construction, electrical and energy industries all utilise components, products, methods and services from the Brandenburg metal industry.

2.1 Company structure and regional focal points

The metal industry is one of the strongest industries in terms of employment and revenue in the Brandenburg manufacturing industries. Distributed across all Brandenburg counties, statistics show 2,506 companies with 37,575 employees[3] who work on different value creation levels and who all work with the material metal. Compared to 2008, revenue in the Cluster core in 2017 increased by more than 20%, from around 4.05 billion euros to 4.92 billion euros[4], against the backdrop of a relatively stable number of companies and almost identical employment numbers. The bulk of the companies are small and medium-sized enterprises, most of them with fewer than 50 employees[5].

The task fields of the company can be roughly described by means of their industrial sector classification[6]. Key areas in the Cluster Metal Industry are metal production and processing, the manufacture of metal products, mechanical engineering, and the repair and installation of machines and equipment. Engineering offices and research and development can also be classified under the Cluster. The manufacture of metal products is in this case the most strongly represented industrial sector[7].

Metal companies exist in all Brandenburg regions, in both traditional and newly developed locations. The largest numbers of metal industry companies are based in the counties Potsdam-Mittelmark, Oder-Spree and Teltow-Fläming.

Especially important locations of the Brandenburg metal industry are for example in Brandenburg an der Havel, Eberswalde, Eisenhüttenstadt, Finsterwalde/Massen, Hennigsdorf, Lauchhammer, Ludwigsfelde and Prenzlau (cf. Figure 5). In this respect, the Regional Growth Areas (RGAs) are fundamentally important for the regional implementation of the Cluster strategy and of the Master Plan Metal Industryl. To date, the RGAs Brandenburg an der Havel, Cottbus, Eberswalde, Fürstenwalde, Frankfurt (Oder)/ Eisenhüttenstadt, Luckenwalde, Neuruppin, Oberhavel, Schwedt/Oder, Spremberg, Westlausitz and Schönefelder

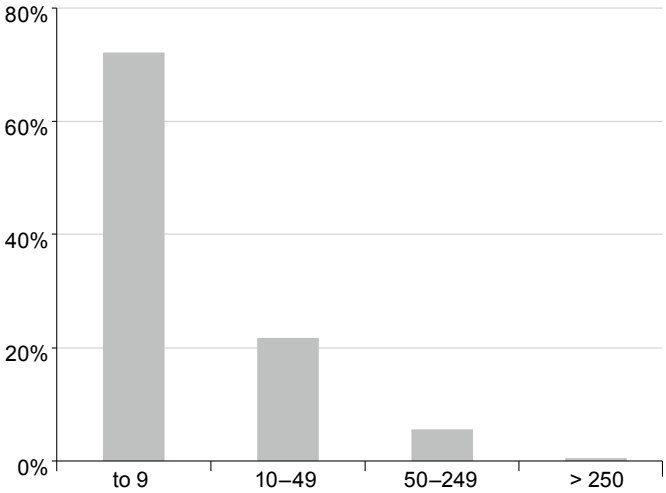


Figure 3: Companies in the Cluster Metal Industry according to number of employees (2018), source: Office for Statistics Berlin-Brandenburg

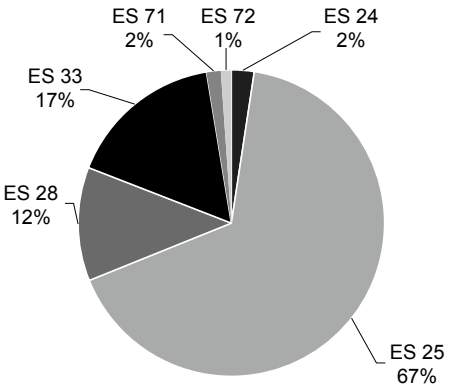
3 Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg: Development and significance of the Brandenburg-specific Clusters Food Industry, Plastics and Chemistry, Metal Industry and Tourism in the State of Brandenburg 2008–2018 – Monitoring report, p. 10, January 2020. The company data (number, distribution and revenue) were obtained in 2018, the number of employees in 2017.

4 Ibid., p. 13.

5 Data pool for number of companies as per cluster boundaries based on the company register statistics for 2018: Office for Statistics Berlin-Brandenburg.

6 According to the classification of industrial sectors NACE Revision 2 from 2008, source: https://www.destatis.de/DE/Methoden/Klassifikationen/_inhalt.html/, accessed on 2 September 2020.

7 Data pool for number of companies in breakdown by economic sector (ES 2008), as per cluster boundary based on the company register statistics for 2018, source: Office for Statistics Berlin-Brandenburg.



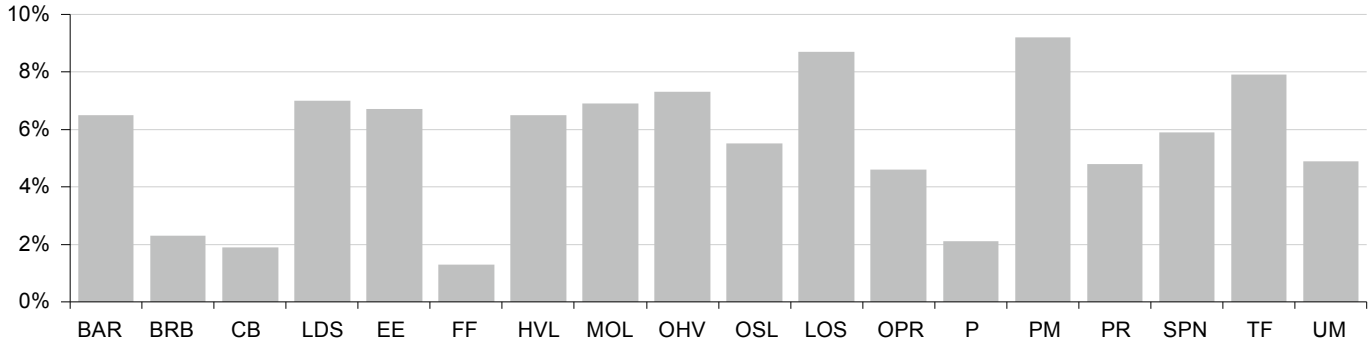
ES 2008	Economic sector
24	Metal production and processing
25	Manufacture of metal products
28	Mechanical engineering
33	Repair and installation of machines and equipment
71	Engineering offices
72	Research and development

Figure 4: Companies in the Cluster Metal Industry according to industrial sector (2018), source: Office for Statistics Berlin-Brandenburg

Kreuz have all confirmed the Cluster Metal Industry as being one of their key focal clusters.

2.2 Universities/technical colleges and non-university research institutions

As part of the capital region, Brandenburg has a high level and unique density of universities, technical colleges and research institutions with subject relevance to the Cluster. Subjects in material research, mechanical engineering, electrotechnology, mechanics/mechatronics and automation technology, production, process, method and manufacturing technologies, in logistics, and in factory operations are all among the research areas which are worked on in cooperation with international, national and regional cooperation partners. Moreover, relevant inter-industry competences are available for companies in the Cluster, in particular in information technology and in economic sciences for the tasks presented by digitalisation and modern company management. The Cluster actors also make recourse to experts in neighbouring federal states. Partner relationships exist in particular with institutions in Berlin, Saxony and Saxony-Anhalt.



BAR – Barnim
BRB – Brandenburg (Havel)
CB – Cottbus
LDS – Dahme-Spreewald
EE – Elbe-Elster
FF – Frankfurt (Oder)
HVL – Havelland
MOL – Märkisch-Oderland
OHV – Oberhavel
OSL – Oberspreewald-Lausitz
LOS – Oder-Spree
OPR – Ostprignitz-Ruppin
P – Potsdam
PM – Potsdam-Mittelmark
PR – Prignitz
SPN – Spree-Neiße
TF – Teltow-Fläming
UM – Uckermark

Figure 5: Distribution of companies across Brandenburg counties (2018), source: Office for Statistics Berlin-Brandenburg

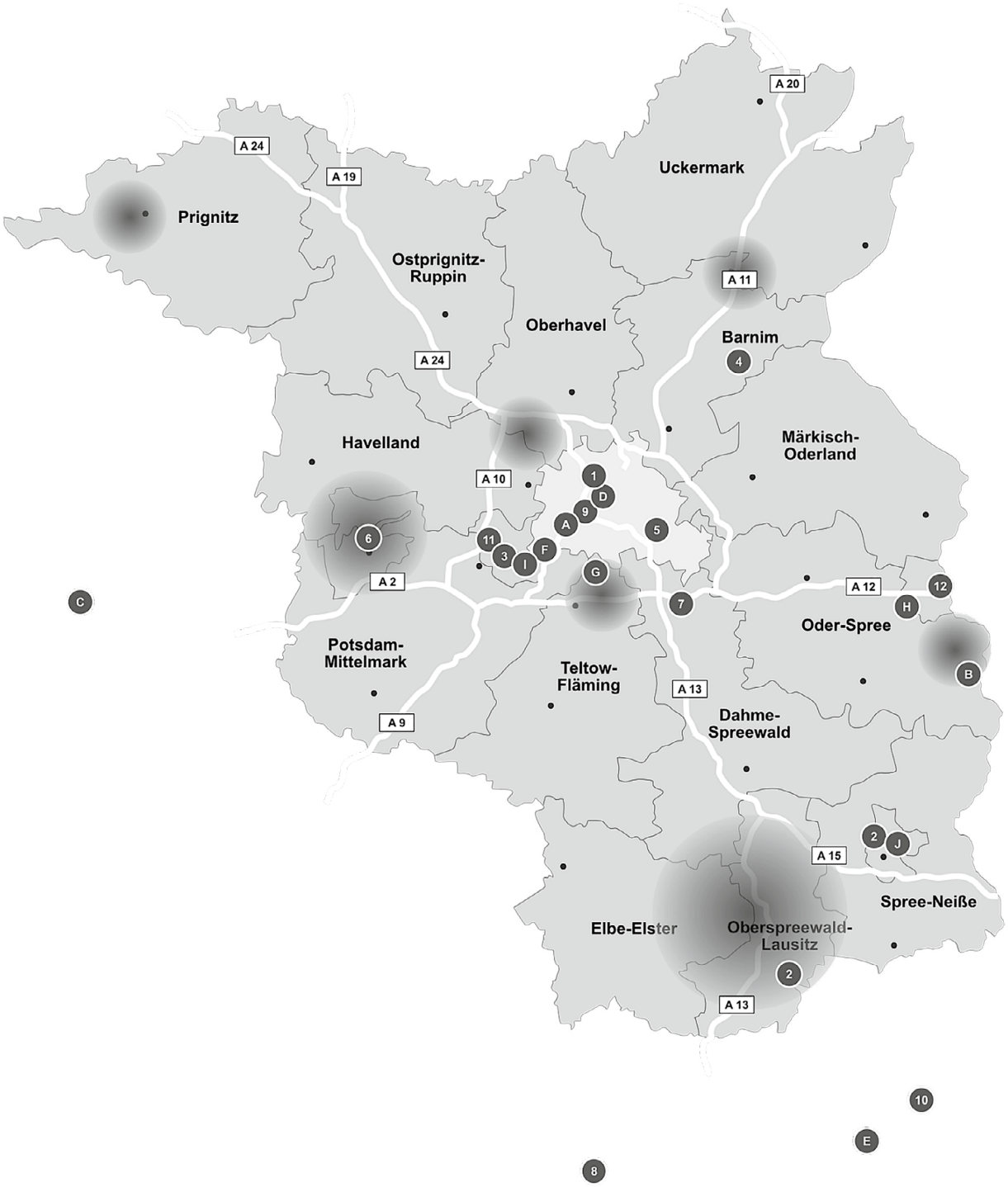


Figure 6: Universities/technical colleges (numbers) and non-university research institutions (letters) relating to the Cluster Metal Industry as well as regional focal points of companies in Brandenburg (see legend from Tables 1 and 2)

Almost all universities and technical colleges in Brandenburg work on metal-specific research subjects and offer services for companies. Furthermore, some of the universities and technical colleges offer expertise in relation to automation and production technology, digitalisation and business economics. These are joined by universities and technical colleges in neighbouring federal states with which the Cluster players work closely together. Some examples are also listed in the following table in alphabetical order.

Table 1: Universities/technical colleges with Cluster links in Brandenburg and bordering federal states with a selection of relevant specialist key focal points

University/technical college	Regional focal points (selection)
1. Beuth University of Applied Sciences, Berlin	• Electrical engineering • Mechatronics • Mechanical engineering
2. Brandenburg University of Technology Cottbus-Senftenberg	• Automation technology • Electrical engineering • Factory planning and factory operations • Manufacturing technology • Information management and company leadership • Mechanical engineering • Operations management
3. University of Applied Sciences Potsdam	• Product design
4. Eberswalde University for Sustainable Development	• Sustainable business • Company leadership and production management
5. HTW Berlin - University of Applied Sciences	• Electrical engineering • Automotive engineering • Engineering informatics • Mechanical engineering
6. Brandenburg Technical University of Applied Sciences	• Automation technology • Energy and process engineering • Information technology • Mechatronics • Mechanical engineering
7. Wildau Technical University of Applied Sciences	• Automation technology • Energy systems • Aviation technology • Mechanical engineering • Telematics
8. TU Bergakademie Freiberg	• Mechanical engineering • Process and energy engineering • Material sciences and technologies

University/technical college	Regional focal points (selection)
9. TU Berlin	• Energy and automation technology • Mechanical engineering, especially tool machines and factory operations • Material sciences
10. TU Dresden	• Electrical engineering • Lightweight construction • Aerospace technology • Mechanical engineering • Process engineering • Material science
11. University of Potsdam with the Hasso Plattner Institute (HPI)	• Innovation and knowledge management • Spectroscopy and sensor technology • Business informatics • Artificial intelligence and intelligent systems • Cybersecurity – enterprise security • Digital engineering • IT entrepreneurship • School of Design Thinking
12. European University Viadrina	• European New School of Digital Studies (ENS) • Information & Operations Management • Management & Marketing

The non-university research institutions based in Brandenburg with Cluster links have a wide-ranging, highly specialised scale of competences in the areas of material technology and analysis, manufacturing and automation technology, and in additive manufacturing. Cooperation also exists between non-university research institutions in Berlin and other bordering federal states.

Table 2: Non-university research institutions with Cluster links in Brandenburg and neighbouring federal states with a selection of their specialist key focal points

Research institution	Regional focal points (selection)
A. Federal Institute for Materials Research and Testing (BAM)	• Material testing, materialography • Corrosion, corrosion protection • Structural analysis • Non-destructive testing • Welding manufacturing processes, integrity of welded joints
B. ArcelorMittal Eisenhüttenstadt Forschungs- und Qualitätszentrum GmbH	• Testing materials and raw materials for metal production and processing • Corrosion testing • Coating testing
C. Fraunhofer Institute for Factory Operation and Automation (IFF)	• Efficient, sustainable production
D. Fraunhofer Institute for Production Systems and Design Technology (IPK)	• IT solutions for company and production management • Digital engineering • Production processes • Automation
E. Fraunhofer Institute for Machine Tools and Forming Technology (IWU)	• Development of efficient technologies for production • Formative and machining manufacturing processes, handling technologies
F. Helmholtz-Zentrum Berlin for Materials and Energy (HZB)	• Material research
G. Institute for Thin-Film Technology and Microsensor Technology (IDM)	• Characterisation of structures and surfaces • Thin-film technologies
H. Leibniz Institute for High Performance Microelectronics (IHP)	• IT security
I. Max Planck Institute of Colloids and Interfaces	• Intelligent surfaces • Material coatings
J. Panta Rhei Research Centre for Lightweight Construction Materials	• Additive manufacturing processes • Lightweight construction materials • Manufacturing and joining technologies • Construction of lightweight and composite components • Material engineering and analysis

2.3 Networks, associations, chambers

Although the locations of the Cluster are geographically diverse, the Cluster Metal Industry is characterised by a high level of networking that is already supported by national and regional networks. They coordinate and carry out joint initiatives in cooperation with associations, chambers and social partners.

Table 3: Networks, associations, chambers and social partners with Cluster links in Brandenburg with a selection of their specialist key focal points

Network, association or chamber	Regional focal points (selection)
1. South Brandenburg Metals and Electrical Industries Consortium (ARGE MEI)	Over 60 companies from the counties Elbe-Elster and Oberspreewald-Lausitz, as well as Saxony-Anhalt, are represented in this network for the metals and electricals industries network. Joint challenges and projects are discussed in regular company meetings.
2. The German Association for Small and Medium-sized Businesses (BVMW)	As a nationally active association for small and medium-sized businesses, the BVMW represents the interests of its member companies and supports them by keeping them informed and by networking.
3. Chambers of Crafts (HWK)	The Chambers of Crafts Cottbus, Frankfurt (Oder) and Potsdam support their members in their daily challenges. They offer possible solutions ranging from initial, continuing and advanced training, to company guidance and practical ways of using technical innovations.
4. Chambers of Commerce and Industry (IHK)	The Chambers of Commerce and Industry Cottbus, Ostbrandenburg and Potsdam represent the common interests of all companies belonging to it.
5. Metalworkers' Industrial Union (IG Metall)	As a workers' union, the IG Metall represents employees from the metal-electro, steel, textile-clothing, wood-plastic and the information and communication technology industries.
6. Eisenhüttenstadt Metalworking and Environmental Technology Association (KoMU)	The objective of the KoMU is, via funding for initial and continuing training, to secure the next generation of skilled employees and create an environment for future-oriented skilled worker development, in order to support regional development.
7. Network Lightweight Design Metal Brandenburg (LMB)	The LMB is a network of partners from science and business with specialised competences in metal and hybrid lightweight construction. It offers support in searching for lightweight construction solutions, potential partners, suppliers and research institutions, and provides information on suitable funding programmes.
8. The Network of the Metal and Electrical Industry in the Capital Region (ME)	The network, as an initiative of the Berlin and Brandenburg metal and electrical industry union (VME) and the Berlin-Brandenburg Business Associations (UVB), is a platform for companies of the industry to exchange information and experiences. At the same time, it offers the chance to establish and intensify contact to universities/technical colleges and research institutions in Berlin and Brandenburg.

9. Metall Finsterwalde – ARGE Netzwerk Metallverbindung	The company network of the metal industry in Finsterwalde pursues the objective of strengthening the connection between policy, the economy and people, and to support regional development.
10. Netzwerk Metall Barnim (NMB)	The “Network Metal” of the county Barnim is a lobby of the location’s metal processing companies. Its objectives are to facilitate two-way communication and information among companies as well as revealing potential for synergy and cooperation in the interest of reinforcing the location’s economy.
11. profil.metall	profil.metall supports the steel and metal processing industries in Brandenburg and Berlin. Industry interests are represented, cooperation between companies and universities and international cooperation are funded, skilled worker initiatives carried out, and new products, processes and markets are aimed for as part of various activities and projects.
12. Association for Electrical, Electronic & Information Technologies (VDE)	As a union for the industries and professions in the area of electrical and information technologies, the VDE provides an international expert platform for businesses, students and young professionals focusing on science, standardisation and product testing.
13. The Union of the Metal and Electrical Industry in Berlin-Brandenburg (VME)	The VME is a pool of companies in the metal and electronic industries in Berlin and Brandenburg. In charge of free collective bargaining, the VME supports the labour and economic conditions of its member businesses, thus promoting the competitive ability of the entire metal and electronics industry.
14. The Mechanical Engineering Industry Association (VDMA)	The VDMA is an association and industry network of mechanical and system engineering and is represented in eastern Germany via a regional representative. It provides its members, primarily medium-sized companies, with various services, represents their interests in state and local politics and enables joint progress to be made on important subjects.
15. The Association of German Engineers (VDI)	The VDI supports, promotes and represents engineers, natural scientists and computer scientists; in doing so it acts as an organiser, a network and a multiplier of technology knowledge.
16. Prenzlau Business Forum (WFP)	The WFP is committed to ensuring Prenzlau is a modern industrial location and improving location conditions, especially for the metal and electronic industries as well as renewable energies via the training of engineers from the region.
17. German Electrical and Electronic Manufacturers’ Association (ZVEI)	As Germany’s industrial association, the ZVEI represents the interests of its member businesses. The association’s work is based on the exchange of experience and views among its members on current technological, economic, legal and socio-political subjects related to the electro industries.

2.4 Links to other Berlin-Brandenburg clusters (cross-cluster)

The economic players in the Cluster Metal Industry are usually at the top of the value chain. Partners from other clusters and industries should therefore be involved regarding innovations. The cross-cluster objectives represent both an opportunity and a challenge for the Cluster Metal Industry participants. New technologies, perspectives and market access points can be used via cross-cluster and inter-industry activities. The Clusters Energy Technology, Food Industry, Healthcare Industry, ICT, Media and Creative Industries, Plastics and Chemistry, Optics and Photonics, and Transport, Mobility and Logistics have particularly strong interfaces. There are many consumer and supplier relationships or technology partnerships with the stakeholders of these clusters. Intensive links also exist with the trade industry segment and the construction industry. The following Table 4 provides an overview of potential subjects for cross-cluster activities and projects.

Table 4: Potential cross-cluster subjects (selection)

Cluster Energy Technology	• Materials and technologies for new applications, e.g. renewable energies and recycling • Automation • Energy efficiency, decarbonisation • Skilled employees
Cluster Food Industry	• Machines and systems for the food and agricultural industries • Automation • Materials for aggressive environments
Cluster Healthcare Industry	• Medical technology, device engineering • Surface technology • New materials, implants • Company healthcare management
Cluster ICT, Media and Creative Industries	• Product design, industry design, usability • Digitalisation of company processes • Artificial intelligence, Big Data • Virtual reality, augmented reality, mixed reality • IT security and security with IT
Cluster Plastics and Chemistry	• Lightweight construction/composite materials, metal-plastic hybrids including additive manufacturing technologies • Sustainable material solutions • Automation • Product design • Skilled employees

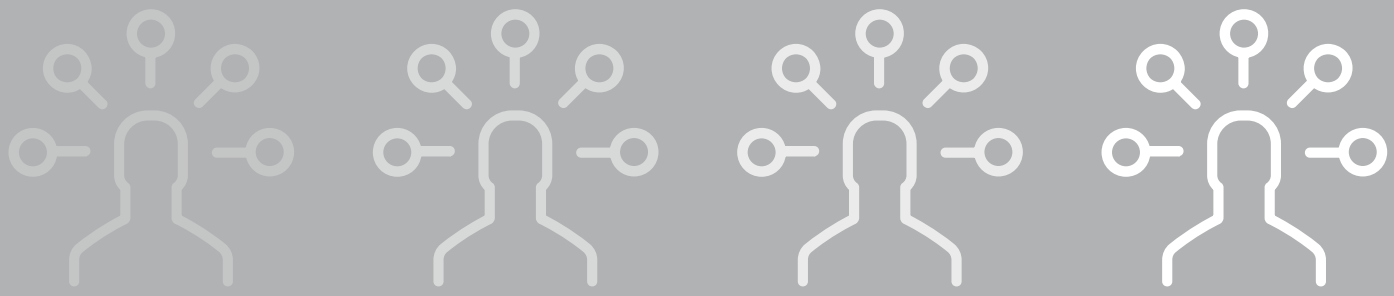
Cluster Optics and Photonics	• Lasers for material processing • Application of new developments in light engineering and microsystem technology • Lasers in process measurement engineering and quality control • Sensory technology
Cluster Transport, Mobility and Logistics	• Manufacturing technologies and processes • Maintenance, repair and overhaul • Lightweight construction • Resource-efficient and energy-efficient processes, automation, logistics • Component and process inspection processes • Intelligent and sustainable mobility • Skilled employees

It was possible to continually increase the number of cross-cluster projects over the last years. As these projects mostly display a high innovation potential, this is also the focus of the Cluster Management. The objectives and potential of this subject “cross-industry value creation (cross cluster)” will be described in more detail in Section 5.1.4.

2.5 Cluster structures

The Cluster Metal Industry Brandenburg was established with a launch event “Synergies with steel” in November 2012 in Eisenhüttenstadt. The accompanying structures have since supported the developments in the Cluster. The Cluster Spokesperson represents the Cluster in public and is Chairperson of the Strategic Council. The implementation of projects and activities is coordinated and supported via the Cluster Management and is accompanied by an additional steering committee. A council consults on the strategic alignment of the Cluster. This council is made up of representatives from businesses, associations, networks, social partners, research institutions and administration. By means of its networking it promotes the technology and knowledge transfer between the players in the Cluster and beyond.

The Cluster Management carries out activities that serve the networking, cooperation and project initiation of cluster players. Various event types such as cluster conferences, forums or thematic workshops are used for this purpose. It also supports the players with concrete projects at all stages: from the initiation at syndication to thematic focus points over the entire term of the project. Furthermore, the Cluster Management is responsible for marketing activities and supporting activities in securing skilled employees for the entire cluster.



3 Focus of the fields of action and key parameters

3 Focus of the fields of action and key parameters

3.1 Strategic framework

The strategic framework for innovation policy in the four clusters specific to Brandenburg[8] is formed by the Regional Innovation Strategy of the State of Brandenburg (innoBB 2025 plus), which was updated in 2019 – as is the case for the Cluster Metal Industry. The innovation strategy sets out guidelines for expanding and opening up innovation efforts and prioritising sustainable innovation. Internationalisation is a prerequisite for maintaining attractiveness and competitiveness and is effectively supported in Brandenburg by strengthening regional locations. In addition, cross-industry cross-cluster cooperation is also set to be strengthened further.

Special focus is placed on sustainability issues. Key focal points for the clusters are seen in the fields of "Digitalisation", "Real-world laboratories and test fields", "Work 4.0 and skilled employees" as well as "Start-ups and new businesses".

These guidelines and priorities set in the innovation strategy are all covered in the fields of action, key points and topics in the Master Plan for the Cluster Metal Industry.

The Master Plan is also based on the "Brandenburg Industrial Policy Guidelines"[9], which identify important operational fields of action such as innovation and digitalisation, as well as guidelines and key focal points of the innoB 2025 plus

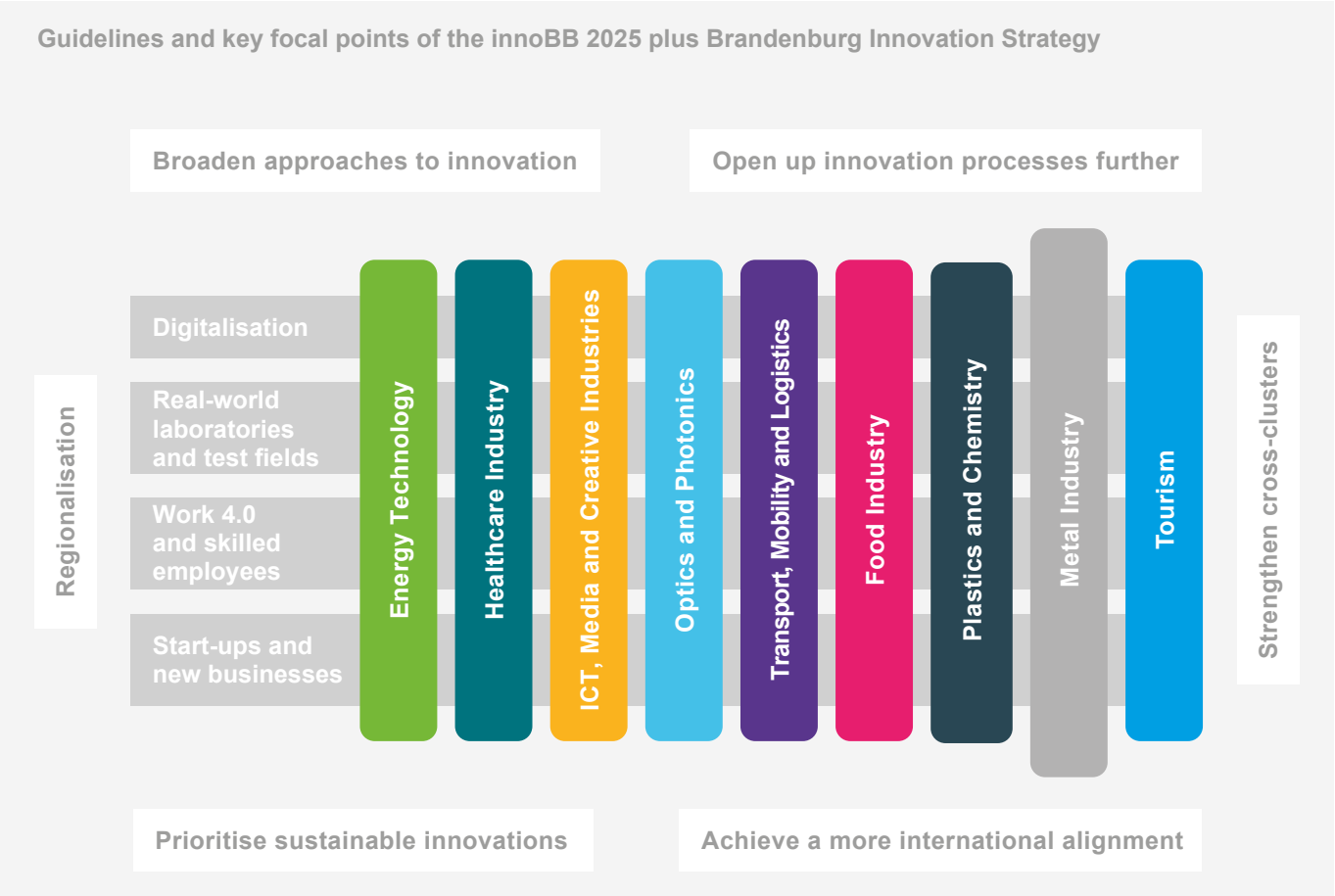


Figure 7: Clusters, guidelines and key focal points of the innoBB 2025 plus Brandenburg Innovation Strategy

8 Within the framework of the innoBB 2025 joint innovation strategy with Berlin, five transstate clusters are managed: Energy Technology, Healthcare Industry, ICT, Media and Creative Industries, Visual Technology and Photonics, and Transport, Mobility and Logistics. Brandenburg is also pursuing specific clusters such as the Food Industry, Plastics and Chemistry, Metal Industry and Tourism.

9 Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg (2019): Brandenburg Industrial Policy Guidelines, Potsdam.

securing skilled employees and relevant qualifications. At European level, the "Horizon Europe" framework programme will focus on global challenges and European industrial competitiveness[10] for the period 2021 to 2027. The thematic pillar of "Climate, Energy and Mobility" will become relevant for the technical focus of the players in the Cluster Metal Industry. The combination of these three terms is indicative of the challenges identified in Brandenburg. In addition, the general focus of the Master Plan also covers new ecological and social challenges.

3.2 Structure of the fields of action, key parameters and thematic areas

The previous structure of the fields of action, key points and thematic areas has proven to be technically sound and practical for the classification and assessment of innovation projects. The fields of action set out in the 2014 Master Plan of "Innovation Workshop, Cooperation Network and Skilled Employees Matrix" have not lost any of their importance or conciseness in terms of their framework for action, and valuable progress has been made in all three areas. The fundamental transformation processes in the energy and mobility/automotive sectors that were already emerging at the time are now taking place – in some cases accelerated by other factors such as the coronavirus pandemic. Sustainability requirements have become significantly more important: sustainability and climate protection no longer take place alone in separate markets, but have rather become a socially accepted challenge. Potential digitalisation opportunities were already firmly anchored in the first Master Plan – particularly in terms of the design of value-creation and development processes – but these have now become key focal points. By combining these three central driving factors, digitally supported tools and processes can promote the development of sustainable solutions.

With this in mind, the proven structure of the three named fields of action will be maintained and supported by updated key points (10) and thematic areas (37) in the continuation of the Master Plan. The Innovation Workshop groups together the aspects that deal with new potential solutions that are visible on the market, enabling a more cost-effective, faster, safer and sustainable provision of services and preparing the necessary technological basis for this. The Cooperation Network field of action covers the thematic areas of cooperation between companies, between companies and scientific institutions, and between all groups of players to promote and strengthen the locations of the metal industry in Brandenburg. The Skilled Employees Matrix describes the measures taken to strengthen companies in terms of securing skilled employees. These are based on the guidelines of Brandenburg's skilled worker strategy of "Train, retain and gain for Brandenburg".

The topics and measures covered in the three fields of action are closely interrelated. This is exemplified by successful innovation, which requires close networking between companies, partner companies and scientific institutions, and relies on the participation of qualified and committed employees. Employee recruitment issues are closely linked to the image of a company that is powered by aspects such as its innovation activities and attitude towards sustainability issues.

3.3 Effects of the coronavirus pandemic

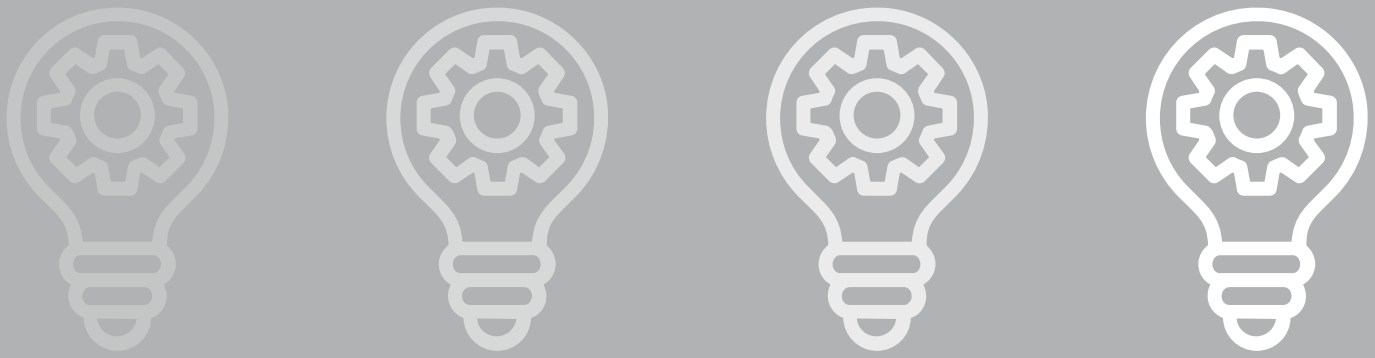
What initially appeared to be a sudden, short-term problem will lead to substantial medium to long-term changes in individual sectors of the economy. Generally speaking, the impact of coronavirus restrictions will tie up a significant proportion of the attention and resources of companies for the foreseeable future, leaving less scope for innovation than in previous years. At the same time, the impact can also be seen as an opportunity to introduce long overdue changes and innovations. In addition to their fundamental importance, digitalisation issues are now becoming increasingly pressing. Recent months have seen a real rise in the importance of new digital forms of communication, the organisation of distributed work – including in home office situations – and the topics of automation and the structure of integrated processes. Supply bottlenecks caused by global production losses have led to the realisation that supply chains need to be made more robust and redundant, and that local sources of supply need to be factored in more often.

The slump in demand and production has placed a real question mark over consumer behaviour. Issues of sustainability in all its facets are now becoming increasingly

10 European Commission: Horizon Europe – the next EU investment programme for research and innovation (2021–2027), September 2019.

important. This leads to a comprehensive need for development, starting with sustainable solutions for energy production and mobility. At the same time, these have to be incorporated into the individual stages of the value chain – ideally at the same time – so that they can take effect. This offers the opportunity for new product technologies coupled with innovative production technologies and intelligent development processes.

The crisis also represents a touchstone for the ability of all social players to communicate both with each other and among themselves. Valuable contributions can be made here through the existing networking within the cluster and the potential for future development in this regard.



4 Field of action Brandenburg Metal Industry Innovation Workshop

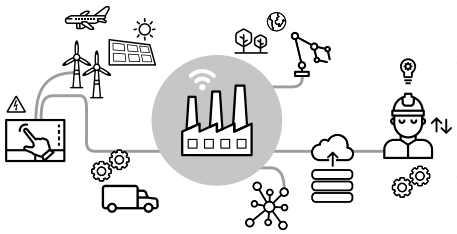
4 Field of action Brandenburg Metal Industry Innovation Workshop

Innovations form the basis for the economic success of tomorrow. On the one hand they pave the way for future value creation (product innovations), while on the other hand they facilitate the efficient production of products and services. This in turn serves to boost productivity when it comes to the development of new products (process innovations). In addition to product and process innovations, there are a number of other types of innovation such as those in service and sales, which combine to enable new services based on new business models. This all has to be underpinned by an innovation-promoting environment for employees and access to the necessary scientific expertise.

Field of action Brandenburg Metal Industry Innovation Workshop

Create innovations

- **Innovation alignment, innovation culture**
- **Interdisciplinary** and **process-oriented thinking,** consideration of **non-technical innovations**



Market performance

- **Products** with **improved** features (lightweight design, wear resistance, can be repaired and recycled, functionality/design, etc.)
- **Sustainable** applications and services (renewable energies, sustainable mobility and hydrogen economy)
- Maintenance, repair and overhaul **(MRO)** and **product-specific services, new business models** with intensified client retention
- Market and technology **"foresight"**

Efficient and sustainable processes

- Digitalisation of **design, manufacture planning and factory planning processes**
- **Resource- and energy-efficient** processes, **decarbonisation**
- **Material efficiency, recycling** and **reusing**, contributions to the **circular economy**
- **Quality** assurance and management, **efficiency** using modern **components and process inspection methods**
- Continuous process chains in automated **production, procurement, logistics** and in **supply chain** management
- Digitally supported sales processes
- **Information security**

New scientific basis and technologies

- Creating and using insights from **material technologies**, new (connecting, hybrid, "smart") materials, component concepts
- Mastering and continuing to develop **manufacturing technologies**
- Development and strengthening the application of **digital technologies for the needs** in the Cluster, e.g. IoT, machine learning/AI, assistance systems, AR, change and knowledge management

Figure 8: Key parameters and subject areas in the field of action Brandenburg Metal Industry Innovation Workshop

4.1 Create innovations

Companies are currently noticing an increasing speed of change with different influences, such as the internationalisation of competition, increases in raw material and energy prices, as well as various sustainability requirements, which means that innovations are being given high priority. Triggered by external influences (development of new market constellations, activities of competitors, crises) or by internal ones (competence development, idea management, restructuring, self-motivation), it is possible to engage in creative processes to develop concrete solutions and products out of problems, challenges and ideas. The impetus to strive for innovation has to come from higher up within the company, whereas the development of solutions is ideally supported and contributed to by all those involved in the process. Innovation processes are becoming increasingly systematic and targeted. Furthermore, psychological and socio-scientific elements relating to the perception and behaviour of those involved are also included in order to create a continuous chain of effects between market orientation, customer loyalty and technology.

4.1.1 Innovation alignment, innovation culture

■ **Objective**

To strengthen innovation activities in companies – maintain the high value of innovation within the region.

The present challenges we are facing have served to highlight both the importance and culture of innovation. The creation and economic exploitation of innovations, including product, process, service or business model innovations, call for an explicit commitment to innovation and an open, constructive communication, action and decision-making culture within companies. With a well-established innovation strategy in place and the culture to go with it, occasionally supplemented by external knowledge and expert professionals, it is possible to come up with new innovations and generate additional value creation. Intelligent innovation methods are set to become more prominent, too, as the market is increasingly calling for shorter product life cycles.

■ **Relevance**

The varying degrees of dynamism in the individual submarkets require an innovation system that is specifically tailored to the company and its performance in terms of value creation. While traditional innovation processes focusing on the development of technological competence ("technology push") are still successful in established markets, intelligent customer and market-related approaches ("market pull") can be successful too – particularly in current dynamic markets that are also characterised by the emergence of new business models. Proven approaches to lean management supplemented by new approaches to finding solutions – via Design Thinking[11], for example – have been and still are successfully put into practice by companies across Brandenburg.

■ **Potential**

Since the innovation alignment and culture are highly dependent on internal company factors and influences, the effect of external support instruments is fundamentally limited. Innovation can be indirectly promoted through training, networking activities and the exchange of best practice, as well as through a wide range of support structures and instruments. The activities of the cluster are geared towards stimulating innovation when taken as a whole. Seen in this light, innovations can be regarded as the central good of cluster activities, which means those that highlight innovations in a communicative way and thus promote an innovation alignment among those responsible within companies are to be granted further support.

A proven example is the annual presentation of the Brandenburg Metal Innovation Award. In addition to prize money, the positive public perception in particular helps the prize winners to become better known, encourages them to come up with further innovations, and opens up new business opportunities.

4.1.2 Interdisciplinary and process-oriented thinking, consideration of non-technical innovations

■ **Objective**

To support interdisciplinarity and process-oriented thinking to strengthen the innovative power of companies in Brandenburg – including non-technical innovations.

A transfer of knowledge and methods between different disciplines enriches and broadens perspectives beyond a person's own field of expertise and can contribute to a better understanding of complex issues and tasks. It is particularly appropriate where societal challenges, such as improving sustainability, need to be addressed by different disciplines and specialisations.

Almost every activity in the innovation context is embedded within business processes, that is to say it is based on available information and decisions and in turn triggers subsequent process steps. For this reason, it is primarily process-oriented approaches to solutions that are required. Special importance is attached to non-technical innovations, which include new types of product, service, process, organisation and marketing concepts as well as business models. The primary value creation is based on not only the technologies used, but also changes aimed at previously

11 The principles of Design Thinking were developed at Stanford University and taught at the "d.school" at the Hasso Plattner Institute of Design at Stanford University in Palo Alto. In Brandenburg, the School of Design Thinking at the Hasso Plattner Institute in Potsdam has been offering training and further education modules on Design Thinking since 2007.

unknown application contexts, possible uses, organisational structures, or mechanisms for yield and value creation[12].

■ **Relevance**

The turning point in energy and mobility as well as tasks relating to sustainability and digitalisation drive innovation and call for an interdisciplinary approach. Brandenburg is already home to a whole host of competent and practically minded solution providers. The universities and non-university research institutions with their integrated competence and transfer centres have various offers available that are tailored to the needs of companies.

■ **Potential**

The inclusion of interdisciplinary and process-oriented ways of thinking as well as the consideration of non-technical innovations are only just beginning. Wildau Technical University of Applied Sciences, for example, has initiated an integrative and attractive organisational concept in the form of a learning, research and transfer platform known as the "Wildauer Maschinen Werke". The model promotes team building between the chairs and puts together offers for students and interested parties from the business world with a focus on digital competence. Interdisciplinary innovation processes are also easier to manage in technology centres and innovation parks with a conscious mix of different industries and competences.

In any case, the central element comes in the form of needs-based networking between partners who ideally do not come from the same economic background or field of knowledge. The information and support services have not yet been taken up by all companies. New formats that offer more direct access to the problem approaches need to be developed and experienced in practice. This can be achieved by further intensifying the level of networking among the players, in particular by involving the chambers and associations as trusted representatives of the companies. The basis for this is provided by the innoBB 2025 plus Brandenburg Innovation Strategy, which focuses explicitly on approaches to inter-industry cooperation (cf. Section 5.1.4).

4.2 Market performance

For companies, economic growth means using cost advantages and innovations to oust competitors in existing and saturated markets on the one hand, and entering new markets on the other. This can be achieved both with innovative products and with services or product-related services such as care and maintenance. Fundamental transformation processes are well underway in the energy and automotive subsectors, and these require new products and services in potentially new application contexts. There is also a dynamic demand for innovative technological solutions in the newly developing fields of renewable energies, sustainable mobility and the circular economy. This opens up a wide economic field for companies in Brandenburg with strong technology and process expertise.

4.2.1 Products with improved features

■ **Objective**

To market and develop products with improved properties through the targeted use of technologies, in particular lightweight construction.

Against the background of comprehensive efficiency and sustainability requirements, the product properties of lightweight construction, functionality/design, wear resistance/durability, and reparability and recyclability are all of particular note. Contemporary products are characterised by the fact that they are not harmful to people or the environment, or that no processes harmful to the environment are used in their manufacture or operation, or that no toxic substances are released.

Lightweight construction plays a special role in the context of sustainability. In mobile applications, lightweight construction solutions save energy and operating costs, and during production, resource and energy efficiency is increased due to the reduced use of materials.

With all innovative solutions, the cost dimension must also always be kept in mind in order to successfully market the solutions developed.

12 Definition of non-technical innovations in Technopolis: Economic and Administrative Analyses of Potential Needs for Public Support Mechanisms to Promote Non-Technological Innovations, a study commissioned by the Federal Ministry for Economic Affairs and Energy (BMWi), p. 19 ff., 31 October 2016.

■ **Relevance**

Significant value-added shares of the Brandenburg metal industry continue to be generated in the existing industrial sectors. In addition to emerging industries, these are key customers and also demand innovative products and services.

Lightweight construction is now established and in demand as an innovation driver in almost all industrial sectors. For some years now, lightweight construction solutions have also found their way into the construction industry. In fact, a large number of industrial projects have been initiated and successfully completed by respective companies, networks and scientific competence centres in Brandenburg. These contribute significantly to the now growing acceptance and demand for lightweight construction solutions.

■ **Potential**

When it comes to improving product properties, the potential here is manifold. The changes in the energy and mobility sector are also having an impact in traditional industries, which is opening up the potential for innovation across the entire breadth of industrial value creation.

Improvements in manufacturing costs, weight, functionality and sustainability can all be achieved, particularly in combination with knowledge of new materials technologies and the use of innovative manufacturing processes. Lightweight construction is an opportunity for every designer to design components in a way that is efficient in terms of costs, materials and resources. In lightweight construction projects, the closely coordinated interplay of several disciplines in the selection of materials, design, structural-mechanical analysis and weight optimisation is particularly evident, just as it is in the partly additive manufacture and realisation of hybrid connections. In addition to the further development of classic metalworking and metal processing methods, the specialist disciplines of bionics and evolutionary technology are proving particularly promising. This is where efficient functional structures are derived from nature, optimised and produced using additive manufacturing processes or modified conventional methods. To ensure that the new solutions also achieve long-term market penetration, it is essential to support accompanying standardisation activities[13].

With the increasing tendency to integrate several functions into components, questions of repair and recyclability must also be taken into account in the component design ("design to recycle").

In bringing together the necessary information and skills, it is vital to strengthen small and medium-sized enterprises in particular, as these generally only have limited resources for innovation. Proposals from chambers, networks, associations and R&D institutions in Brandenburg can all provide effective support in this regard.

4.2.2 Sustainable applications and services

■ **Objective**

To open up new and emerging application markets for the players in the Cluster Metal Industry. Synergy effects with the energy and mobility industry – as well as with other players in the circular economy – should be used more intensively.

The energy and mobility revolution is placing new demands on the materials and systems we use. The metal industry is an enabler for the production, transport, distribution and storage of renewable energies in the form of the heat, electricity, hydrogen or synthetic fuels it produces. Industrial companies in this industry are also major consumers of energy. We must develop ways to make sustainable energy procurement safe and economical – for example, by means of cooperative energy procurement coupled with supply-oriented network control.

In the field of automotive engineering, drive systems that are compatible with renewable energies are increasingly gaining acceptance. Storage technologies, especially those based on hydrogen as well as heat and battery storage, are of particular importance in terms of the use of renewable energies. Solutions from the metal industry are also required in the fields of circular economy and bioeconomy.

■ **Relevance**

All approaches to future production in Europe, and thus in Germany in particular, are subject to the demand for the

13 Participation in the DIN-SPEC process is particularly useful in innovative environments in order to develop standards with relevant market participants at an early stage and thus develop a new market, https://www.din.de/de/forschung-und-innovation/din-spec, accessed on 30 July 2020.

consistent implementation of clean technologies and a resource-conserving approach to raw materials.

With its former focus on lignite-based electricity generation, Brandenburg is particularly affected by the change in the energy industry towards renewable energies, although it is now a pioneer in the generation of electricity from wind power and other renewable sources. Particular attention is being paid to the development of storage technologies to cushion the dependency on the volatile energy sources of wind power and solar radiation. Here in Brandenburg, developmental priorities have been set for battery-based electric storage, the production and storage of hydrogen[14] and the storage of heat and cold[15]. The development is being followed by the establishment of new companies, increasingly in the areas of battery production and the manufacture of components through to vehicles for sustainable mobility.

Having said that, there are also several suppliers in Brandenburg who produce parts and components for combustion vehicles. They are in the midst of a comprehensive transformation process that they will find difficult to manage on their own – especially if, as small or medium-sized enterprises (SMEs), they have only limited development capacity. In order to counteract potentially negative employment developments in good time, a timely reorientation towards innovations in the context of new energy sources and mobility is crucial[16].

■ **Potential**

Through sustainable engineering, the consumption of renewable and non-renewable resources can be reduced, environmental pollution minimised, and high social and ethical standards guaranteed by the specification of a sustainability code.

As buyers for the metal industry, new, developing or up-and-coming industries offer additional, expanding potential for the placement of products and services. Metal-specific competitive advantages can be identified in particular by networking with specialised R&D facilities and competence clusters. With this in mind, the skills and activities in Brandenburg have to be presented transparently and granted active support.

In the capital region, sustainable vehicle technologies are developed, tested and tried out across a wide range of different technologies. Especially in Brandenburg, solutions are being developed for commercial vehicles with electrified drive and working units, rail vehicles with fuel cells or battery-based electric drive modules, and even for aircraft (“electric flying”). The thought processes surrounding the strategic establishment of a hydrogen and, in particular, electrolysis industry provides a huge opportunity to ensure and increase the necessary value creation in the State of Brandenburg while maintaining competitiveness[17].

4.2.3 Maintenance, repair and overhaul (MRO) and product-specific services, new business models with intensified client retention

■ **Objective**

To support Brandenburg's companies with the development of service concepts and business models for existing and new applications, especially with regard to renewable energies, sustainable mobility and the circular economy.

MRO, i.e. all measures in connection with the maintenance, repair and overhaul of plants, equipment and complete industrial facilities – as well as more extensive product-related

14 Federal Ministry for Economic Affairs and Energy (BMWi): The National Hydrogen Strategy, June 2020.

15 The Potsdam-based GeoForschungsZentrum (GFZ) is a pioneer in this field with its series of research and demonstration projects in Brandenburg and Berlin on heat and cold storage and the storage of hydrogen in the geological underground.

16 A. Blöcker, K. Dörre, M. Holzschuh (eds.): Auto- und Zulieferindustrie in der Transformation – Beschäftigtenperspektiven aus fünf Bundesländern, ein Projekt der Stiftung Neue Länder in der Otto Brenner Stiftung [Automotive and supplier industry in transformation – employment perspectives from five German states, a project of the Neue Länder Foundation in the Otto Brenner Foundation], Frankfurt am Main 2020.

17 D. Nozharova, W. Diwald: H2-Industrie Potenzialstudie Brandenburg – Studie zur Identifizierung und Analyse der Chancen und Potenziale zur Wasserstoffnutzung und Ansiedlung einer Wasserstoffindustrie im Land Brandenburg, insbesondere unter Beachtung der energie- und industriepolitischen Aspekte [H2 Industry Potential Study for Brandenburg – Study to identify and analyse the opportunities and potentials for hydrogen use and the establishment of a hydrogen industry in the State of Brandenburg, particularly with regard to energy and industrial policy aspects], prepared by the German Hydrogen and Fuel Cell Association, July 2019, on behalf of the Ministry of Economic Affairs and Energy of the State of Brandenburg, https://mwae.brandenburg.de/media/bb1.a.3814.de/Wasserstoff_Industrie_Potenzialstu-die_Brandenburg.pdf, accessed on 4 September 2020.

services and after-sales services for capital goods – constitute a separate economic market. Based on experience in air and rail transport, these services can also be commercially successful for investment-intensive plant and machinery – or in the field of renewable energies and the circular economy.

New business models with intensified customer loyalty also offer the opportunity to involve the customer even more closely in the development processes and thereby deliver the best possible specific solutions.

■ **Relevance**

As a regional state, Brandenburg needs special strategies and business models to be able to carry out MRO services both effectively and efficiently. Existing services in energy technology as well as in rail and air transport offer best-practice examples of how services can be successfully offered on a national and international scale in new contexts.

■ **Potential**

MRO requires precise measuring and testing technology (for example, for structural health and machine condition monitoring), as well as for the inspection of assemblies and installations with complex designs, such as gas turbines, aircraft engines, supporting structures in automotive and mechanical engineering, and also in buildings. The players already active in this business segment often rely on optical imaging systems and intelligent pattern recognition (sometimes with self-learning algorithms/artificial intelligence) coupled with a high level of measurement accuracy. The spatial distance to the place of operation is bridged by remote maintenance systems using state-of-the-art communication technology. In addition to strong logistical connections, the local availability of powerful computing and communication infrastructure is therefore becoming an increasingly important prerequisite.

The competence for maintenance and service tasks is closely linked to a fundamental understanding of products and technology, which is not usually transferable at will. This hurdle represents an inherent "copy protection" for third parties, which is why – in principle – every manufacturer of complex products has the potential to offer customer-specific services or a complete package of products and services (in the form of hybrid service bundles). Customers are increasingly looking to buy not only the products themselves, but also the accompanying service package to ensure the most trouble-free operation possible. With this in mind, companies offering a suitable overall package can enjoy clear competitive advantages and significantly increase their own vertical integration in the process. The use of design thinking methods, for example, allows user-centred design solutions[18] to be developed and tested in a short time.

This development opens up new demand-oriented business models where, instead of selling products, a permanent right of use is granted, thereby helping to reduce the level of investment. For the provider of these solutions, this maintains the relationship with the customer over the entire product life cycle so that immediate action can be taken in the case of changes in demand. To this end, individual companies can be supported by shared distribution platforms of networks (such as B2B platforms for large-scale chemical/process engineering plants or for the production and use of renewable energies).

In addition to applications in the supply and disposal infrastructure, in particular energy supply and transmission, as well as in mechanical and plant engineering, we are also seeing new applications in the circular economy and bioeconomy.

4.2.4 Market and technology "foresight"

■ **Objective**

To establish a jointly supported market and technology projection as a structured "foresight process".

The dynamic changes currently observed in the markets towards renewable energies, systems for sustainable mobility and the realisation of closed resource cycles are considered serious by the players within the Cluster. The aims are to obtain a structured picture of the interdependencies of the individual developments and to bring the Cluster players in line with the changing market needs.

■ **Relevance**

Brandenburg's economy is characterised by a high level of diversification across several market segments and areas of expertise. Furthermore, the value creation chains in the industrial sectors of the Cluster Metal Industry extend beyond

18 Cf. Section 4.4.3.

state borders, which makes national and international links relatively close. As far as individual companies are concerned, which in Brandenburg generally means small or medium-sized enterprises that have always focused their attention on traditional direct business partners, a separate market analysis covering a multitude of individual aspects to be considered represents a necessary challenge.

■ **Potential**

Innovations take time. This can be clearly evidenced by the current adjustments found in drive technology for vehicles, for example, which affect the entire value-added chain from the vehicle manufacturer to system suppliers and on to component or individual-part suppliers. This requires the cooperation of scientific institutions, the assessments of chambers, associations and networks, as well as the active participation of forward-thinking companies to ensure a reliable assessment of market developments. A whole host of market and technological influences have to be systematically brought together to define identifiable lines of development. Individual aspects can be illustrated and made comprehensible through consistent market and technology scenarios. This makes it possible to identify development paths that lead from the current situation to a desired future constellation. The players in the Cluster Metal Industry often get involved at the beginning of the value creation process. This means representatives of the respective application sectors also have to be involved in this process[19].

4.3 Efficient and sustainable processes

A company's cost structures are largely determined by the efficiency of its processes. Efficiency potentials can be seen in the digitalisation of processes and how seamlessly they interact with each other. In addition to profitability targets, other requirements surrounding the sustainability of corporate processes are now gaining in importance.

4.3.1 Digitalisation of design, manufacture planning and factory planning processes

■ **Objective**

To support companies with the efficient design and organisation of digital design, manufacture planning and factory planning processes.

The digitalisation of design, manufacture planning and factory planning processes comprises operational support in the form of digital design and planning tools as well as their digital interconnections. In terms of content, the design process begins with the functional and geometric design of the part/functional component/total system. This includes calculations and designs, mathematical and physical modelling and simulation for validation and optimisation, and the subsequent steps in the manufacture planning and factory design processes.

■ **Relevance**

The continuity of the digital planning chain is an important element for maintaining economic efficiency and market success in view of the short development times required against the background of increasingly complex and new products. This is where companies in the Cluster Metal Industry are confronted with the challenges of not only making the right choice from a large number of available individual systems each with their own requirements for efficient operation, but also linking them to form a continuous and efficient process chain.

■ **Potential**

The optimisation of business processes is one of the key tasks when it comes to remaining competitive in terms of profitability and time-to-market. In addition to value-adding manufacturing processes ("downstream"), the permanent optimisation of planning processes ("upstream") is just as necessary for long-term survival in the market.

Information about the factory and its processes offers flexibility and variability for manufacturing. This is where companies are to be supported with regard to process organisation and the equipment of the necessary software infrastructure as well as the acquisition of competences and qualifications. Universities in Brandenburg already have a number of key areas of competence that must be made more widely known to companies and offered as support services. Here, too, the corresponding didactic and support services of the system suppliers can be provided via other suitable educational institutions and via the networks in the fields of information and media technology.

19 Cf. Section 5.1.3.

4.3.2 Resource-efficient and energy-efficient processes, decarbonisation

■ **Objective**

To improve competitiveness as a result of reducing resource and energy consumption in metal industry processes, supporting companies with decarbonisation and thus implementing ecologically oriented manufacturing processes.

Metal production and processing are based on various resource- and energy-intensive processes. The efficient use of material and energy resources promotes environmental protection and drives down costs. The use of renewable energy can also be strengthened and thus the production of climate-damaging CO_2 reduced if production processes are adapted to the temporary availability of electricity or hydrogen from renewable sources. This is why it is so important to develop, test and implement economic concepts that take greater account of the concept of sustainability.

■ **Relevance**

Steel production in particular, not to mention individual processing steps (such as those in foundries and in material conversion), have so far generated considerable amounts of greenhouse gases due to the processes involved. Similarly, purchasers are increasingly demanding proof of resource- and energy-efficient production. This also includes the avoidance of process steps that require and release toxic or environmentally harmful substances (such as those found in surface finishing processes and for corrosion protection, lubricants and release agents for forming and demoulding processes, and “oil-free coils”).

■ **Potential**

The ongoing optimisation of resource and energy consumption must keep pace with the growing demands for sustainability and economic efficiency. In addition to the purely material and energetic approach, lean management methods are also effective for preventing waste. The approaches begin with the temporary shutdown of complex, interlinked production plants at the end of a shift or even between production orders and extend to the adaptation of production times depending on the availability of renewable energies.

But the component design phase also sets the course for energy and resource efficiency in the production process. This requires the capacity for extensive industrial testing – for example, to carry out machining and joining tests, to investigate the energy-efficient production of additively manufactured components, and to carry out finishing tasks. Similarly, the design and planning tools have to be supplemented by the dimensions of sustainable production and use.

A particular challenge comes in the form of converting to processes with low or zero CO_2 emissions. A promising approach in crude steel production can be seen in the use of hydrogen instead of carbon in the form of coking coal to reduce iron ore. This requires a sufficient and economic supply of hydrogen from renewable sources. Conceptual frameworks for the decarbonisation of the economy are now available in the form of the EU Hydrogen Strategy[20] and Germany’s National Hydrogen Strategy. In its own study[21], the State of Brandenburg has analysed the conditions for the production and use of renewable hydrogen and identified incentives for the establishment of a hydrogen industry in view of the existing regional economic structure.

The increased use of steel scrap should not be neglected either. The focus here is on quality (avoidance of impurities such as Cu, Zn, As and radioactive contamination) and securing the supply chain by tapping into several suppliers from different states.

There is further potential for energy savings in heating and cooling processes in production and in the air conditioning for factory and warehouse buildings.

20 The European Commission adopted the EU Hydrogen Strategy on 8 July 2020, https://www.stahl-online.de/index.php/medieninfor-mation/eu-wasserstoffstrategie-verabschiedet-wichtige-weichenstellung-fuer-stahlindustrie-in-europa/, accessed on 31 July 2020.

21 D. Nozharova, W. Diwald: H2 Industry Potential Study for Brandenburg – Study to identify and analyse the opportunities and potentials for hydrogen use and the establishment of a hydrogen industry in the State of Brandenburg, particularly with regard to energy and industrial policy aspects, prepared by the German Hydrogen and Fuel Cell Association, July 2019, on behalf of the Ministry of Economic Affairs and Energy of the State of Brandenburg, https://mwae.brandenburg.de/media/bb1.a.3814.de/Wasserstoff_Industrie_Potenzialstudie_Brandenburg.pdf, accessed on 4 September 2020.

4.3.3 Material efficiency, recycling and reusing

■ **Objective**

To make use of solutions for material efficiency, recycling and reuse

Material costs continue to represent a significant cost factor within the metal industry. Solutions that help to save materials, recycle used materials or production waste, or return them to the material cycle are also highly welcome in the interest of the sustainability approach. Against the background of the circular economy, it is essential to take into account the entire life cycle of products, that is from raw materials to use and conversion to recycling.

■ **Relevance**

Life cycle assessments of certain product and material groups are increasingly being discussed at a European – and consequently also at a national – level, for example for electric vehicles[22] and battery systems[23]. The concept of electric mobility would be unthinkable without a circular economy[24].

■ **Potential**

The starting point is the reduction of all types of waste in operational processes, using lean management methods for example. The circular economy in the steel industry is already quite well developed. Nevertheless, there is still potential for optimisation in the separation and sorting of production waste and residual materials, for the efficient processing and extraction of raw materials, and for reducing environmental pollution.

Particularly in combination with material technologies, a corresponding construction methodology and design, and (partly additive) production technologies that save on materials, it is possible to adopt an integrated approach to create new solutions. To this end, the specialist disciplines must be networked more closely with one another and aligned with the innovation needs of the companies.

Furthermore, the companies have to be supported with introducing an environmental management system. These issues call for further regulation at a political and European level, but they create a level playing field for companies. As long as simple disposal is systemically possible and cheaper than voluntary recycling or contributions to the circular economy, companies that operate sustainably will be at a disadvantage when it comes to cost. Changes in production processes in favour of the circular economy are often linked to investments, and support services are helpful for companies in this respect. Generally speaking, this objective is to be thematically analysed by all players in the cluster so that they can respond quickly to corresponding market demands and political requirements with new innovations.

4.3.4 Quality assurance and management, efficiency using modern components and process inspection methods

■ **Objective**

To pursue quality assurance and quality management objectives to ensure competitiveness.

Products, processes and services are subject to defined quality requirements. This calls for quality assurance measures as well as consistent quality management to ensure standards are continuously met. Companies in Brandenburg can be effectively supported with information, further training and opportunities for exchange, and corresponding proposals will be made by different players within the cluster.

■ **Relevance**

When it comes to value creation, ensuring and managing quality are indispensable. Strategies, technologies and processes that contribute to quality assurance serve to consolidate a company's competitive edge, which is why the topic of quality assurance is more than just a passing fad. A more recent field looks at quality management in the design and planning process – particularly with regard to the

22 EEA Report: Electric vehicles from life cycle and circular economy perspectives, TERM 2018: Transport and Environment Reporting Mechanism (TERM) report, European Environment Agency, 2018.

23 RECHARGE – The Advanced Rechargeable & Lithium Batteries Association: PEFCR – Product Environmental Footprint Category Rules for High Specific Energy Rechargeable Batteries for Mobile Applications, December 2020.

24 K. Nicke, G. Holst, T. Gleiter, L. Reichelt, W. Zittel: Batterierecycling als Beschäftigungsperspektive für die Lausitz – Ansätze einer arbeits- und beschäftigungsorientierten Regionalentwicklungsstrategie, ein Projekt der Stiftung Neue Länder in der Otto Brenner Stiftung [Battery recycling as an employment perspective for Lusatia – Approaches to a work- and employment-oriented regional development strategy, a project of the New Länder Foundation in the Otto Brenner Foundation], Frankfurt am Main 2019.

cooperation of several development and planning partners. The current EN ISO 9001 standard was revised in 2015, with new focal points including the systematisation of risk management and increased process orientation, relating in particular to its documentation and optimisation. A clear commitment on the part of the company management to ensure consistent quality management is also called for, and for the first time, this also includes requirements for knowledge management, since knowledge is increasingly becoming a decisive competitive factor for companies.

■ **Potential**

The potential for quality improvements is as inexhaustible as the further development and differentiation of products and services in an international competition. Quality assurance and quality management are particularly demanding when products and services are produced or provided in small quantities in combination with a high level of diversity. The properties required by the customer in each case are to be broken down into concrete measurable quality properties and followed up later in the process. Here, the digital networking of the sensor information and clear assignment to the individual products offer further-reaching productivity advantages with regard to quality assurance. In production, non-destructive inline process testing tends to be the preferred method in conjunction with component and functional testing. Advances in optical and acoustic testing methods enable economic solution modules for quality assurance in view of advanced evaluation methods. This is because testing costs are included in the manufacturing costs in the same way as error avoidance costs. In this case, it is important to strive for a comprehensive optimum of the expenditures for quality assurance measures as well as the costs of errors and their consequences.

4.3.5 Continuous process chains in automated production, procurement, logistics and in supply chain management

■ **Objective**

To implement continuous digital information flows in order to improve efficiency and flexibility in automated manufacturing.

Comprehensive information chains to support automated processes in companies are created through consistent, seamless digitalisation and bridging of existing physical and IT interfaces. On the one hand, this applies to manufacturing processes from raw materials to finished products and to performance processes for the generation of services. On the other hand, development processes from the initial conception to the start of production can also benefit greatly from the continuity of the information chain. Supply chain management tools create transparency across companies and can dampen unwanted fluctuations and peak loads in the supply chains.

■ **Relevance**

The IT-related consistency of digital tools in companies is still very much in its infancy. Approaches to solutions are usually based on large companies in the automotive manufacturing industry (automotive and aircraft construction) as marketers[25] or system providers. Following the thus far continuing trend towards an increase in the number of variants, both production and development processes are becoming more complex and significant. The new developments currently pending in the course of the transformation towards the production and use of renewable energies and the search for sustainable mobility solutions indicate a huge need for development, which can only be met by an efficient division of labour and optimally designed processes.

■ **Potential**

Even though the phase of increased attention in the years 2015 to 2018 has passed in the context of the term “Industry 4.0”, it can still be assumed that there is still a great potential for optimisation across the entire range of companies in the metal, electrical and mechanical engineering sectors. The process chain from the customer’s order through to delivery is rarely closed and automated. Islands of action and system breakdowns exist both in the automation of order processes and in production – often also in connection with quality assurance and logistics. The transition from development to production is still characterised by breakdowns, although digital models and simulation-supported tests can save the costs of real test series for workpieces, tools or processes. Additive manufacturing allows individual prototypes or pilot components to be produced with the required level of strength and functional properties, yet the challenge remains to make the solutions currently offered by digital planning and control systems available to SMEs. This is because extensive information and qualification measures are required in addition to the necessary level of investment.

25 The term “original equipment manufacturer (OEM)” is also commonly used in the automotive industry.

4.3.6 Digitally supported sales processes

■ **Objective**

To raise awareness among Brandenburg's companies with regard to changes in distribution structures, re-orientation support through information exchange, the conversion to digitalised processes and distribution platforms, as well as the establishment of joint initiatives.

Digital sales platforms in the trade and service sector have developed rapidly over the past ten years, and we have seen them find their way into everyday use in various business-to-consumer markets. In view of international competition, e-commerce distribution platforms[26] and online marketplaces for B2B business are also currently developing. That said, the disruptive nature of these developments means it is unlikely that individual market participants will be able to adjust to this development in their own market environment if they pick up on it too late.

In this respect, developments in the e-commerce sector will have to be carefully monitored over the next few years, with a real need for information and support services to be developed and offered at an early stage – especially for SMEs.

■ **Relevance**

While production-related functions such as procurement, logistics and supply chain management are already subject to digitalisation, considerable innovations and changes in distribution processes are also expected – probably in connection with digitalised distribution platforms.

■ **Potential**

In technological terms, modern customer relationship management (CRM) systems with advanced algorithms and suggestion lists offer productivity advantages in sales and can open up new sales potential. Here, too, the aim is to achieve higher productivity, transparency and agility by establishing integrated processes. Hybrid service bundles also offer further value-added potential, such as the ability to derive relevant services and service offerings from the sale of products.

Encounters with digital distribution platforms represent a completely new challenge for individual companies, as they have to identify the emerging developments and numerous proposals in their own market environment in the first instance before alternative solutions appropriate to the scope can be developed.

In principle, there is some potential in the joint approach, although distribution plays a centrally competitive role within a company. A balance is needed here between a collective grasp of emerging phenomena and individual action. The players within the cluster, particularly the networks, associations and chambers, are predestined to include or else strengthen – these developments within their repertoire.

4.3.7 Information security

■ **Objective**

To support companies, particularly SMEs, against threats to IT security.

As the use of digitalised processes continues to rise, measures to ensure information security are required to follow suit. The protective goals of confidentiality, availability and integrity are to be ensured by means of technical and non-technical measures. For this purpose, the German Federal Office for Information Security (BSI) recommends a procedure for identifying and implementing security measures as part of the company's own information technology. This involves the installation of an information security management system (ISMS). For SMEs, identifying threats and initiating countermeasures is a challenge in terms of being able to cover the breadth of potential issues and being sufficiently technically effective.

■ **Relevance**

While the operational security division was once responsible for issues of security, integrity and the prevention of unauthorised access to the factory premises, the shift of communication and value creation to the use of digital media and channels has opened up new threats and points of attack. In addition to technical issues, non-technical aspects such as behavioural hazards (including the use of unsecured data sources and channels, the operational use of

26 The e-commerce agency Netz98 has developed a modular IT solution kit for digital sales platforms. Simone Käfer: Vertriebsplattform für die Industrie – B2B Commerce Edition [Sales platform for the industry – B2B Commerce Edition], source: https://www.maschinenmarkt.vogel.de/vertriebsplattform-fuer-die-industrie-a-549249/, accessed on 2 September 2020.

private end devices without secure defence mechanisms, and the handling of confidential information and passwords) also require increased attention[27].

■ **Potential**

The first sources of information are the conferences and events of the networks[28] and chambers. The regular IT security days of the Brandenburg and Berlin Chambers of Trade and Industry and Commerce in cooperation with the Cybercrime Central Contact Points of the Brandenburg and Berlin police forces are a good example. In Brandenburg, the competence centres for digitalisation[29] offer relevant information and further training.

4.4 New scientific basis and technologies

These thematic areas are primarily aimed at scientific institutions, especially universities, technical colleges and non-university research institutions, but not forgetting the developing companies, networks, associations and chambers that support the coordination between the supply and demand of scientific and technological knowledge.

4.4.1 Creating and using insights from material technologies, new materials, component concepts

■ **Objective**

To align research, development and innovation activities in the fields of material technologies with future market and application requirements and offer targeted support.

In addition to the development of new materials or combinations of materials, a clear focus should be placed on the research and further development of known materials for new applications, and product solutions with improved properties for established applications or to improve sustainability in production and usage.

Material developments can rarely be considered in isolation on account of the close interdependence with structural design and the complex interactions in the manufacturing process. In view of the diversity of possible solutions, it is important to achieve a controlled – and in some cases early – involvement of the companies concerned in research and development activities in the sense of a comprehensive innovation approach.

■ **Relevance**

The application of new material technologies and their further development form a central basis for technical innovations in the metal industry, electrical engineering and mechanical engineering. Individual materials and composites[30] are considered, which facilitate new component concepts and functions and/or improve the manufacturability of the components. The complexity of the technologies in Brandenburg's companies requires a broad, demand-oriented technological skill set on the part of the science and university locations, but also on the part of the companies themselves.

■ **Potential**

The potential of material technologies is diverse and holds a whole host of future possibilities for the region. New fields of application notably exist in the development of renewable energies and sustainable mobility, which include solutions made of high-strength, high-temperature or wear-resistant and low-corrosion materials.

The technical focus starts with ferrous metals and extends to non-ferrous metals – for example, in lightweight construction, for particularly high conductivity (Cu alloys) or high-temperature resistance in combination with lightweight construction (Ti aluminides). But there is also still

27 Prof. M. Scholl: Stärkefaktor Mensch: Digitalisierung nicht ohne Informationssicherheit.

28 The Association of the Software, Information and Communications Industry in Berlin and Brandenburg (known as SIBB e.V.) offers information and events as well as a special expert forum on IT security topics, source: https://www.sibb.de/forum-informationssicherheit, accessed on 2 September 2020.

29 For example, the Digitalwerk Centre for Digitalisation in Craft Trades and SMEs, the Leibniz Institute for Innovative Microelectronics, the Cottbus Medium-sized 4.0 Competence Centre, the IT Security Competence Centre at the HPI in Frankfurt (Oder) and the Department of Business and Administrative Informatics/Digital Media at Wildau Technical University of Applied Sciences.

30 Material made of two or more bonded materials which, when combined, have different material properties than their individual components. Examples of particle, fibre and layered composites of metal, ceramic or polymer components include high-strength metal-plastic sandwich structures and wear-resistant metal-ceramic coatings.

innovation potential to be realised when it comes to developing new steel materials – for example, to resolve the conflict of objectives between high strength[31] and the required ductility. A further field of activity is represented by structured materials and hybrid material composites (metal-ceramics, metal-plastic, metal-wood) and gradient materials that are able to fulfil multiple component requirements perfectly on account of their specified properties. At the Panta Rhei Research Centre for Lightweight Construction Materials at the Brandenburg University of Technology Cottbus-Senftenberg, for example, new materials are being researched, developed and applied in an interdisciplinary manner by the participating chairs of metallurgy and materials engineering, design and production, joining and welding technology, polymer-based lightweight construction and applied physics/sensor technology II in cooperation with companies in the region. The existing expertise and laboratory equipment is also available to Brandenburg's businesses through the Wildau Technical University of Applied Sciences.

From an ecological point of view, it is largely possible to substitute environmentally harmful substances used in applications such as corrosion protection (phosphating). To this end, it is necessary to develop and introduce alternative processes with more environmentally friendly materials.

A further field of material technology is opening up due to the rapid development of additive manufacturing. Innovative component geometries with configurable material properties are opening up completely new applications, particularly in the energy industry, automotive engineering, medical technology and bioeconomy. These are inducing a wide-scale demand for the research and development of material technologies.

4.4.2 Mastering and continuing to develop manufacturing technologies

■ **Objective**

To promote scientific technology and process development for Brandenburg companies in a bid to improve economic efficiency and prepare for new applications.

Different manufacturing processes take place along the value chain from raw material and semi-finished products through to components and end products. The next step is to develop these further. The Cluster Metal Industry is characterised by its wide range of manufacturing processes, which include forming and casting technology, forming technology, cutting technology (especially machining), joining technology and coating technology, as well as processes for changing material properties such as heat treatment. Key focal points with numerous key players in the cluster are joining technology, primary forming technology and surface technology. Additive manufacturing processes[32], particularly those for metallic components, have developed considerably in recent years and are currently attracting great interest. The disciplines of production engineering and materials science are closely interlinked. The diversity of the processes means that the research and development objectives of the scientific players and participating companies have to be oriented towards new and existing applications relating to Brandenburg's value-added segments.

■ **Relevance**

Choosing a suitable manufacturing process is fundamental to the success and economic efficiency of a product. Prerequisites in this regard include an understanding of the suitability of several possible processes as well as the greatest possible mastery of the respective process in use. This is all based on technological knowledge that is developed and shared at scientific institutions.

In Brandenburg, this takes place across several university locations, all focusing on the needs of regional industrial companies.

31 Steel grades with yield strengths between 1,300 MPa and 2,000 MPa are currently being targeted for structural applications, with a theoretical upper limit of 7,000 MPa.

32 The term "additive manufacturing" (ASTM standard F2792) is used for processes in which a component is built up automatically from digital 3D data by adding volume elements or layers directly onto each other or onto an existing workpiece. The term "generative manufacturing" was used in the past; however, "additive manufacturing" has now become more widely accepted (VDI guideline 3405). See Martin Kumke: Methodisches Konstruieren von additiv gefertigten Bauteilen – Grundlagen der additiven Fertigung [Methodical Design of Additively Manufactured Components – Fundamentals of Additive Manufacturing], Wiesbaden 2018.

■ **Potential**

In conjunction with materials technologies, new and further developed production technologies are opening up a wide range of new applications in almost all areas of industrial value creation. These include energy production, mechanical engineering, automotive manufacturing, aerospace technology, water management, recycling management, medical technology, the food industry and the bioeconomy. By forming the basis of economic production processes, these technologies also serve value creation.

Additive manufacturing processes in particular are booming, as these enable the energy- and resource-efficient production of metallic components. They also open up a whole new world of design freedom, including delicate component structures and defined cavities as well as the selective use of required material properties through gradient materials.

It is important to bear in mind that additive manufacturing is still in its infancy. In the medium term, the technology should also be available in a controllable form for conventional industrial production uses. For additive manufacturing to really take hold in series production, it has to be developed further still in terms of cost and time efficiency, although it does offer savings on component storage costs in the medium term.

First of all, the additive design principle calls for new thinking when it comes to component design and production planning. For example, further lightweight construction potential is facilitated by the application of bionic design principles and topology optimisation. Additive processes enable function-integrating hybrid (e.g. metal/fibre-reinforced plastics) lightweight construction systems by combining metal 3D printing with fibre-reinforced plastic structures that are suitable for load paths.

Special challenges arise when machining copper components, which are used in applications such as energy engineering. Lower absorption rates mean the beam sources require more power during the melting process, and new approaches are still in development – for example, using diode lasers (optimised wavelength windows) or coatings for better light injection.

Closely related to additive manufacturing processes, the demand for controllable photonic processes is generally on the rise. In addition to the further development of laser beam sources and optics, arc and plasma processes also promise higher component assembly rates. Closely linked to the beam source is the development of real-time capable process monitoring and control systems that feature a high degree of robustness against disruptive influences in production environments.

Another special future field is opened up by ultrashort pulse lasers (pico- and femtosecond lasers) for ablation and cutting, drilling, structuring and polishing temperature-sensitive materials.

In addition to the additive processes, the established manufacturing processes are also justified and offer potential for further development with the aim of improving economic use. This is all still based on a comprehensive understanding of classic industrial applications with the aim of ensuring robust and competitive production of high-quality products.

4.4.3 Development and strengthening the application of digital technologies for the needs in the Cluster

■ **Objective**

To strengthen the scientific basis in research, development and communication of digital technologies for use by companies in Brandenburg.

In addition to manufacturing and materials technology skills, the importance of digital technologies for the companies in the Cluster has increased significantly. This trend is expected to continue in the future, with digital solutions and tools set to play a central role in almost all business processes (see Section 4.3). To do this, companies need access to technologies and solutions, not to mention fundamental subject-specific expertise. Examples of relevant fields of knowledge include sensor data processing, the Internet of Things, self-learning algorithms (machine learning) and application scenarios of artificial intelligence – for example, for use in the evaluation of large amounts of data or in the design of assistance systems. Other topics of central importance for companies, ranging from change and knowledge management to the application of sociological findings, can be seen at the “people – technology – organisation” interface. It is therefore important to strengthen the scientific basis at universities, technical colleges and non-university research institutions across the state with regard to the digitalisation needs of the economy.

Relevance

Nearly all universities and technical colleges in the State of Brandenburg are researching and working on current digitalisation issues and sharing their findings with companies in the form of scientific papers, practical projects and contemporary continuing training formats[33]. Furthermore, non-university research institutions such as the Hasso Plattner Institute (HPI) are developing future solutions for business applications based on machine learning and artificial intelligence, while the Leibniz Institute for Innovative Microelectronics (IHP) is developing and testing solutions for IT security.

Potential

In 2017, the State of Brandenburg identified the need for a digitalisation strategy geared to the economy and decided to take action[34]. This forms part of the state's digitalisation strategy known as "Digitales Brandenburg". To this end, priorities and support formats for Brandenburg-based businesses, especially SMEs, have been designed to meet the needs of the region. In this context, the innovation and competence centres throughout the state – such as the Innovation Centre for Modern Industry (IMI Brandenburg), the SME 4.0 competence centre Cottbus, and the Digitalwerk Centre for Digitalisation in Craft Trades and SMEs – also support companies in carrying out their digitalisation activities or else provide help with building up their own IT security capabilities through the IT Security Competence Centre. The unique programme known as "Brandenburger Innovationsgutschein – BIG digital" offers effective support to small and medium-sized companies with their planning, investments and further training for employees.

The technical basis for this is provided by the departments of computer science, business information technology, automation technology, innovation management and social sciences across Brandenburg's universities. These are to be strengthened in terms of their needs-based technical specialisations as well as their networking and quantitative effectiveness.

Through the "Strengthening technological and application-oriented research at scientific institutions" (StaF directive)[35] programme, the Ministry of Science, Research and Culture (MWFK) of the State of Brandenburg supports technological and application-oriented research at scientific institutions. Its objectives are to increase research intensity in the scientific institutions and develop a sense of synergy effects through cooperative collaboration. The focus will increasingly be on cluster-spanning and collaborative projects in a bid to open up more interdisciplinary fields of knowledge going forward.

33 The HPI offers open online courses on topical issues such as "Artificial Intelligence and Machine Learning for Beginners", "Cybersecurity Basics" and "Design Thinking 4.0" free of charge: https://open.hpi.de/?locale=de, accessed on 28 July 2020.

34 https://mwae.brandenburg.de/media/bb1.a.3814.de/Digitalisierung_Wirtschaft_Brandenburg_Kurzfassung.pdf, accessed on 28 July 2020.

35 Information for the state's scientific institutions can be found on the portal of the Brandenburg Investment Bank: https://www.ilb.de/de/infrastruktur/zuschuesse/staerkung-der-technologischen-und-anwendungsnahen-forschung-an-wissenschaftseinrichtun-gen-staf-rl/, accessed on 12 October 2020.

5 Field of action Brandenburg Metal Industry Cooperation Network

5 Field of action Brandenburg Metal Industry Cooperation Network

Cooperation goes hand in hand with innovation and represents a crucial factor for economic success. The current and upcoming challenges can hardly be met by one player alone: new competent partners and impulse generators are needed to get to grips with the current market changes and the tasks associated with digitalising central business processes. The transparency of relevant and competent partners – as well as the way they organise the exchange of experience and knowledge among each other – are tasks that the Cluster players have successfully accomplished together and will continue to develop in the future. The aim of this field of action is to support exchanges between players in the Cluster as well as networking across clusters and regions in order to strengthen cooperation. This will help to complete and extend the region's value and supply chains at national level while also improving competitiveness at company level.

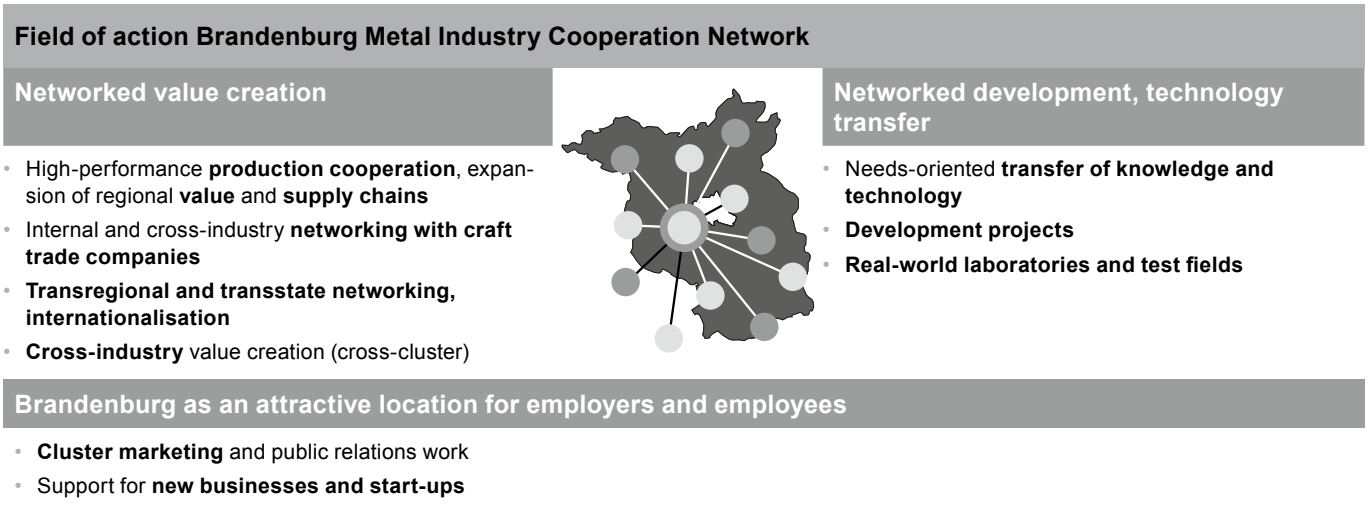


Figure 9: Key parameters and subject areas in the field of action Brandenburg Metal Industry Cooperation Network

5.1 Networked value creation

Value creation in the industrial and manufacturing sectors is generally the result of the interaction between several parties involved in the value creation process. The targeted regional development of value-added chains, which also include handicrafts and industry-related services, is proving particularly advantageous for Brandenburg as an industrial location[36]. Companies that have supplier and customer relationships can benefit from both geographical proximity and networking opportunities. The effects of the restrictions resulting from the coronavirus pandemic in particular demonstrate the importance of robust and regionally anchored value and supply chains; however, these are not limited to the State of Brandenburg, but have a cross-regional, cross-state and cross-industry impact. The companies in the Cluster Metal Industry often provide services to end customers in cooperation with partners outside the Cluster, such as companies in the energy industry, the automotive sector, and the health and food industry.

5.1.1 High-performance production cooperation, expansion of regional value and supply chains

■ **Objective**

To initiate and strengthen new and existing production cooperation and support regional networks and initiatives.

Production cooperation supports the shared cross-competence creation of products and services. Material suppliers and participants in various stages of the value chain up to

36 Ministry of Economic Affairs and Energy of the State of Brandenburg: Brandenburg Industrial Policy Guidelines, May 2019.

the final product (including logistics and product-related services) all act together as value-added partners to enable services to be provided to the end customer. Changing markets also have an impact on supply chain requirements, as these require agility and flexibility from the parties involved, while at the same time ensuring economic efficiency and performance. Knowledge of available skill sets within the region and the promotion of value-added networking in the Cluster also have a role to play in this regard.

■ **Relevance**

The automotive and mechanical engineering sectors are highly networked, but these networks are generally not of a local/regional nature. These networks develop gradually, as value-added partnerships are based on trust and cooperation in practice.

A living example of regional networking is the “Metall Finsterwalde” network, which boasts around 20 companies in the metal and electrical engineering sector, training and continuing training companies, and local businesses with the support of the Cottbus Chamber of Commerce and Industry (IHK). This is where those responsible in the participating industrial companies meet regularly to exchange best practice and initiate cooperation. The strong idealistic connection with this location has been brought to life in the form of a specially designed monument[37].

Exceptional situations such as those resulting from the restrictions imposed by the coronavirus pandemic show that regional value chains and partners are gaining in importance again. Trust and security of supply are considered to be just as important decision-making factors as purely economic ones.

■ **Potential**

The networking of value creation opportunities within the metal industry and the automotive and mechanical engineering sectors has not yet reached its full potential. Here, the supporting technologies provided (such as surface and finishing technologies, upstream and downstream production processes, and handling and logistics operations) can take the form of regional service packages that also set them apart when it comes to engaging in international business.

The promise of a solution in the form of additive manufacturing technologies to materialise individual components from a data set has the potential to create new value-added networks.

Value-added cooperation can also be implemented in such a way that several users jointly procure and operate complex production machines and systems. This can lead to a higher degree of capacity utilisation and thus reduce operating costs for those involved. Coordinated by the Cluster Management, the players in the Cluster can support the initiation of cooperation or its design through platforms and networks.

5.1.2 Internal and cross-industry networking with craft trade companies

■ **Objective**

To further develop networking opportunities with craft trade companies both within the sector and beyond.

The craft trades are also involved in the further development of existing value creation opportunities and the formation of new ones. Modernisation and new investments require individual, tailor-made solutions in which the quality of execution is usually crucial to the success of the industrial company placing the order.

■ **Relevance**

Typical customers for the skilled trades include the public sector and private households, as well as industrial companies. In Brandenburg, trade businesses employ an average of between five and 20 people. Trade businesses face new challenges that make it necessary for them to adapt their practices, especially in the area of digitalisation. As a rule, a large proportion of their employees are involved in providing services on site at the customer's location. This leaves few resources available for the conversion to digitalised business processes.

■ **Potential**

The state offers real potential for craft trade businesses with regard to the transformation process towards renewable energies and sustainable mobility. Larger investments and company settlements help to create an environment

37 Network Metal Finsterwalde and IHK Cottbus: Die Stählerne Blume [The Steel Flower], illustrated book on the landmark in Finsterwalde/Massen, 2018.

with plenty of opportunities to secure work. This is where craft trade companies can be supported with their external image in a bid to establish long-term business relationships.

Additive manufacturing processes are an equally interesting field of technology for the craft trade: they make it possible to produce unique pieces, which fits in well with the range of services offered by the trade. Craft trade businesses are supported by the chambers of crafts within the state as well as by the Cluster Management and other support services offered by the state's economic development agency.

5.1.3 Transregional and transstate networking, internationalisation

■ **Objective**

To offer systematic support for networking across regions and states.

Companies can strengthen their market position and achieve additional value creation through transstate networking and internationalisation. To be able to ensure and increase the innovative capacity of metal companies in the region, broader players from science and economic development must also play their part.

■ **Relevance**

As a general rule, the level of added value cannot be covered by companies from Brandenburg alone; regional, transstate value-added cooperations have developed over time – especially in the peripheral districts and in the immediate vicinity of Berlin.

■ **Potential**

Supporting transstate networking (for example, with Saxon or Polish business partners) often presents a challenge in terms of conveyor technology. One approach to making support services possible on a transstate basis could be to offer joint support programmes at state level. An example is the coordination of the States of Brandenburg and Saxony with regard to Lusatia, involving a uniform procedure for applications and common contacts throughout the entire project phase.

To establish a meaningful and targeted expansion of business beyond national borders, it is first necessary to understand the strengths of the region's companies in terms of a value-added system. This results in a picture that also reveals gaps that cannot be closed with regional partners, making it possible to take a targeted approach to searching for international partners. Suitable partners in this regard include cluster organisations in other states as well as business development agencies and regional representatives (innovation agencies, regional governments or ministries). The state's economic development agency and the chambers of commerce already provide information and initiation opportunities for companies seeking international contacts.

5.1.4 Cross-industry real net output creation (cross-cluster)

■ **Objective**

To systematically exploit the potential of cluster and cross-sector networking.

The companies in the Cluster Metal Industry often provide market services together with representatives of other industries. If innovative services are to be implemented economically, it is essential to establish a closer exchange with both new and existing solution providers from other clusters and industries on a targeted basis.

■ **Relevance**

In the innoBB 2025 plus Brandenburg innovation strategy, the "Strengthening cross-clusters" objective has been named as one of four priority topics. In the context of digitalisation, companies and scientists in the Cluster ICT, Media and Creative Industries are regarded as important enablers.

■ **Potential**

The symbioses with other sectors, such as the energy industry and the health and nutrition industry, are as varied as their applications, and the combinatorics of services is characterised by an increasing level of diversity.

The Cluster Management of the state's economic development agency and the chambers of commerce play a central role in this regard. In terms of the design of the innovation strategy, a particular perception of clusters has developed with regard to their high cross-cluster potential. A number of cross-cluster support activities have been developed,

including networking events and trade fair presentations with participants from several clusters[38]. The format of an open, interactive cross-cluster camp has been very well received by the Brandenburg and Berlin community and is set to be developed further. This concept was initiated by the Cluster Metal Industry and will be carried out for the first time in 2018 together with the Cluster ICT, Media and Creative Industries.

5.2 Networked development, technology transfer

Innovations are more likely to succeed if the protagonists pursue the same goal while still being different and complementary in their characteristics. This could include practitioners with strong implementation skills in combination with systematic concept developers, or representatives of an application industry in connection with specialists in enabler technologies (such as those with special skills in data analysis, modelling and simulation). Cooperations are particularly appealing to SMEs in the Cluster Metal Industry, as they only have limited capacity of their own for innovation projects. The challenge is finding the "right" cooperation partner. As a general rule, the players in the cluster (particularly the chambers, associations, networks, university transfer offices and the Cluster Management itself) offer themselves as neutral mediators in the search for suitable partners. Over the course of an innovation project, from generating ideas to bringing them to life and testing them in realistic scenarios, a variety of skills and facilities are required from the laboratory to the test field.

5.2.1 Needs-oriented transfer of knowledge and technology

■ **Objective**

To further develop demand-oriented knowledge and technology transfer between the players in the Cluster Metal Industry and related sectors.

Knowledge and technologies only unfold their full potential when they are converted into added value. This begs the central design question of how to improve the networking of players between science and business further still. Essentially, a bridge needs to be built between the supply and delivery of technologies and the demand from companies. Information ideally needs to be exchanged in both directions for both parties to benefit in the long term, and it is also essential to identify and include both cross-sectoral and interdisciplinary knowledge.

■ **Relevance**

The need for a structured transfer of knowledge and technology was addressed early on by establishing support structures, which is why the state has a large number of relevant offers available for companies. A number of competence and transfer institutions have been developed and established since the Cluster Metal Industry was founded[39].

A particular challenge, however, comes in the form of the spatial distribution of the companies across the Brandenburg region. The transfer offices at the universities, for example, have developed innovative proposals to bridge the "last mile to business" in close cooperation with the chambers of commerce and local business associations and networks, among others. In the Regional Growth Areas (RGAs) without a university location, the important tasks of knowledge and technology transfer are taken over by the local university offices[40]. These act as regional start-up, contact and coordination points for prospective students and local companies alike. They also provide access to the scientific community and act as contacts for recruiting university graduates as specialists for regional companies.

■ **Potential**

The potential for development cooperation between companies and science is still considered very high, and there are a number of successful examples. The framework for the transfer of knowledge and technology is provided by the

38 Examples include events on the application potential of AR/VR technologies organised by the Cluster Metal Industry and the Cluster ICT, Media and Creative Industries 2018. In 2019, a joint "lightweight construction" trade stand was established at the Hanover Trade Fair by the Cluster Management of Transport, Mobility and Logistics/Plastics and Chemistry/Metal Industry with contributions from the various companies.

39 Innovation Centre for Modern Industry (IMI Brandenburg), Cottbus; the SME 4.0 competence centre Cottbus; the Digitalwerk Centre for Digitalisation in Craft Trades and SMEs, Werder; the "Innovation Hub 13" project, Cottbus – Wildau – Eberswalde; and the IT Security Competence Centre.

40 At present, Brandenburg's universities are represented in the RGAs Spremberg, Prignitz (with sites in Wittenberge, Pritzwalk and Neuruppin), Schwedt/Oder, Luckenwalde, Finsterwalde, OHV (with site in Velten) and Westlausitz (with site in Fürstenwalde), as of 17 September 2020.

transfer strategy that was adopted by the state in 2017. This involved launching a process that optimises the structures for transfer, improves transparency, communication and cooperation between the various players, and sharpens the funding landscape as needed. It also includes expanding the number of local offices, strengthening the start-ups in the vicinity of the scientific institutions, and taking increased measures to secure skilled employees and transfer personnel from university graduates to companies across the region.

Innovations are conceived and implemented by people. With this in mind, communication and bringing the people involved together are crucial. There is still potential here to tap into further companies for a targeted transfer of knowledge and technology, and it is important to make best practices more widely known within the economy. This is why, in addition to the approach involving the local offices, mobile transfer opportunities are currently being implemented by the universities in order to establish an exchange with companies throughout the state. The fundamental basis of interaction between the players is trust, hence chambers, networks and the Cluster Management are increasingly being asked to act as pilots and neutral mediators. Further potential could also be tapped by strengthening the position of university professors in their transfer work. Just like the research professorship model, a "transfer professorship" can institutionalise what is a mostly voluntary commitment. This would create the necessary freedom and make it possible to offer consulting, development and research services for companies at short notice without having to submit research and funding applications specifically for this purpose.

The "Innovation Hub 13" project[41] is currently developing and operating innovative approaches to transfer, and transfer scouts are crucial contributors in this context. As professionally experienced scientists or self-employed entrepreneurs, they understand the languages of both worlds and, as individuals, they can establish the link between science and practice.

Generally speaking, it is considered important to retain and fund staff for networking, consulting and development at universities and networking points on a long-term basis. This is in a bid to reinforce the intensive cooperation that is built on trust. Greater involvement of non-university institutions should also be encouraged.

5.2.2 Development projects

■ Objective

To promote the sustainable initiation and support of development cooperation.

Development cooperation facilitates the joint creation of ideas and innovations in the form of products, processes or services incorporating various skill sets. The process of organising the necessary networking elements between different companies or enterprises and research institutions is costly, time-consuming and in need of improvement. All Cluster players are involved in the initiation of cooperation and their design, with intermediaries and the Cluster Management in particular playing an important role.

■ Relevance

Cooperation makes it possible to come up with ideas and put them into practice. In doing so, it contributes to strengthening not only the economic power but also the research and development intensity of companies in Brandenburg. That said, the necessary resources or competences are not always available, which is why it is important to support the creation and implementation of cooperative collaboration between companies and between companies and research institutions in the region.

■ Potential

Many players consider the potential for development cooperation to be very high[42]. Successful long-term cooperation in particular requires the partners to be a good fit for each other in order to fully exploit the available potential. Interesting starting conditions for innovation can come from cooperation between representatives of traditional, established industries that already have credible access to the financial

41 A project by Brandenburg University of Technology Cottbus-Senftenberg together with Wildau Technical University of Applied Sciences and the research department for polymer materials and composite (PYCO) of the Fraunhofer IAP to support innovations in specific fields of application: digital integration, lightweight construction and life sciences as part of the "Innovative Hochschule" federal states initiative, source: https://innohub13.de/innovation-hub/, accessed on 6 August 2020.

42 Participation forum for updating the Master Plan for the Brandenburg Cluster Metal Industry to record the needs, interests and priorities for the period from 20 April to 15 May 2020.

markets, and innovative start-ups with a strong connection to universities and research. But it takes a lengthier process for good partnerships to develop. Effective support can be provided here with existing funding resources to enable the systematic initiation of contacts and preparation of projects[43].

There are a large number of funding programmes at state, national and European level. The Central Innovation Programme for SMEs (ZIM) of the Federal Ministry for Economic Affairs and Energy (BMWi)[44] is a proven instrument for SMEs. Further potential is seen in joint projects with individual companies or in larger national and international consortia with a larger number of partners for a focal point – for example, in the field of lightweight construction. This – also international – networking is necessary in some areas of technology so as to remain competitive on a global scale and maintain the creation of value in Brandenburg.

With this in mind, further sensitive technology areas with a close connection to production have to be identified jointly in order to strive for thematically focused funding. Large companies have their own research and development departments for this purpose, and SMEs can tap into this potential – for example in cooperation with companies and scientists in the Cluster.

In the area of project application and implementation, processes need to be optimised further in terms of efficiency, but the rise in consistently digitalised application and report formats is simplifying processes for applicants and evaluators alike.

5.2.3 Real-world laboratories and test fields

■ **Objective**

To provide inspiration for real-world laboratories and test fields.

In order to turn new technologies into marketable applications, it is essential to create environments in which tests can be carried out under near-application conditions. Real-life laboratories and test fields create a suitable environment for testing technical and non-technical innovations under realistic conditions at an early stage, and existing regulatory framework conditions can be modified on a local or temporal basis. This generates indications for optimising the existing laws and regulations in favour of feasible, sustainable solutions. Real-world laboratories and test fields are a focal point of the innoBB 2025 plus Brandenburg innovation strategy. Players in the cluster are tasked with providing inspiration for real-world laboratories and test fields and launching prototype applications.

■ **Relevance**

Metal-based solutions often make a substantial contribution to fundamental innovations – for example, in the context of the energy revolution or for modern mobility systems whose sustainability impact has to be evaluated in a broad application context.

■ **Potential**

By focusing on specific regions, the application relevance is highlighted so that the economic, environmental and social effects of innovation can be analysed comprehensively.

Suitable topics for real-world laboratories and test fields can notably be found in the intersections between energy, mobility, industry and society – for example, contributions towards an improved sector coupling in energy production and use, as well as in the establishment of a water industry, and in combination with sustainable mobility solutions.

Real-world laboratories make it possible to establish visible reference cases that help the companies involved to improve their market perception.

5.3 Attractive location for employers and employees

Brandenburg is increasingly scoring points when it comes to sustainability issues and solutions. The key industry players for the development of new and sustainable value-added chains are already represented in Brandenburg, especially with the inclusion of Berlin and the other neighbouring states. The task is to showcase the benefits of Brandenburg as a real hub for those who live there and those who are yet

43 The Federal Ministry for Economic Affairs and Energy (BMWi) supports innovation networks within the framework of the Central Innovation Programme for SMEs (ZIM). Brandenburg already has its own funding instruments in place to support joint applications for EU projects.

44 The Central Innovation Programme for SMEs supports individual R&D projects, R&D cooperation projects and innovation networks. The programme is open to all topics, https://www.zim.de/ZIM/Navigation/DE/Home/home.html, accessed on 6 August 2020.

to be enticed – as committed employees on the one hand, and as entrepreneurs and investors on the other. From the very beginning, the Cluster players have pursued the task of shaping Brandenburg's brand recognition as a modern industrial location with the challenges of a federal state in a bid to put it at the top of its game.

The marketing and public relations measures are backed up here with support services for settlement and investment, as well as with special offers for start-ups and new businesses. The overarching themes of energy system transformation, the implementation of the hydrogen strategy, the development of the bioeconomy and the implementation of mobility transformation from technical brackets that consistently bring together the individual subprojects both as arguments and as cross-sectoral topics. A common image problem of the industry and cluster sectors, including the chemical, photonics and microelectronics industries, which are mainly characterised by STEM occupations, speaks in favour of organising these initiatives across clusters.

5.3.1 Cluster marketing and public relations work

■ **Objective**

To strengthen transregional visibility using marketing and public relations measures in a bid to further develop the image of the metal, electrical and mechanical engineering industries in Brandenburg.

The tasks of cluster marketing and public relations work function in two dimensions. On the one hand, it is essential to improve the transregional visibility of the locations with efficient and innovative companies as well as future-oriented research institutions to showcase Brandenburg as an attractive investment location. On the other hand, the image of the metal, electrical and mechanical engineering industries has to be redeveloped, taking into account the dynamic developments in the markets, in a bid to attract skilled employees and executives to the regions in Brandenburg.

■ **Relevance**

Awareness and a positive image are of considerable relevance for companies and research institutions. A single company or institution cannot manage this overarching task alone; it takes many Cluster players, most notably the chambers of commerce, scientific institutions, local authorities, the state's economic development agency, and the Cluster Management to be able to present a concise overall picture.

■ **Potential**

The image of the metal, electrical and mechanical engineering industries is seen as a fundamental factor in this respect. The new challenges posed by the megatrends of digitalisation and sustainability are creating new and attractive fields of activity and perspectives. These offer new starting points for communication with the target groups, especially young people, in a bid to create a new image. Whereas work in the metal sector used to be associated with terms such as "heavy", "dirty", "dangerous" and "monotonous", the new tasks in the cluster can be described with attributes such as "smart", "clean", "digitally supported" and "customer-oriented".

This can be achieved through holistic and transstate concepts for the integrated energy and mobility revolution, which Brandenburg is developing in conjunction with Berlin (key focal point of mobility: commuter flows, electromobility, sustainable energy and goods supply, digital economy and exchange of skilled employees) and Saxony (structural change, renewable energy production, partly based on a hydrogen economy, industrial production and exchange of skilled employees).

The individual regions of the state can develop their full potential if it is possible to shape the necessary framework conditions for maintaining the industrial foundations. This refers to a balanced and beneficial industrial, energy and environmental policy for the state, as well as the creation of attractive living conditions for its citizens.

5.3.2 Support for new businesses and start-ups

■ **Objective**

To support new businesses and start-ups. Support also has to continue to take into account companies that are in difficulty.

New businesses and start-ups are an important source of innovation and facilitate future value creation[45]. The aim is to continue to increase the number of innovation-based start-ups in the future and support the companies that emerge from them in their development. It is also important to work

45 The innoBB 2025 plus Brandenburg Innovation Strategy, key focal point of "Start-ups and new businesses", p. 8.

on developing the networking opportunities between the newcomers and the established enterprises. With this in mind, existing companies still have to be given appropriate consideration in terms of support and funding when focusing on new businesses and start-ups. The dynamic impact of new companies has to be considered in terms of its effect on Brandenburg's economic system as a whole.

■ **Relevance**

After initially being quite low, the number of companies choosing to start up in Brandenburg has developed very positively in recent years[46]. Spin-offs from universities and non-university research institutions are of particular importance in this context. The economic structure in the Cluster Metal Industry consists mainly of established companies and craft trade businesses. These have the task of facing up to market and process changes by incorporating digital solutions.

■ **Potential**

Start-ups often deal with digital solutions and come up with new solutions for the market without having to consider existing processes and investments. Both the established and the new companies stand to benefit from working together and can form attractive added-value and development cooperative relationships.

Setting up a company in the metal, electrical and mechanical engineering industries is generally associated with higher technical and financial risks than, for example, in the digital start-up scene. This is why it is so important to support research-intensive start-ups in particular, which are often located at university locations or research institutions. Support can include start-up advice, the temporary provision of workshop and laboratory capacities, and help with innovations and investments. But start-ups can also be effectively strengthened by networking and creating public awareness, in the form of award ceremonies, for example.

46 Brandenburg has moved up from 15th among the federal states (between 2014 and 2016) to 8th (between 2015 and 2017), source: KfW Banking Group: KfW Entrepreneurship Monitor 2018, p. 5.

6 Field of action Brandenburg Metal Industry Skilled Employees Matrix

6 Field of action Brandenburg Metal Industry Skilled Employees Matrix

The competitiveness and future viability of companies in the metal, electrical and mechanical engineering industries depend crucially on the availability of skilled employees in the regions. Research institutions are also dependent on highly qualified and highly skilled employees in order to develop the necessary scientific knowledge. Goals and tasks for securing skilled employees have already been anchored in the first Master Plan, and the joint efforts of industry, educational institutions and the social partners are having a positive impact.

In the meantime, new challenges have emerged, notably due to new technologies and work content resulting from the digitalisation of business processes in companies. Furthermore, demographic developments such as the foreseeable retirement of the baby boomers and the move from rural regions to the big cities are leading to regional staffing bottlenecks. The aim is therefore to maintain existing training capacities and support structures in Brandenburg, expand them in a targeted and demand-oriented manner, and adapt them to changing needs.

The following topics are covered by Brandenburg's skilled worker strategy[47] with the three objectives of training, retaining and gaining skilled employees.

Field of action Brandenburg Metal Industry Skilled Employees Matrix

Focus on people and society

- **Attracting skilled employees**
- **Corporate social responsibility** (CSR) towards clients, stakeholders, staff and society

Sustainable staff deployment

- **Design of sustainable working conditions:** "decent work", "new worlds of work"
- **Development of skilled employees, leadership** in modern organisations, involvement of staff in transformation processes

Training for skilled employees and executives

- **Career and study guidance** for technical occupations
- **Dual training**
- **Higher education**
- **Further training** of skilled employees and executives
- **Business succession**
- Development of **up-to-date teaching material**
- **Management skills, soft skills,** foreign languages, **cultural understanding**
- **Establishment of modern forms of learning,** linked with the company's requirements

Figure 10: Key parameters and subject areas in the field of action Brandenburg Metal Industry Skilled Employees Matrix

In general, it can be stated that interest in employment in the manufacturing sector and industry has declined – particularly among younger people. With this in mind, in addition to the initial vocational qualification, the aspects of how companies present themselves to the public also have to be taken into account if they are to be perceived as attractive employers. Another topic to be addressed is how personnel development takes place and how the most important resources – that is, the people in the company – are handled.

47 Ministry of Labour, Social Affairs, Health, Women and Family: Training, retaining and gaining skilled employees for Brandenburg – The State of Brandenburg's strategy for securing skilled employees, July 2018.

6.1 Focus on people and society

The external image of a company is crucial to its success on multiple levels. At market level, it is the perceived value proposition from the perspective of potential customers that influences the demand for products and services. At social commitment level, important stakeholders and the interested public are addressed. Issues of social and societal sustainability are becoming increasingly important. In the current situation regarding skilled employees, which is already characterised by a pronounced and growing competition for employees, the attribute of being an "attractive employer" is an important prerequisite for successful recruitment of skilled employees within the framework of a universal external image.

6.1.1 Attracting skilled employees

■ **Objective**

To support companies in Cluster Metal Industry sectors with recruiting skilled employees.

The impending or existing shortage of skilled employees, particularly in the technical and STEM occupations[48], also presents major challenges for players in the metal, electrical and mechanical engineering sectors. Various strategies and measures for recruiting skilled employees have to be implemented, taking into account the compatibility of family and work, as well as those for recruiting experienced, older employees and foreign skilled employees, and integrating the long-term unemployed. Flexible training and further education models that meet the needs of the market, including part-time studies, can also support the recruitment of skilled employees.

The external image of the company as an employer must be consistent with the other messages, viewed holistically and designed accordingly. Each company is essentially responsible for ensuring this is the case for itself; however, SMEs in particular are at a resource-related disadvantage compared with large companies. Local or professional joint measures can be taken to help create an effective positive image, with associations and business development agencies in a position to provide support here. Highlighting soft location assets such as existing infrastructures, childcare facilities, schools, medical care and leisure activities also has an indirect positive effect on regional attractiveness and thus also on the development of the situation regarding skilled employees.

■ **Relevance**

The bottleneck in the supply of skilled employees is generally regarded as a central challenge that has to be overcome in order to remain competitive and robust for the future. Furthermore, the existing personnel bottlenecks will be exacerbated over the next five to ten years as the baby boomers begin to retire. With this in mind, the demand for skilled employees, which in many cases remains unmet, is likely to remain high.

■ **Potential**

The image of the metal, electrical and mechanical engineering sectors can be positively influenced in a new way by focusing on sustainable solutions. These have to place real emphasis on the individual company's reputation as an "attractive employer". This in turn has to be anchored in the respective corporate objectives and corporate culture and lived on a daily basis. In doing so, it opens up scope to attract and retain both young and experienced employees. Aside from the design of the central decision-making criteria by the company itself, such as adequate remuneration, flexible organisation of work, and the prospect of attractive further development possibilities, these can be accompanied by a general increase in the attractiveness of the region, notably in the form of accessibility, the existing infrastructure and the locally available leisure facilities. In this respect, the state and local authorities are also faced with corresponding challenges. Generally speaking, the chambers and Cluster Management support initiatives that bring companies and interested applicants together.

The State of Brandenburg can also benefit from the potential of taking a targeted approach to returnees. By returnees, we are referring to skilled employees who grew up and were trained in Brandenburg, who have taken professional career steps in other states or abroad, and are now striving

48 STEM occupations are based on the qualifications of science, technology, engineering, and matheematics. A comparatively high proportion of STEM occupations are found in the metal and electrical industry, cf. MINT-Herbstreport 2014: MINT – attraktive Perspektiven und demografische Herausforderung, Gutachten für BDA, BDI, MINT Zukunft schaffen und Gesamtmetall [STEM Spring Report 2013 – Innovative Power, Opportunities for Advancement and Demographic Challenges, expert report for BDA, BDI, "Creating a STEM future" and the Gesamtmetall federation], Cologne, 6 May 2013.

to reconcile family and career in a liveable and affordable environment, perhaps as a result of entering a new phase in their lives. Existing returnee programmes already show encouraging results in this respect.

Companies in Brandenburg have recently also proved attractive to Polish skilled employees. This is evidenced by a general shift away from relocating to Western European countries and West German states in favour of working in Brandenburg, and the possibility of a daily commute home is a positive contributor. With the support of the chambers and the Cluster Management, the companies have already gained solid experience with the measures taken in this context.

6.1.2 Corporate social responsibility (CSR) towards clients, stakeholders, staff and society

■ **Objective**

To help economic players to act in a socially responsible manner and improve their environmental performance.

In addition to environmental and economic aspects, the concept of sustainability also includes issues of corporate social responsibility. Corporate social responsibility (CSR) essentially describes the action taken by companies to operate in a socially responsible manner. It refers to a company's guidelines for dealing with legal and corporate rules in business transactions, environmental issues and towards its employees, and for ensuring compliance with these rules – including by its own suppliers. Compliance with CSR guidelines and the introduction of environmental and energy management systems – as well as the relevant certification – pose a particular challenge for companies, especially those of a small to medium size. That said, evidence of such compliance is often essential if they want to apply as a supplier. Informational and organisational support from the players in the Cluster can reduce the effort involved.

■ **Relevance**

Since 2017, large companies with more than 500 employees have been subject to the CSR Directive Implementation Act[49]. This states that affiliated suppliers who are not originally subject to reporting requirements may be included in the reporting requirements of the purchasing company.

■ **Potential**

The CSR Directive Implementation Act only requires and regulates the reporting obligation with regard to social sustainability aspects. The decisive factor is the public's overall perception. For this reason, the goals and measures of corporate social responsibility must be anchored in the corporate culture and lived out as daily practice. CSR is becoming increasingly important as a central criterion for jobseekers when choosing an employer.

6.2 Sustainable staff deployment

In addition to the recruitment of employees on the basis of a positive external perception, positive working conditions and the way in which the company deals with its employees are crucial to sustainable employee deployment.

6.2.1 Design of sustainable working conditions

■ **Objective**

To support companies with the design and development of sustainable working conditions.

Sustainable working conditions are described with the terms "good work" and "new working worlds". They mediate between the requirements of highly productive – often digitalised – work content, as well as the needs of employees in terms of a sustainable employment relationship. The central issues are remuneration, working hours, occupational health, and health and safety management, equal opportunities, family friendliness and work-life balance, as well as opportunities to get involved and develop. The framework conditions are to be designed in such a way that a high level of job satisfaction is achieved among employees and that the performance and motivation of teams is maintained in the long term. The design of sustainable working conditions must be deeply seated as an essential element of corporate social responsibility.

49 The Bundestag passed the CSR Directive Implementation Act on 9 March 2017. This governs the non-financial disclosure requirements of large companies on environmental, labour and social issues, respect for human rights and the fight against corruption and bribery. Under certain conditions, suppliers – in relation to the entire supply chain – are also included, source: https://www.bundestag.de/dokumente/textarchiv/2017/kw10-de-berichtspflichten-unternehmen-csr-493972, accessed on 28 August 2020.

SMEs with limited scope for human resource (HR) development in particular are dependent on external information and exchange formats. They are also dependent on support services provided by educational institutions, chambers, associations and social partners in order to create appropriate framework conditions that enable teams to perform and be motivated in their work in the long term.

■ **Relevance**

Good working conditions form the basis for sustainable employee deployment in companies of all sizes. Changes in the nature of their work, as well as the further compression and virtualisation of their activities as processes become more digitalised, leave employees having to contend with ever-evolving stress factors. The new working situations resulting from the coronavirus pandemic, which have changed whether people work from home or the office, and the use of digital communication channels have considerably accelerated these developments and will – in some cases – establish themselves as the norm in the long term.

To this end, working time agreements can be made more flexible, release processes simplified, data security rules defined and one-sided burdens on employees avoided. The importance of internal communication has increased exponentially, and so communicative, social concerns must be taken into account as vital components of a productive environment.

■ **Potential**

In addition to achieving stable employment relationships, productivity and the quality of both work processes and results can be increased significantly by establishing good framework conditions that are tailored to employees and their work.

Occupational health and safety tasks, for example, have already been well established across companies. At present, the focus is on achieving a workplace design that also takes into account the requirements of increasingly digitalised activities based on the division of labour. The aim here is to facilitate real concentration in the workplace as well as communication and social exchange. The lack of childcare facilities has proved to be a major stumbling block, especially during the restrictions imposed by the coronavirus pandemic[50]. This situation resulted in significant absences from work, so there is a real need for action here, which can be resolved in cooperation with local businesses and public institutions.

6.2.2 Development of skilled employees, leadership in modern organisations, involvement of staff in transformation processes

■ **Objective**

To support companies with the development of skilled employees and application of contemporary management principles.

Company-initiated HR development measures are ways of meeting the company's own specialist and management needs in the medium to long term. In addition to remuneration, compatible individual working hours, and the ability to participate and collaborate in professional matters, opening up career prospects is becoming an increasingly important factor in terms of public image. The basis for this stems from recognition and appreciation of the employee's skills, as well as commitment and performance as central components of a corporate culture.

In view of the dynamic changes brought about by new technologies and a stronger focus on processes, executives have a new key role to play. Here, manufacturing companies have to be supported with regard to contemporary methods and instruments of skilled personnel development and the application of modern management and participation principles.

■ **Relevance**

The development of skilled employees, the further development of management principles and the involvement of employees in change processes are already important tasks in a company when viewed individually. It is inconceivable to think of the current and upcoming change processes in the markets as well as those to optimise internal processes and cost structures without the involvement of qualified and committed personnel. Companies in the manufacturing sectors in particular see a real need for development in this regard.

50 Article on the IG Metall web portal: "Kitas und Schulen im Notbetrieb" [Nurseries and Schools in Emergency Mode], https://www.igmetall.de/thema/corona-krise-ratgeber-news-und-mehr/ darauf-seltern-jetzt-angewiesen, accessed on 28 August 2020.

■ **Potential**

Company-led measures for HR development contribute to meeting the demand for skilled employees and executives in the medium to long term. Rapport with the company can be strengthened through individual development measures such as training courses, participation in further education measures and even dual-training courses.

The studies on digitalisation projects in recent years have shown that the involvement of employees as idea providers and participants with the skills to innovate solutions is to be regarded as a central success factor. The inclusion of those directly involved in the process in shaping operational conditions and processes deepens the existing expertise and boosts performance and the willingness to become more involved in the company's objectives.

Dynamic progress, for example in the field of digital technologies, is also stimulating new, participatory, agile management cultures, accompanied by flat hierarchies that rely on personal responsibility. Managers are faced with new challenges in order to give their employees a sense of structure and orientation in the increasingly complex working environment[51] and to adapt their own understanding of their role to new requirements.

In the further development of the management culture, aspects of intercultural and diversity management can open up further potential for HR development.

6.3 Training for skilled employees and executives

The initial and continuing training of technical and managerial staff is a cornerstone for the economic development of companies. The individual subject areas along the education chain are listed below and supplemented by central focal points on teaching content and modern forms of learning.

6.3.1 Career and study guidance for technical occupations

■ **Objective**

To strengthen the professional and academic orientation towards STEM professions, especially for the sectors of the Cluster Metal Industry in the general school system, and targeting young women in particular.

Improving the situation regarding skilled employees begins in the general school system before students start deciding on their future careers. This is where the course can be set for a career in the manufacturing industry, and it is also when the STEM subjects[52] that form the basis for technical occupations or higher education start to be differentiated.

Vocational orientation in schools is anchored in the framework curriculum of the general school system[53] in Berlin and Brandenburg, which was newly created in 2017. The handbook for the vocational and academic orientation of the LISUM[54] outlines approaches for the cooperation of schools with companies, upper secondary school centres and universities. This is where the schools depend on the commitment of regional companies with regard to offering practical insights into industrial career prospects in particular.

■ **Relevance**

In view of the increasing demand for skilled employees, vocational and academic orientation is becoming increasingly important for Brandenburg companies in the sectors of the Cluster Metal Industry.

■ **Potential**

There are currently various ways of recruiting potential graduates at schools and informing them about their own

51 The Berlin-Brandenburg business associations are developing and testing modern leadership concepts and methods together with the Bundeswehr in the "Leading" digital forum with junior executives, sources: https://www.uvb-online.de/de/digitalforum-fuehren-0 and https://www.fuehren.digital/, accessed on 28 August 2020.

52 Science, technology, engineering, and mathematics subjects.

53 Framework curriculum for general schools in Berlin and Brandenburg, 2017, focus on vocational and study orientation, https://bildungsserver.berlin-brandenburg.de/rlp-online/b-fachuebergreifende-kompetenzentwicklung/berufs-und-studienorientierung/, accessed on 28 August 2020.

54 Handreichung Berufs- und Studienorientierung mit Unterrichtsbeispielen für die Jahrgangsstufen 7 bis 10 im Land Brandenburg [Handbook for the vocational and academic orientation with teaching examples for grades 7 to 10 in the State of Brandenburg], publisher: State Institute for School and Media Berlin-Brandenburg (LISUM), 2018.

work and training opportunities[55]. These include the provision of internships, participation in practical learning, and even the presentation of one's own company in the careers advice handbook. In addition, companies also have the opportunity to offer places at the annual Future Day for girls and boys alike.

School administrators or vocational and study coordinators are available as direct contacts for companies. The latter coordinate the elaboration, further development and implementation of the career and study guidance concept.

A number of positive examples – initiated by Brandenburg companies in cooperation with universities[56] – prove the feasibility of the approaches and highlight the initial successes of initiatives such as student internships.

6.3.2 Dual training

■ **Objective**

To support companies with the provision of dual-training courses and apprenticeships.

Particularly in the manufacturing and industrial sectors, the provision of dual-training opportunities for skilled employees by companies providing apprenticeship places in partnership with a vocational school is a cornerstone of economic success. Technical apprenticeships of this nature also provide a practical basis for subsequent university studies in engineering or natural sciences. For smaller companies, the provision of an apprenticeship can represent a considerable hurdle[57] if they are not in a position to cover the multitude of necessary tasks and training areas. This is where partners such as educational institutions or other companies can offer support[58] with joint training courses. In the companies providing apprenticeships, the trainers also have to be supported so that they can develop the technical and social skills necessary to ensure the placement is a success. All players in the cluster are required to analyse existing structures and develop new approaches.

Closely linked to the appeal and impact of training are current training contents that are geared to the future and can be imparted in line with existing needs. This is in addition to the need to reorganise occupations requiring training and update training contents by means of providing additional qualifications, for example. Digital expertise[59] and placement types[60] are of increasing importance in this regard, taking into account the relevant interfaces.

■ **Relevance**

Needs-based training is the linchpin of future value creation and research. Even today, considerable shortages can be seen in areas such as welding, automation technology and production planning.

■ **Potential**

The state government intends to offer further support for vocational education and training. Using broad-based image campaigns (such as the current "Brandenburg will Dich! – Hier hat Ausbildung Zukunft." [Brandenburg wants you! Training has a future here.]), it is hoped that young people will become more aware of career development opportunities and access to training. In addition, publicity campaigns are intended to promote the reputation of vocational education and training in society in general in a bid to attract more

55 The range of services offered by the State of Brandenburg is presented on the platform of the Ministry of Education, Youth and Sport (MBJS): https://mbjs.brandenburg.de/bildung/uebergang-schule-beruf/berufs-und-studienorientierung.html, accessed on 18 September 2020. Brandenburg's "Network Future" association (Netzwerk Zukunft. Schule und Wirtschaft für Brandenburg e. V.) shows interested companies the possibilities of becoming actively involved as partners of schools in providing vocational and study guidance to young people, www.netzwerkzukunft.de/fuer-unternehmen/ unser-angebot-fuer-unternehmen, accessed on 18 September 2020.

56 The "Offene Werkstatt" [Open Workshop] is an initiative of the Brandenburg Technical University of Applied Sciences, whereby workshops, workshop equipment and facilities for machining, rapid prototyping (FDM), joining technology, materials testing and production measurement technology are made available for pupils and students, as well as for external projects. Workshops on technical topics (soldering, CAD, 3D printing, textile printing, product development, etc.) are offered to pupils in an educational format, source: https://offene-werkstatt.th-brandenburg.de/, accessed on 18 September 2020.

57 The "JOBSTARTER plus" programme run by the Federal Ministry of Education and Research (BMBF) supports SMEs with regard to in-house training, source: https://www.bmbf.de/de/jobstarter-fuer-die-zukunft-ausbilden-1072.html, accessed on 28 August 2020.

58 To this end, a working group of regional education service providers has been set up in Brandenburg, whose member companies have developed corresponding joint training programmes and are coordinating their activities. Source: http://www.eepl.de/ag-bildungsdienstleister-regional/, accessed on 28 August 2020.

59 Cf. Section 6.3.4.

60 Cf. Section 6.3.6.

young people to participate in the dual system. It is essential to regain and strengthen awareness in society that learning and practising a technical profession offers long-term success, recognition and strong prospects. Young women in particular are to be targeted, with further potential seen in approaching drop-outs[61] to try and inspire them with practical tasks in technical professions and make the most of their valuable talents.

6.3.3 Higher education

■ **Objective**

To strengthen Brandenburg's universities and technical colleges with regard to demand-oriented study programmes for the companies in the Cluster Metal Industry.

Brandenburg's technical colleges and universities offer an extensive range of subjects in the metal, electrical and mechanical engineering industries[62]. In addition to a wide variety of application-based degree programmes, there are also options available for academic research careers. As things currently stand, the number of first-year students has stabilised in recent years due to the exceptional commitment of the universities to recruiting new students. Demographic change has also made itself felt in higher education. The attractiveness of technical and scientific courses of study has developed much more positively, with the number of first-year students of engineering and natural sciences/mathematics increasing slightly in recent years. For this reason, technical colleges and universities need additional support with regard to their technical, methodologically appealing offerings for the economic players in the Cluster Metal Industry. This also includes measures to encourage young people to study for technical and scientific professions.

■ **Relevance**

Technical and entrepreneurial knowledge is fundamental to the competitiveness and sustainability of companies. This is taught with varying degrees of intensity at technical colleges and universities.

■ **Potential**

The university locations in Brandenburg have an advantageous effect on surrounding companies and are a great attraction for companies to settle here. The geographical proximity facilitates scientific cooperation, ranging from internships, student research projects and Master's theses to company-funded practical projects and development cooperation. In these processes of exchange with practice, theoretical knowledge is supplemented by practical experience and skills. Both graduates and companies are given the opportunity to get to know each other in real-life scenarios and, if all goes well, to prepare for a future employment relationship.

By encouraging cooperation between companies and universities, especially through dual study programmes, it is possible to inspire those involved to feel more deeply rooted in the region. For this reason, the aim is to expand the range of dual study programmes on offer, possibly also increasingly in the form of part-time models that allow students to pursue their professional activities in parallel.

Further potential is seen in a subject-related expansion of the range of courses on offer, particularly with regard to sustainable technologies. This would make it possible to increase the number of first-year students and meet the needs of companies and research institutions in Brandenburg, especially in terms of structural change.

6.3.4 Further training of skilled employees and executives

■ **Objective**

To support companies and employees with company training measures, and offer support for training providers. In this context, dual study opportunities and modules on new technologies and developments in digitalisation are to be provided by suitable educational institutions and universities.

The further training of employees in companies is currently regarded as a broad and challenging field. The high level of capacity utilisation in companies means that continuing

61 The European University Viadrina is currently cooperating with regional companies on the question of how early school leavers can be better intercepted. The results are still being evaluated, source: Newsletter 2018/01 of the Transfer Office of the European University Viadrina Frankfurt (Oder).

62 Cf. Section 2.2.

training has so far been implemented mainly on a job-related basis, i.e. "by doing" or "on the job"[63]. In day-to-day business, it often takes a back seat to acute problems. SMEs are also dependent on providing continuing training for their employees. They often find it difficult to identify target-oriented opportunities for the company and implement further training measures due to the lack of specific resources this requires. This is why it is important to put together practical continuing training programmes adapted to the company and its individual requirements for companies and employees. Here, education providers are required to develop appropriate opportunities, take up future-relevant teaching content and convey it effectively with the help of modern equipment and contemporary forms of learning.

To this end, support will be granted to initiatives that bring together companies, employees and training providers to create training opportunities that meet the needs of the market.

■ **Relevance**

Technological developments and changes in the markets require constant adaptation to the state of the art and the current competitive situation. A good example of this can be seen in the tasks that arise in many business areas as a result of digitalisation[64] and the resulting need for continuing training. This development is being further accelerated by the restrictions imposed by the coronavirus pandemic. New job specifications mean that even professions that have been learned have now changed significantly. The awareness of "lifelong learning" is to be implemented as a model when designing continuing training modules for different target and age groups within companies.

■ **Potential**

There is a tendency to request rather small-scale teaching modules – for example, on concrete issues of digitalisation – which can be supplemented as required by individually accessible digital teaching units[65]. To promote continuing vocational training, the Ministry of Economic Affairs, Labour and Energy provides suitable and proven support measures for companies and employees alike[66]. The digitalisation of individual courses, both in the form of teaching and through the use of mobile, digital terminals, can effectively support attendance rates[67]. Synergies can also be drawn from the joint use of resources, such as workshop and laboratory equipment and machinery in educational institutions, secondary school centres and universities. Local or subject-oriented networks can effectively mediate between interested companies and training providers and promote new, cooperative training solutions. Encouraging initial results of regional initiatives[68] show that these approaches are pointing in a promising direction.

63 Continuing training in the context of digitalisation issues is largely carried out in Brandenburg companies using internal learning methods. These are essentially learning processes that rely on trial and error (learning by doing) and learning from colleagues (learning on the job), source: C. Kampe, A. Walter, D. Porep: "Arbeit 4.0 in Brandenburg" as part of the "Fach- und Arbeitskräfte in Brandenburg" [Skilled and unskilled employees in Brandenburg] project by the Economic Development Agency Brandenburg, funded by the Ministry of Labour, Social Affairs, Health, Women and Family from the European Social Fund and the State of Brandenburg, June 2018, p. 41.

64 In the digitalisation of machine processes, for example: production control of interlinked machines in a continuous flow or workshop production, elimination of interface problems in the networking of existing machines, the implementation of an integrated Industry 4.0 concept with the aim of achieving added value in terms of profitability and flexibility in meeting customer requirements.

65 Overall, the data on the study "Arbeit 4.0 in Brandenburg" study as part of the "Skilled and unskilled employees in Brandenburg" project tend to confirm the assumption that companies are currently looking for formats that support digitalisation (cf. p. 44 of the study in question).

66 Continuing Education Directive of the Ministry of Economic Affairs, Labour and Energy (MWAE): https://www.ilb.de/weiterbildung, accessed on 18 September 2020.

67 The "LTA-FIT" qualification system (Learning, Training, Assistance – Formats, Instruments and Topics) developed in the SME 4.0 competence centre Cottbus with the aim of offering comprehensive SME-oriented teaching of both technical and methodological skills (FMK) and personal and social skills (PSK) in the context of Industry 4.0 is well received by companies. This system, which also provides microdegrees for specific specialist content, is to be further developed with a view to creating a comprehensive, transparent overall package for companies in the manufacturing sector.

68 For example, the skilled worker service platform of the Lusatian economic region with corresponding search portals, https://wirtschaftsregion-lausitz.de/en/wirtschaft/fachkraefteserviceplattform/weiterbildung.htm, and the "Lausitz – Starke MINT-Region" [Lusatia – strong STEM region] portal of the Lusatian economic region in cooperation with the Federal Employment Agency, the Lusatian Economic Initiative and the Economic Development Agency Brandenburg (WFBB), https://www.mint-lausitz.de/, accessed on 30 September 2020. Information and coordination services of the Education Office of the Elbe-Elster district, https://www.lkee.de/Soziales-Kultur/Bildung/Bildungsbüro, accessed on 31 August 2020.

6.3.5 Development of up-to-date teaching material

■ **Objective**

To modernise and create an appealing format for company training and further training opportunities according to company requirements, particularly with regard to digitally supported processes.

Shortages can already be seen in the Cluster's traditional technical areas, with the number of graduates far below demand in the fields of metal production[69] and energy technology[70] in particular. In addition to the classic apprenticeship occupations, the demand for recently established occupations such as plant mechanic and construction mechanic is becoming apparent. These training occupations teach more and more digitalisation-based skills, such as 3D printing, apps for monitoring production processes, augmented reality operations, automatic identification, real-time data systems, man-to-machine communication (M2M), machine data acquisition (MDE), predictive maintenance, programmable logic controllers (PLC) and the configuration of networked production systems.

There is further need to revise teaching content – primarily for continuing education – with regard to current digitalisation-based tasks.

A broad alliance of companies and educational providers coordinated by chambers and associations is necessary to identify current and attractive educational content that meets the needs of companies, schools and continuing training institutions and to develop suitable continuing training modules.

■ **Relevance**

From the point of view of the companies, the aim is to achieve an effective dovetailing of educational content and forms of learning with the subsequent application of the newly acquired knowledge "on the job" alongside the work itself.

■ **Potential**

Digitalisation will continue to play an important role, and not just in conjunction with new requirements regarding IT programmes or machine programming knowledge. In the context of digitalisation, communication and interdisciplinary knowledge are of central importance. The companies in the metal industry have recognised particularly serious changes in the required skill sets for their employees in this area, particularly with regard to basic communication skills and internal knowledge transfer[71]. Modules to be taught on an integrative basis cover the areas of "digitalisation of work", "data protection and information security" and "business processes and quality assurance systems". Corresponding changes are currently being incorporated into the training regulations.

New additional qualifications have also been developed, such as those for process integration, system integration, IT-supported plant modification and additive manufacturing processes for the metalworking occupations.

6.3.6 Management skills, soft skills, foreign languages, cultural understanding

■ **Objective**

To enhance extracurricular qualifications, management skills and soft skills, as well as foreign language skills and cross-cultural understanding.

In addition to technical skills, non-technical skills have not lost any of their importance, and in some cases they have even gained a new, high status in the coordination of technological and information technology tasks. Interdisciplinary education is important in order to master the challenges of the profession in the future. Many topics can be covered across different industries. Specifically, it is about methodological, social and personal skills, which include management skills as well as dealing with other people and oneself. In view of the internationalisation of markets and

69 In the field of metal production, there is particular demand for the following apprenticeships: process mechanic in the metallurgical and semi-finished products industry, foundry mechanic, cutting machine operator in metalworking, construction mechanic and metal worker in metal construction, industrial mechanic, machine and plant operator in mechanical engineering and industrial engineering. Source: Partial evaluation of Arbeit 4.0 in the Cluster Metal Industry (metal, electrical, mechanical engineering), Economic Development Agency Brandenburg (WFBB), May 2020, based on the results of the "Arbeit 4.0 in Brandenburg" study, cf. Kampe et al.: Arbeit 4.0 in Brandenburg, Potsdam 2018.

70 In the field of energy technology, the apprenticeship occupation of electronics technician is in particularly high demand, source: ibid.

71 Source: ibid.

the integration of foreign employees, cultural understanding and foreign language skills are becoming increasingly important. The companies in Brandenburg are to be supported in supporting their employees with developing their personal, non-specialist skills.

■ **Relevance**

Due to the capital-intensive production methods in the metal industry, it can be assumed that technical content will continue to play a special role in the future. In the context of digitalisation, this will involve the interaction of software and machines, the networking of operating areas and, above all, the involvement of the employees concerned. So as to ensure the successful implementation of digitalisation processes, competences in the areas of communication and internal knowledge transfer[72] are also essential.

■ **Potential**

Against the background of the increasing number of foreign employees and customer and supplier relations outside Germany, foreign language skills and intercultural competence will become increasingly important.

Intercultural work is important both for shaping customer relations and establishing development cooperation as well as for production or service provision and retaining international specialists. This is where training courses for extracurricular qualifications and foreign languages are to be integrated into the training on a compulsory basis with further training modules developed as required – for example, to deepen knowledge of the state with a special focus on the economy (including international trade, legal issues and cultural characteristics). In this context, funded stays abroad during school and university years should be more strongly promoted.

6.3.7 Establishment of modern forms of learning, linked with the company's requirements

■ **Objective**

To support the coordination and development of modern forms of learning between education providers and companies for initial and continuing training.

Vocational training has a chance of success if there is a close cooperation between the company providing the training, the training provider and the trainee before, during and after the training programme. Likewise, the interaction of the different learning institutions (such as the vocational school, company or education service providers) has to be coordinated with regard to the course contents and didactic forms of teaching. This calls for the use of suitable teaching and learning materials, some of which digital, with a focus on action, processes and teams.

In this context, both parties, education providers and companies, have to be supported with using or further developing the appropriate forms of learning in line with the course content – if necessary through the involvement of other players in the Cluster, in particular the chambers and networks.

■ **Relevance**

The great importance of workplace-related continuing education and training formats points to a trend of increasing dovetailing between work and continuing training. The frontal teaching or "at the workbench" training practised so far only reaches a fraction of the participants. Today, a wide range of action and situation-oriented forms of learning is available, offering advantages in terms of professional conciseness and practical relevance. In addition, digital forms of learning can help bridge spatial and temporal distances to reach a large number of participants more effectively. The companies themselves are often not yet aware of the exact requirements of the plants, which is why training providers have to develop suitable opportunities in dialogue with the companies[73]. Modular options complete with digital services (virtual classrooms) in combination with support services directly on site in the form of blended learning[74] are suitable here.

■ **Potential**

The most promising forms of learning at present are:

- Knowledge transfer: written learning materials, using the wide range of Internet-based opportunities such as webinars as online/offline resources, supplemented by face-to-face seminars

72 Source: Partial evaluation of Arbeit 4.0 in the Cluster Metal Industry (metal, electrical, mechanical engineering), Economic Development Agency Brandenburg (WFBB), May 2020.

73 Ibid.

74 Learning model in which computer-supported learning – for example, via the Internet – is combined with traditional teaching methods.

- Teaching skills in laboratories, learning factories
- Establishing practical relevance: short internships, implementation of practical projects in competence centres, transfers through organisation of excursions and workshops

As a general rule, the aim is to achieve an integrated practical and action-based approach. Informal learning "by doing" or "on the job" as an important form of learning is to be effectively supported and the focus on skills should be strengthened. The topics and tasks are to be kept up to date with the current state of science and research and tailored to modern requirements. To this end, the teaching staff among the training providers must be familiarised with the new forms of learning[75] and the corresponding technical infrastructure must be kept up to date.

6.3.8 Business succession

Objective

To support Brandenburg's businesses with the regulation of their business succession.

As a result of generational change, small and medium-sized companies are increasingly faced with the challenge of creating succession arrangements for the company management. The transition process has to be initiated at an early stage so as not to jeopardise the future prospects of the company for both employees and business partners. Applicants who are not always qualified but at the same time interested can be considered as candidates for company succession. Training and coaching are necessary to adapt the skills of interested candidates. Legal and organisational aspects also play a role in a company's managerial succession, and it takes several years to deal with these. With this in mind, it is important to handle the matter in good time[76] and provide companies with assistance in this area[77]. The Business Succession Directive promotes awareness raising measures with regard to business succession[78].

Relevance

Succession planning is an acute or pending problem for many companies. This requires the development and implementation of solution strategies that ensure the continued operation and long-term performance of the companies. In addition, SMEs often lack contingency plans for the sudden loss of service providers.

Potential

Advisory services and solution strategies tailored to the company's situation make it possible to consolidate value creation and employment in the region. For this reason, various players in the Cluster, in particular the chambers of commerce and business associations, with the support of the state government, are expanding information services and instruments to provide support both for the searching company and for the potential successor.

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75 Within the framework of the Cluster Metal Industry, the "Digital Learning in initial and continuing education and training in the metal, plastics and chemical industries in South Brandenburg – Digital MKC" project addresses the media competence of training personnel. New digital technologies will be presented and tried out, such as the HoloLens, the welding simulator and the ProGlove – glove scanner for warehouse logistics, source: https://metall-brandenburg.de/de/news/digital-mkc-digitales-lernen-der-aus-und-weiterbildung, accessed on 31 August 2020.

76 Experience shows that measures for a succession plan should be initiated at least five years before the planned departure of the company manager.

77 Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg (MWAE): Start-up and Business Succession Strategy for the State of Brandenburg, 3 March 2017, https://mwae.brandenburg.de/de/existenzgründung-und-unternehmensnachfolge/bb1.c.478821.de, accessed on 18 September 2020.

78 Through the support programme provided by the Ministry of Economic Affairs, Labour and Energy of the State of Brandenburg (MWAE), the State of Brandenburg provides grants to promote awareness among owners of SMEs of the need for early business succession planning. Information on the programme can be found on the ILB portal, https://www.ilb.de/de/wirtschaft/zuschuesse/unternehmens-nachfolge/, accessed on 18 September 2020.

7 Forecast

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In the context of the state's other strategic documents, the Master Plan provides the framework for future innovation projects and jointly supported initiatives. The Master Plan serves as a guideline for the concretisation of measures and projects that are not explicitly listed in this document in any great detail.

The Master Plan is the result of a bilateral and multilateral exchange between the players from industry, science, other stakeholders, associations, chambers, administrations and the Cluster Management. Changes that could have a significant impact on the contents of the Master Plan are expected, particularly due to the dynamic changes in the markets, the progress in productivity as a result of digitalisation, the tasks of improving climate protection, and handling the skilled labour situation. With this in mind, the Master Plan is to be regarded as a dynamic document which, in a structure of medium to long-term fields of action and key points, takes up concrete topics for the economic structure in the cluster and describes them in terms of objectives and potential. An accompanying market and technology preview and regular updates help to keep this document active and up to date.

To continue with the cluster process, cluster management instruments will be used and cross clusters will be further developed. These include the cluster events, meetings of the Strategic Advisory Board and other technology expert groups, trade fair and internationalisation activities, and the information services provided by the Cluster Management.

8 Imprint

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Master Plan for the Cluster Metal Industry Brandenburg

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LEARNING FROM EACH OTHER. TAKING ACTION TOGETHER.

The Cluster Metal Industry has successfully built up a close network effective across the whole of Brandenburg. Side by side, companies, scientists and those involved in economic development face the challenges related to technology innovations, resource efficiency and demographic developments. Transdisciplinary knowledge and joint action are key factors for successfully mastering the transformation in the metal industry.

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