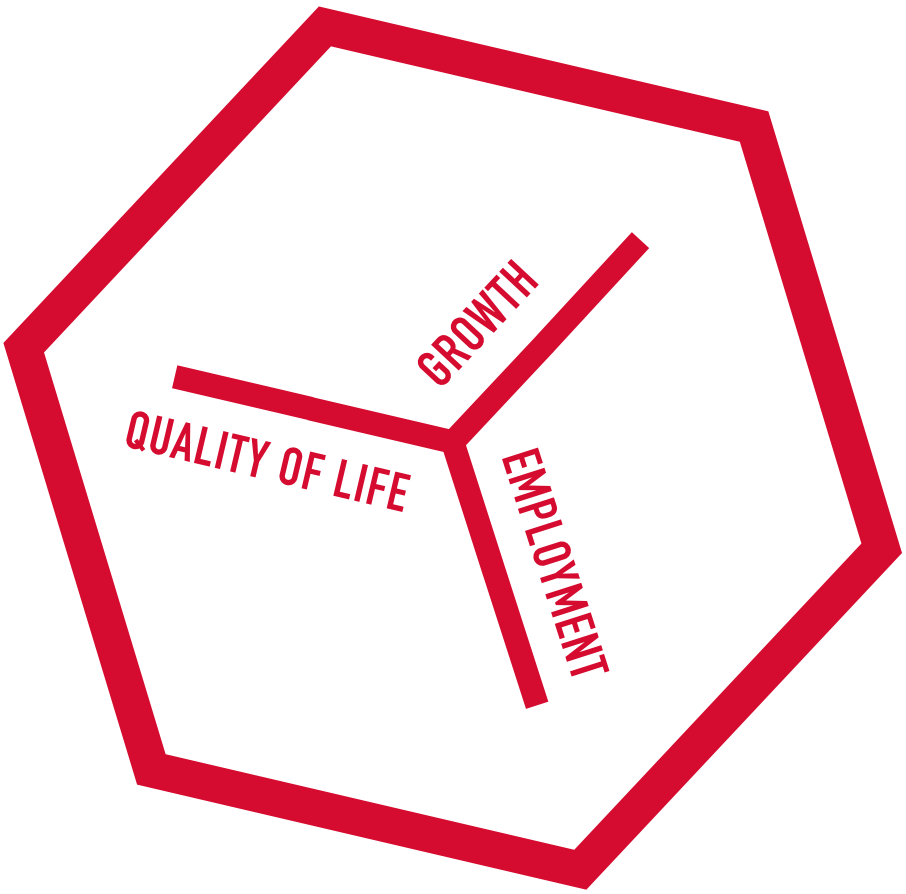
REPORT



"LEITBILD WABE" MODEL

Update of the Model of Sustainable Growth and Employment (WaBe) in the European Metropolitan Region of Nuremberg

WaBe
Wachstum & Beschäftigung

metropolregion nürnberg
SEE IT. FEEL IT. STAY.

SCIENTIFIC AND STRATEGIC
SUPPORT FROM PROGNOS AG

prognos

CONTENTS

1 THE MODEL – A SUCCESS FACTOR FOR A STRONG REGION

The European Metropolitan Region of Nuremberg is one of the 11 metropolitan regions in Germany and consists of 23 districts (Landkreise) and 11 independent cities (kreisfreie Städte) in Middle Franconia, Upper Franconia, Lower Franconia, Upper Palatinate and Thuringia. It forms a dynamic network that transcends borders and unlocks potential. With around 150,000 companies and a working population of approximately two million people, the metropolitan region is an important economic backbone in Bavaria. Its gross domestic product (GDP) is €167 billion, which is comparable to that of the three Baltic states. However, the metropolitan region is also a hub of innovation and progress. Home to outstanding universities with around 100,000 students and also to renowned research centres and leading high-tech companies, it is a unique innovation hub with no end of opportunities. Knowledge is shared and valuable connections are made at the region's key networking event for science, the annual Science Day or Wissenschaftstag. Thanks to its central location and well-developed infrastructure, the metropolitan region – which connects people, drives progress and shapes the future – is the gateway to Europe. More specifically, it is a gateway that brings together business, science and people – a place where success stories are written and ideas become reality.

The model of Sustainable Growth and Employment (WaBe) in the European Metropolitan Region of Nuremberg is a central part of the overall regional strategy and serves as a **compass** for the region. (The name "WaBe" comes from the German words **W**achstum and **B**eschäftigung, meaning "growth" and "employment" respectively.) Through clearly defined areas of competence, the aim of the model is to steer the region's economic, technological and scientific focus, but without actively including touristic, social, cultural or other areas. It shapes the image and self-image of the European Metropolitan Region of Nuremberg and provides it with a distinctive **profile** of its economic strengths. At the same time, the model has a broad regional basis and, as a **network**, encourages different players to work together. This creates synergies which in turn pave the way for sustainable development and help to strengthen the region as a unit. The model points the way for a deep-rooted regional integration that allows its existing value creation potential to be unlocked in full. The overall goal has always been to safeguard the economic momentum and future viability of the metropolitan region in the long term through the joint efforts of many regional players. WaBe aims to make the region competitive and viable for the future by clearly defining areas of focus and innovative approaches.

The metropolitan region of Nuremberg's "Leitbild WaBe" model has a long history shaped by high motivation, adaptability and constant economic and social change in the region. One major milestone in the development of the "Leitbild WaBe" model was **in 2010**, when the development model was officially reviewed once again (as it had been in 1998 and 2005) and was adopted for the first time for the entire metropolitan region. At the time, as well as supplementing the Automation and Automotive areas of competence, the new approach focused on the fundamental notion of technology as a driver of innovation and the associated boost to growth and employment. For a number of years, this "technology push" strategy led the metropolitan region towards an objective of generating economic growth as well as retaining high-quality jobs in the region and creating new ones. Following a period of economic prosperity, the question was once again whether the region was sufficiently prepared for the future. Because of this, **the model was optimised for the last time in 2015/2016**. Over time, both the economic and social challenges have changed, which is why the model was extensively reworked, with a new focus on cross-innovation – the creative exchange of knowledge, ideas and technologies between different sectors – which involved moving from a technology-oriented to a solution-oriented approach. One central component here is the search for answers to social and technological questions regarding the future. Identifying common themes made it possible to determine cooperation potential, which in turn encourages a greater degree of collaboration between the areas of competence and raises the profile of this and the corresponding initiatives.

At the beginning of 2024 – i. e. after the 2015/16 "Leitbild WaBe" model had been in existence for around 10 years – the key players of the metropolitan region of Nuremberg decided to evaluate and optimise it. The main input in implementing the model came from the **seven areas of competence with their competence initiatives**, the **relevant expert forums** in the metropolitan region (Business, Science, Transport & Planning and Climate Protection & Sustainable Development) and the regional **Chamber of Commerce and Industry**. Together, they assume responsibility for promoting economic development in the metropolitan region of Nuremberg and were therefore actively involved in the process. In the course of this process, the European metropolitan region itself, the areas of competence and the areas of activity developed in 2015 were subjected to both **quantitative** and statistical analyses as well as being analysed **qualitatively** using dialogue formats. In **three workshops** and numerous meetings, the participants took stock of their work in recent years. Here, they identified topics, trends and successful projects and the model was revised based on these.

The metropolitan region offers good working conditions and jobs

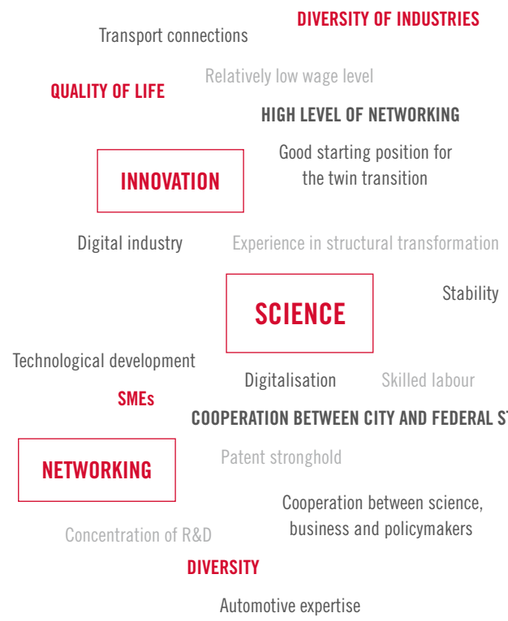
The European Metropolitan Region of Nuremberg has seen many improvements in its standard of living and working conditions. Indicators along the development objective demonstrate that the employment situation is positive. Between 2014 and 2023, the number of people employed increased by around 171,000 (or 12.4 %) to a total of 1.55 million employees who are liable to social security contributions. The unemployment rate also came down to the low level of 3.7 percent in 2023 and has continued to fall ever since. This is a clear indication of a robust regional labour market. However, in spite of these positive developments, growth here is marginally slower than in other parts of Bavaria and also throughout Germany.

The high number of employees with formal vocational training forms a solid basis for the regional labour market, accounting for around 65 percent of the workforce in 2023 and therefore constituting the backbone of the regional economy. Nonetheless, while 16 percent of employees in the entire region are university graduates, this is below both the Bavarian average (2023: 20 %) and the German average (19 %). All of this data shows that there have been positive developments on the labour market but also that the overall region is lagging behind Bavaria and Germany as a whole.

The metropolitan region is economically successful

With its economic momentum, the metropolitan region of Nuremberg is able to strengthen its competitive edge and the diversity of its economic structure in the long term. Between 2014 and 2022, the region's GDP recorded growth of around 32.1 percent, reaching a total of €167 billion (or approximately €47,000 per head of population) in 2022, which is on a par with figures for Bavaria and for Germany as a whole. This clearly points to a solid economic basis. However, absolute GDP per capita in the region is significant lower than in Bavaria (approximately €51,000). One success factor in the region is the continued growth in innovation. In 2019, the number of people working in research and development (1.4 %) corresponded to the level for Germany as a whole and was below the figure for Bavaria (1.9 %). However, there was a marked increase in the number of people working in this area between 2015 and 2019, with growth of around 30 percent (or 5,000 full-time equivalents). This increase was greater than the rest of Germany (+18 %) and Bavaria (+19 %). As well as this, there has been a high number of patent applications for innovative products and processes for many years now. In all its districts in the metropolitan region, the Chamber of Industry & Commerce's patent innovation index is above the German average. The Nuremberg/Middle Franconia region stands out clearly with 2.4 (2021), which is above the Bavarian average (2021: 1.7). This performance ensures the region a leading position in the competition for future technologies and increases its appeal for high-tech companies. The region's export ratio also underlines its global competitiveness. With exports accounting for 48 percent

WORKSHOP FINDINGS ON THE QUESTION: WHAT ARE THE METROPOLITAN REGION'S THREE GREATEST STRENGTHS?



of industry in 2022, the export ratio is high albeit once again lower than the strong Bavarian level (58 %). This strong international focus – combined with a diverse regional economic structure consisting of different industries, sectors and company sizes – makes the region an economic powerhouse.

The metropolitan region – a home for generations to come

The third sub-goal of the "Leitbild WaBe" model focuses on protecting fundamental resources for future generations through sustainable, environmentally compatible and regionally oriented business practices. Environmental indicators for the metropolitan region of Nuremberg fare very well in regional comparisons. Its ratio of built-up to open space, which is used to measure land usage, is the same as that of Bavaria as a whole (2022: 0.13). In recent years, it has consistently recorded a lower level than Germany as a whole (2022: 0.15). Reducing land usage is a central environmental concern as it can have negative effects on the environment. These include the loss of natural habitats, climate protection, valuable arable land and options for adapting to climate change (flood prevention). The proportion of the region's power consumption represented by renewable energies (2021: 49 %) is the same as that of Bavaria (2021: 49 %) and well ahead of Germany as a whole (2021: 42 %). The expansion of renewable energies in the metropolitan region of Nuremberg in the period 2013 to 2022 (+21 percentage points) was higher than in Bavaria (+13 percentage points) and Germany as a whole (+16 percentage points). The installed capacity of renewable energies[1] (in KW per hectare) is also comparable with Bavaria as a whole (2021: metropolitan region 3.3; Bavaria 3.3).

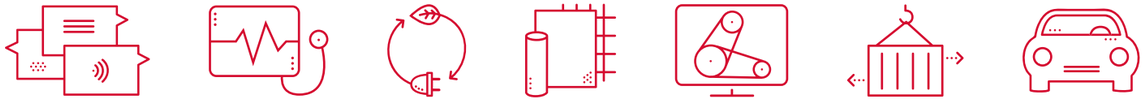
With regard to social aspects, the data shows that the level of prosperity in the south of Bavaria is higher than in the north – here in the metropolitan region, purchasing power per capita (€25,700) is less than in Bavaria (2022: €27,500) but higher than the figure for all of Germany (€25,300). Purchasing power in the region grew by 19.9 % between 2014 and 2023, which was slightly higher than in Bavaria (19.1 %) and Germany (19.6 %). The at-risk-of-poverty rate also illustrates that the level of prosperity in the south of Bavaria is higher than in the north. In recent years, the rate in the metropolitan region's administrative districts (Regierungsbezirke) has been consistently above the Bavarian average (2019: Upper Palatinate 13.6 %, Upper Franconia 13.1 %, Middle Franconia 15.6 %, Bavaria 11.9 %). Due not least to the high standard of living, the population increased by around 126,600 people (or 3.6 %) to 3.6 million people between 2014 and 2022.

These findings demonstrate that the development of the European Metropolitan region of Nuremberg has been fundamentally positive in recent years although, in terms of dynamics, it is frequently lower than figures for Bavaria and Germany as a whole. This should be interpreted as an early warning that the region should not take its **position as a strong business location for granted**. Actively funding growth areas and stimulating the regional economy are essential for safeguarding the region's long-term competitiveness and future viability. With a clear strategy and targeted measures, the region can harness its full potential and maintain its status as a successful economic region and an attractive place to live.

1 The installed capacity consists of biomass, photovoltaics, wind and hydroelectric power.

Area	**21.800 km²** (2024)
Population	**3,6 million** (2023)
Working population	**2,0 million** (2022)
GDP	**€167 billion** (2022)
Export ratio	**48 %** (2023)

2 AREAS OF COMPETENCE – THE CORNERSTONES OF THE MODEL



Although it was still geared towards the Nuremberg region at the time, when the economic model was first developed it defined **economic areas of competence for the metropolitan region of Nuremberg**. These areas of competence stand for sectors in which the region is especially strong economically and form **the cornerstones of the "Leitbild WaBe" model**. These clusters provide orientation for strategic cooperations, encourage innovation and strengthen the region's economic, technological and social development. They are not just an expression of the key strengths of the metropolitan region but also a tool for further advancing the region as a location with a strong competitive edge and a high standard of living. In all areas of competence, there are firmly established initiatives that drive relevant topics. The model now contains seven areas of competence: **Information & Communication, Medicine & Health, Energy & Environment, New Materials, Automation & Production Engineering, Mobility | Transport | Logistics, and Automotive**.

In recent years, these areas of competence have generated many issues that have been addressed and developed further. Backed up by project highlights, the following core messages can be formulated:

IN THE METROPOLITAN REGION OF NUREMBERG …

… business and science are making their mark and showing the way forward into key innovation fields of the future – for example with the *Cleantech Innovation Park* in Hallstadt, the *telematics infrastructure model region Franconia*, the *XR Hub Nürnberg* and pilot projects in the field of sustainable urban logistics.

… universities and research institutions are conducting internationally recognised cutting-edge research in a wide range of areas, such as at the *Bavarian Chip-Design-Center (BCDC)*, which aims to further expand local chip design expertise.

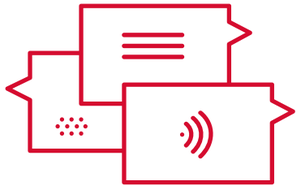
… there are important, successful trade fairs and congresses with a high international profile, including *Smart Production Solutions (SPS)* or *Integrated Plant Engineering Conference (IPEC)* in the field of automation and production engineering.

… public- and private-sector investments are paving the way for growth and employment, e. g. with *Siemens* investing €500 million in Erlangen to establish it as a nucleus for technology activities for the industrial metaverse, or the expansion of *Neue Materialien Fürth GmbH*.

… the implementation of new, innovative ideas is encouraged, such as with the *Medical Valley Award*, the *OM7* and the *NKubator*.

… science, business, policymakers, trade unions and administration come together to form networks and to work together towards success, e. g. in the *transform_EMN* transformation network, *Klimapakt-2030plus* or *Logistik Initiative Bayern*.

2.1 INFORMATION & COMMUNICATION



Area of competence

Information and communication technologies (ICT) are key drivers of the digital transformation in all economic sectors. Business models and entire sectors are currently undergoing another revolution, for example through the use of artificial intelligence. The possible uses of the Internet of Things and 5G mobile communications are being expanded continually, leading smart and digital applications to increasingly become the norm in all areas of life and business. IT security is also growing in importance owing to mounting security requirements and a rise in cybercrime activities. The metropolitan region has outstanding expertise in IT security and is also home to *Fraunhofer IIS*, one of the most internationally renowned institutes in the field of integrated circuits. As well as this, the skills of companies and research organisations based in the region range from open-source software to IT system houses/service providers and data centres, as well as consulting, communication systems and various software solutions.

MAIN AREAS OF FOCUS

IT service providers and telecommunications

- System houses (installation, maintenance, operation)
- Service providers, data centres
- Consulting services for business-related IT (general transformation, data warehouse, automation, logistics, CRM, etc.)

Smart data and security

- Business intelligence
- Big data
- Virtual/augmented reality
- AI
- IT security

Open source

- Open-source software development

Broadband communication systems

- R&D projects in infrastructure (network, network access, applications and content)

Software solutions for automation, medicine and business applications

- Software development
- Software quality

The 86,700-plus people working in the Information & Communication area of competence in 2023 make up around 6 percent of all employees in the metropolitan region of Nuremberg. The number has increased by 19 percent since 2014, demonstrating the dynamic growth in digital technologies. This makes it one of the fastest-growing areas of competence in the metropolitan region of Nuremberg. The main area driving employment growth is Software Development & ICT Services with growth in excess of 50 percent.

Competence initiative

The NIK e. V. competence initiative encourages interaction within the digital economy in the metropolitan region and, together with its 70 members, develops new ideas and momentum. Via different channels, it offers information on trends and issues relating to the digital economy in the region and organises events such as conferences, BarCamps and network meetings. In working groups or at themed events, participants explore digitalisation topics such as New Work & People, AI & Automation, IT Security, Digital Communication or Digitalisation & Sustainability. NIK e. V. also promotes publicly funded projects like *OM7* and *5G-Dialog*.

Topics, trends and highlights

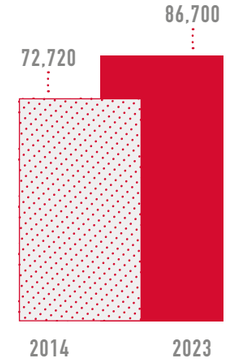
Current issues and technology trends in this area of competence include artificial intelligence (AI) and business automation, IT security, VR/AR and Industrial 5G. As well as this, the link to the cultural and creative industries and the growing interest in New Work and green IT are becoming increasingly important. AI is being harnessed in many different ways in the metropolitan region of Nuremberg, where there is an enormously high affinity among both local SMEs from the IT sector and large corporations (e. g. DATEV eG's AI workshop). Fraunhofer IIS is also actively working on technology solutions such as AI-based language assistance systems with a "Made in Germany" seal of quality. University projects such as *AN[ki]T* in Ansbach or the Center for Responsible Artificial Intelligence (CRAI) at Coburg University are also being carried out.

The most notable projects relating to the *NIK e. V.* competence initiative are:

- *OM7* – a business incubator, creative industry centre and co-working space in Nuremberg – helps start-up founders and young companies from the creative industry to develop new, innovative business models and assists them with the digital transformation.
- *5G-Dialog* provides information about 5G technology and an open testing environment – the 5G testbed "Industry 4.0" – is being made available at Fraunhofer IIS in Erlangen.
- The *XR Hub Nürnberg* educates companies, schoolchildren and students about the latest trends, use cases, innovations and access to extended reality.
- The *AI hub*, which focuses on the use of artificial intelligence in companies, was launched at the beginning of 2025.

EMPLOYMENT
in the Information & Communication area of competence in the metropolitan region of Nuremberg between 2014 and 2023

+19 % (+14,000) ↗



BAVARIA: +46 %
GERMANY: +40 %

6 %
OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

86,700
EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023

Source: Federal Employment Agency

nik
NETZWERK DER DIGITALWIRTSCHAFT

2.2 MEDICINE & HEALTH

Area of competence

Besides continuing demographic ageing and a growing health awareness among the population, technological progress is the main factor that is continually speeding up the growth of value creation and employment potential in the healthcare sector. In particular, digital health solutions, the use of robotics and automation and the application of predictive analytics and artificial intelligence in diagnostics are becoming increasingly prevalent in the sector. As well as its importance as a public service, the healthcare sector is therefore assuming an increasingly important role as a driver of innovation. This means that the areas of research and development, medical technology and healthcare IT are also benefiting from this growing competence in the healthcare sector. As a national leading-edge cluster and *digital health hub* for the German government, the metropolitan region is one of the country's leading centres for medicine and healthcare. The metropolitan region of Nuremberg is known for its diversified medical technology sector with imaging techniques and also for its outstanding competence and leading international research. There is also a focus on digital healthcare in the region.

MAIN AREAS OF FOCUS

Medical technology

- Close links between research and application
- Global players like Siemens Healthineers
- Global players like Siemens Healthineers

Digital healthcare

- Model region for telematics infrastructure
- Healthcare IT
- Development of P4 medicine (preventative, predictive, participative, personalised)

World-leading technology areas

- Diagnostic imaging
- Digital healthcare applications
- Intelligent sensor technology
- Therapy systems
- Ophthalmology

International cutting-edge research

- Member of EITH Health
- FAU/Uniklinik
- Fraunhofer IIS
- Max Planck Institutes

The high and very dynamic employment rates illustrate how much the metropolitan region of Nuremberg has advanced in medicine and healthcare. The 151,160 people employed in this area of competence account for around 10 percent of the workforce in the metropolitan region. Between 2014 and 2023, employment in this area of competence increased by 19 percent, making it one of the fastest-growing sectors.

Competence initiative

Since 2007, *Medical Valley EMN e. V.* has been coordinating questions relating to medicine and health in the metropolitan region of Nuremberg as well as organising the Bavarian Medical Technology Cluster. This competence initiative is also part of the *European Digital Innovation Hubs* network. Other services that are offered include assistance accessing strategic partners from industry, research, healthcare and policymaking as well as access to international markets. The focus is also on organising, moderating and overseeing events and on the range of training and further education events. As well as this, the initiative provides assistance in acquiring funding – since 2010, it has been instrumental in securing more than €150 million. By assisting start-ups, *Medical Valley* also makes an important contribution towards developing the region's business base.

Topics, trends and highlights

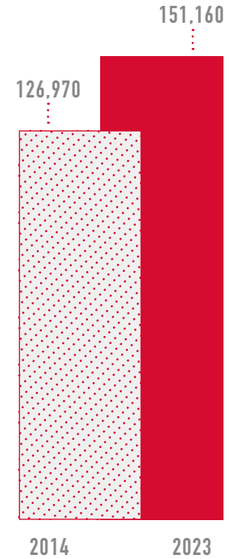
A central topic in the field of medicine and health is the digitalisation of healthcare and the healthcare sector. Here, it is important to develop effective solutions in order to be able to use data that is generated or to gain access to it. Using artificial intelligence opens up new opportunities, including in the field of diagnostic methods. Automation and robotics are also gaining in importance. Beyond these technological questions, a key role is currently being played by compliance with legal regulations – in particular the Medical Device Regulation – and efforts to address the lack of skilled labour.

Project highlights in the Medicine & Health area of competence include:

- Co-organisers of the annual *European Digital HealthTech Conference*
- *Innovative medical technology start-up environment.* Examples include inContAlert with their wearable that monitors the filling level of the urinary bladder in a non-invasive way
- Establishing and piloting telematics infrastructure in real-life operation as part of the *TI-Modellregion Franken* model region programme based in Franconia
- The *Medical Valley Award* with €500,000 for research teams in start-up phases

EMPLOYMENT
in the Medicine & Health area of competence in the metropolitan region of Nuremberg between 2014 and 2023

+19 % (+24,190)



BAVARIA: +22 %
GERMANY: +19 %

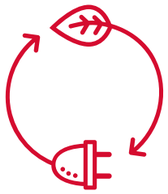
10 %
OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

151,160
EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023

Source: Federal Employment Agency

MEDICAL VALLEY
Europäische Metropolregion Nürnberg

2.3 ENERGY & ENVIRONMENT



Area of competence

In recent years, the effects of climate change have been increasingly apparent. Steps being taken to curb the magnitude of the climate crisis include further increasing the use of renewable energies and expanding closed-loop recycling in Germany and Europe. Here, technological progress and increases in efficiency are playing a more and more important role, together with the expansion of renewable energies, particularly in construction. The metropolitan region of Nuremberg is home to a wide spectrum of companies with both global players and SMEs, which have a high level of competence along the entire energy value chain. The region also has strong research expertise with international cutting-edge research on energy and environment being conducted at 10 universities and 12 R&D institutions.

MAIN AREAS OF FOCUS

Energy technology*

- High-level competence in the construction of power plants and transformers
- Power plant and network control technology
- Plant engineering for renewable energy
- Heating systems

Buildings*

- Energy management and sustainable operation
- Developing and using new construction and insulation materials
- Using renewable energy
- Innovative building technology

Environmental technology

- High-level competence in water management
- Waste and recycling management

Power electronics

- Developing and producing power electronics and related components

Automation and drives

- Developing intelligent control, measuring and regulation systems
- Developing efficient drives (especially electric motors and fuel cells)

* Main areas of focus in the *ENERGIEregion*

Employment figures in the Energy & Environment area of competence confirm that the metropolitan region of Nuremberg is well positioned in this area. A total of 75,610 people work in Energy & Environment, accounting for roughly 6 percent of the region's workforce. Since 2014, the number of people working in the area of competence has also increased by 5 percent, equivalent to an additional 4,300-plus employees subject to social security contributions. The sub-sector of Energy Generation and Distribution has recorded particularly strong growth, having increased by 25 percent since 2014.

Competence initiative

ENERGIEregion Nürnberg e. V. has been making progress in energy-related matters in the metropolitan region of Nuremberg since 2001. The initiative has set itself the goals of promoting the shift towards more sustainability and climate protection in the metropolitan region, stepping up cooperation between business, research and local authorities and raising the profile and competitiveness of the energy industry location. The initiative makes use of a number of different formats. Firstly, it set up projects such as *Klimapakt2030plus*, network platforms like the hydrogen initiative *Wasserstoff-Metropolregion Nürnberg hy+* and research and development networks like *DigiGuss*. It also organises various event formats and initiative groups on different topics relating to the energy industry.

Topics, trends and highlights

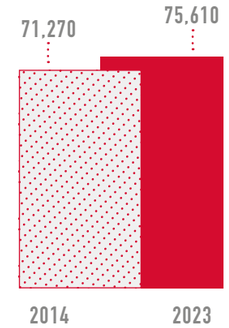
An important topic in the Energy & Environment area of competence is the renovation of existing buildings, particularly with regard to the energy transition in heating. Sector coupling in energy systems, including through the increased use of hydrogen, offers potential for greater efficiency, which in turn can increase the share of the overall system represented by renewable energies. Building digital and networked energy systems is another way to increase efficiency. This area of competence is also currently focusing on sustainable business practices.

The highlights in the Energy & Environment area of competence illustrate, for example, how the aforementioned topics and trends are advanced in a clearly defined and measurable way:

- *Klimapakt2030plus* deals with the transformation of electric power and heat supply and also with energy renovation in the metropolitan region of Nuremberg.
- Economic and regional funding for hydrogen technologies and their practical applications is provided via the *Wasserstoff-Metropolregion Nürnberg hy+* initiative.
- The *NKubator* innovation and business incubator for energy, greentech and sustainability provides support to green and technology-intensive start-ups and assists them with sustainable business practices.

EMPLOYMENT
in the Energy & Environment area of competence in the metropolitan region of Nuremberg between 2014 and 2023

+6 % (+4,330) ↗



BAVARIA: +21 %
GERMANY: +19 %

5 %

OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

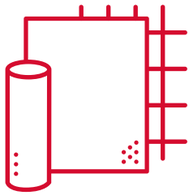
75,610

EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023

Source: Federal Employment Agency

ENERGIE region®
Wir gestalten Energie. Gemeinsam.

2.4 NEW MATERIALS



Area of competence

Developing lighter, more durable and more high-performance materials makes a key contribution to innovativeness in key future industries such as electronics, mechanical engineering and aerospace technology. In the metropolitan region of Nuremberg, there is a wide range of competences in materials research and application, e. g. in technical textiles, innovative building materials, composites, plastics, metal products and surface technology. The region not only has leading research institutions like *FAU Erlangen-Nuremberg* and the *Nuremberg Institute of Technology*, but also strong user industries, e. g. in electrotechnology, plastics and automotive manufacturing. Thanks to the x-ray detector at the *Fraunhofer Development Centre for X-ray Technology* in Fürth, it also has outstanding expertise in material testing.

MAIN AREAS OF FOCUS

Technical textiles

- Textiles for aerospace, construction industry, medical technology, etc.

Technical ceramics, glass and construction materials

- Polymeric, metallic and ceramic materials

Composites

- Technical ceramics for mechanical engineering, automotive manufacturing, aviation, mechanical engineering, etc.
- Glass tubes, rods and profiles made from special glass

Plastics processing

- Processing of plastics in all upstream and downstream areas of the plastics industry, e. g. mould-making, packaging, coating

Metal products/metalwork, lightweight construction, nanotechnology/particle technology, powder metallurgy

- Manufacture of granulates, nanoparticles, pigments
- Manufacture of light metal products for the automotive industry

Surface technology

- Surface treatment and finishing, functionalisation

Material testing

- Material-specific test procedures for different material types

The 80,980 people employed in this area of competence make up around 5 percent of the total workforce in the metropolitan region. This means that the figure for 2023 was around 4 percent below that of 2014. However, when this is broken down into sub-sectors, there are clear growth areas within this area of competence. For instance, ‘Measuring, controlling and navigation devices’ has grown by 29 percent since 2014, while employment in ‘Metal processing and production’ fell by 31 percent in the same period.

Competence initiative

The competence initiative *KINEMA* is led by the Nuremberg Chamber of Industry & Commerce and the City of Fürth. It aims to promote long-term research and development with collaboration between science and business. The competence initiative also takes strategic steps to raise the profile of the metropolitan region as a centre for new materials and to create and safeguard jobs. Another aim is to include SMEs in development processes. The initiative of the New Materials cross-section area of competence focuses on communicating information and contact names and also on various specialist networks, e. g. networks dedicated to additive manufacturing and laser processing. The Chamber of Industry & Commerce user club *Neue Materialien / Prozesstechnik* (New Materials | Process Technology) has also been established and support is provided to projects like t*ransform_EMN* that work towards the transformation of the automotive and supplier industry.

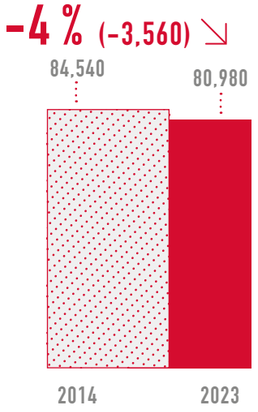
Topics, trends and highlights

Developing new materials is of enormous importance in the shift towards renewable energy. Suitable materials required for developing clean fuel cells, coating technology, photovoltaic modules, etc., are developed in the metropolitan region of Nuremberg. In addition, technologies for separating recyclable materials are important in the context of the circular economy.

The highlights show the strength of the metropolitan region in this area of competence:

- As an interdisciplinary research centre between FAU Erlangen-Nuremberg, Uniklinikum Erlangen and the Max Planck Institute for the Physics of Light, the *Max Planck Centre for Physics and Medicine* conducts research on future topics with a focus on cells in the context of their micro-environment.
- Since 2015, future-oriented research and teaching on plastics have been consolidated at *kunststoff-campus bayern* (Plastics Campus Bavaria).
- The region is home to various research and user centres with independent research institutions, the core of which are represented by *Neue Materialien Fürth* and *Neue Materialien Bayreuth*.
- *EVOSYS Laser GmbH* from Erlangen developed a new approach for laser welding that enables the process time to be reduced by 60 percent, which won them first prize in the Bavarian Innovation Award.

EMPLOYMENT
in the New Materials area of competence in the metropolitan region of Nuremberg between 2014 and 2023



BAVARIA: +2 %
GERMANY: −1 %

5 %

OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

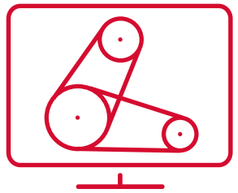
80,980

EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023

Source: Federal Employment Agency

KINEMA
Kompetenzinitiative Neue Materialien Europäische Metropolregion Nürnberg

2.5 AUTOMATION & PRODUCTION ENGINEERING



Area of competence

As a result of technological progress – especially in artificial intelligence, the Internet of Things and robotics – digital transformation in industrial production has gained significant momentum in recent years. The region's focus on Industry 4.0 both in research and in practical application forms a good basis for safeguarding the competitiveness of industrial companies there in the medium to long term. The metropolitan region of Nuremberg's focus in the Automation & Production Engineering area of competence ranges from electric drive technology, measuring technology and software to system integration, manufacturing technology, and mechanical and plant engineering. This area of competence in the metropolitan region of Nuremberg has a strong mix of SMEs as well as the international global player Siemens. Nuremberg is also a top trade fair and congress location with leading automation technology events taking place here, such as *Embedded World* or *Smart Production Solutions* (SPS).

MAIN AREAS OF FOCUS

Electric drive technology

- Research on drive concepts and production engineering, etc.
- Production of electric drive train
- Modelling and simulation

Measuring and control technology

- Production of measuring and test systems
- Image processing systems
- Research in sensor technology

Software for automation

- Leading providers in industrial communication, control software and digital twins

System integration/complete solutions for factory automation

- Integration of products/components by various manufacturers into global solutions in manufacturing industry, process industry, power plants, energy systems and many more.

Manufacturing technology

- Development work and concepts
- Order production in design technology, laser manufacturing, electronics production, tool-making and plastics production

Mechanical and plant engineering

- Manufacture of capital goods, hydraulic and pneumatic aggregates, and basic mechanical elements for production engineering

Since 2014, the number of people employed in the largest area of competence has increased by just under 16,000, which is equivalent to 10 percent growth. This means that, in 2023, a total of 171,900 people in the metropolitan region of Nuremberg (or 11 percent of the workforce) were employed in Automation & Production Engineering. The strong growth in the Information Technology Services sub-sector (+45 %) illustrates the importance of the digital transformation in Automation & Production Engineering.

Competence initiative

The *Automation Valley* competence initiative is coordinated by the respective chambers of industry and commerce in Bayreuth, Coburg, Würzburg-Schweinfurt and Nuremberg and by the East Bavarian innovation offensive IOO. [Kompetenzfeldinitiative -> Kompetenzinitiative] The aim is to boost the competitiveness and innovative capacity of its approximately 300 members through a wide range of activities. To this end, it holds cooperation forums like the IHK-AnwenderClub *Digitale Produktion* for digital production and conferences like the *International Production Environmental Community* (IPEC). It organises trade fair activities, e. g. at the Hannover Messe trade fair centre or at the Fachmesse *SPS – Smart Production Solutions* fair in Nuremberg. The initiative also includes international cooperations, regular transformation maturity assessments and *Automation Valley Profiles*, where best practice examples of member companies are presented and company tours and networking formats are carried out.

Topics, trends and highlights

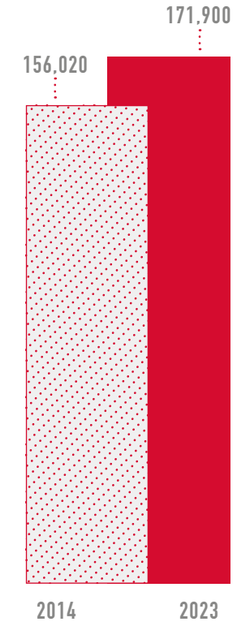
Current topics in the Automation & Production Engineering area of competence include Industry 4.0, digital twins, Work 4.0, artificial intelligence (AI), data science, robotics, industrial metaverse and Manufacturing-X. With regard to both technological and organisational aspects, these trends will continue to play a key role when it comes to actively optimising production processes. Smart, networked, efficient and flexible production is a key competitive advantage that secures value creation potential and helps to create jobs for the metropolitan region.

The highlights in this area of competence show how automation and production in the region can be strengthened in clearly defined and measurable ways.

- As the home to *Siemens, Erlangen* has established itself as a nucleus for technology activities relating to the industrial metaverse with investment volumes of €500 million.
- The *International Production Environmental Community (IPEC)*, an international conference on Industry 4.0 and sustainability, is held annually and attracts some 300 participants.
- *IGZ* in Erlangen has established itself as a business incubator for technology-oriented companies.

EMPLOYMENT
in the Automation & Production Engineering area of competence in the metropolitan region of Nuremberg between 2014 and 2023

+10 % (+15,880) ↗



BAVARIA: +20 %
GERMANY: +19 %

11 %
OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

171,900
EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023
Source: Federal Employment Agency

Automation Valley Nordbayern

2.6 MOBILITY | TRANSPORT | LOGISTICS

Area of competence

The metropolitan region has been an international pioneer in autonomous driving since as far back as 2008, when it included the first ever fully automated underground trains on one of its subway lines. As Franconia was used by *DB Rail* as a model region for its innovative project involving hybrid shunting locomotives, it also has an especially high level of expertise and visibility when it comes to mobility in general and rail mobility in particular.In addition, the region is one of the top logistics locations in Germany with a wide enterprise base that includes both SMEs and global players. The metropolitan region strategically expands these strengths in the Mobility | Transport | Logistics area of competence and monitors technological progress in particular. In this way, it not only drives forward innovative railway technology but also drive technology, intermodal mobility and logistics. Telematics makes intelligent transport systems possible and is playing an increasingly important role in the further development of autonomous driving in particular.

MAIN AREAS OF FOCUS

Railway technology

- Infrastructure and energy
- Operation and maintenance
- Train control and protection
- Vehicles

Drive technology

- Alternative energy sources for mobile applications
- Alternative drive systems for rail vehicles
- Alternative drive systems for commercial vehicles and buses

Intermodal mobility

- For people
- For goods
- Urban mobility

Telematics

- Intelligent transport systems and traffic control
- Autonomous driving
- Door-to-door navigation in public transport

Logistics

- Logistics expertise across different transport modes
- Logistics hub for Central and Eastern Europe
- Transport logistics / combined transport
- Environmentally friendly logistics

Automotive

- State-of-the-art testing and measuring techniques
- On-board power systems
- Components for hybrids and electric drive technology

With remarkable growth of 31 percent between 2014 and 2023, this area of competence brings together highly dynamic economic sectors in the metropolitan region of Nuremberg – a dynamic that is especially apparent in the Logistics sub-sector although the related sub-sectors have also seen increases in the number of people employed in recent years. Around 11 percent of all these employees were working in the various sub-sectors of this area of competence in 2023. This corresponds to approximately 165,450 people.

Competence initiative

CNA e. V. manages the *BahnTechnik | Bayern* cluster and coordinates the *Logistikinitiative Bayern* logistics initiative. It is also a founding member of the *European Railway Clusters Initiative (ERCI)*. The competence initiative organises the Bavarian congresses *MobilitätsCongress, BahnCongress* and *LogistikCongress* in Nuremberg. It also awards prizes such as the *CNA InnovationsPreis* (CNA Innovation Award), *Logistik | ist weiblich* (Logistics | is female) and the *Technology for Future Award*. As well as this, it initiates and oversees various projects and organises 15 themed dialogue platforms.

Topics, trends and highlights

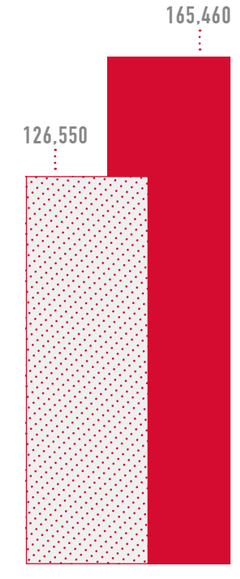
Current topics in this area of competence include new drive technologies such as hydrogen and also autonomous driving, cybersecurity and urban logistics. The change in commuting distances as a result of new post-pandemic workplace concepts brings new challenges but also opportunities. Good usage concepts for existing infrastructure must be examined in order to make logistics processes more sustainable. It is hugely important for new logistics solutions to communicate their purpose clearly so that they can get people on board.

The highlights in this area of competence show, for instance, how mobility, transport and logistics are being advanced in the metropolitan region:

- Logistik Initiative Bayern, the umbrella brand for logistics networks in Bavaria, is coordinated by *CNA e. V.*
- It also manages the *BahnTechnik | Bayern* cluster as part of the cluster offensive of the Bavarian State Ministry for Economic Affairs, Regional Development and Energy.
- A *micro depot concept* was developed as part of a pilot project for sustainable urban logistics with cargo bikes and micro depots.
- *PedeListics* – a number of research projects being conducted by the Nuremberg Institute of Technology on sustainable urban logistics are examining the use of cargo bikes and combined transport in a public transport context.

EMPLOYMENT
in the Mobility | Transport | Logistics area of competence in the metropolitan region of Nuremberg between 2014 and 2023

+31 % (+38,910)



BAVARIA: +30 %
GERMANY: +25 %

11 %
OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

165,450
EMPLOYEES LIABLE TO SOCIAL SECURITY CONTRIBUTIONS IN 2023

Source: Federal Employment Agency

cna
Think Tank | Mobility | Transport | Logistics

2.7 AUTOMOTIVE

Area of competence

In recent years, the automotive sector has undergone radical changes. If we are to achieve decarbonisation, there is no alternative to electrifying drive trains. However, the ongoing development of autonomous driving, its increasing range of applications and the networking of vehicles with their environment are also increasing in importance. At the same time, 'connected cars' (or 'automated vehicles') are fuelling the use of data analyses and artificial intelligence in vehicles. In addition, alternative mobility concepts like car-sharing and ride-hailing are becoming more relevant than ever.

The strong SME base in the metropolitan region has a wide range of technological skills and materials competence and is set to remain significant, especially given the ever-changing nature of the automotive industry. This includes materials such as technical textiles and plastics, as well as everything from modular door systems to hybrid modules in drive technology and on-board power systems, through to specific expertise in electrical drives and rolling bearing technology.

MAIN AREAS OF FOCUS

Materials

- Technical textiles in the production of seats or protection sleeves
- Plastics processing

Modular door systems

- Customised manufacturing
- Merging several functions (window regulator, lock) into a single product

Drive technology

- Series production of hybrid modules

On-board power systems

- High-level competence in assistance systems

Electromobility

- Expertise in electrical drives and power electronics

Warehousing technology

- Global market leader in rolling bearing technology

With approximately 85,270 employees, the various sub-sectors of the Automotive area of competence make up around 5 percent of the total workforce in the metropolitan region of Nuremberg. In spite of the radical changes affecting the sector, this figure has remained largely constant since 2014. The same situation is also found in the individual sub-sectors within the area of competence.

Competence initiative

The *ofraCar* competence initiative is financed entirely via its 50 member companies. This initiative aims to safeguard and increase the competitiveness of the automotive and supplier companies and also to boost the economic strength of the region and improve its quality as an automotive hub. *OfraCar* offers its members three different formats: networking services (e. g. industry get-togethers, company/trade fair visits), collaboration in the form of cooperation groups and work groups, and competence initiatives for employee training and development. The initiative's activities are focused on Upper Franconia. In recent years, a transformation network – *transform_EMN* – was also set up by the Federal Ministry for Economic Affairs and Climate Action and has since also evolved into a key player in the Automotive area of competence *(see https://www.transform-emn.de)*.

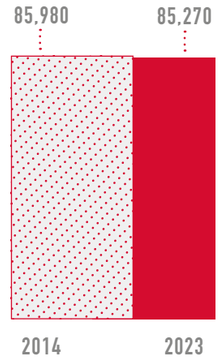
Topics, trends and highlights

The metropolitan region of Nuremberg focuses on firmly establishing a range of companies in the Automotive area of competence and on safeguarding their competitiveness in the context of the transformation in the automotive sector. This reflects important lessons learnt during the coronavirus pandemic with regard to establishing alternative supply chains. There is also a focus on sustainable and stable energy supply in the context of challenges such as the shortage of chips and semiconductors or the energy crisis in recent years. Research and company networks are helping companies to seize the opportunities associated with transformation and meet the requirements of the future:

- The *Cleantech Innovation Park* offers companies, universities and research institutions the opportunity to network and research future technologies together.
- Transformation network *transform_EMN* helps small and mid-sized automotive suppliers to prepare for the transformation.
- Different companies are investing in remodelling the location, e. g. *Bosch* is investing in the mass production of fuel cell systems in Bamberg and *Brose* in expanding and increasing capacity at its factory in Bamberg/Hallstadt.

EMPLOYMENT
in the Automotive area of competence in the metropolitan region of Nuremberg between 2014 and 2023

-1 % (-710) ↘



BAVARIA: +5 %
GERMANY: +2 %

5 %

OF THE TOTAL WORKFORCE IN THE METROPOLITAN REGION OF NUREMBERG

85,270

SOZIALVERSICHERUNGSPFLICHTIG BESCHÄFTIGTE 2023

Quelle: Bundesagentur für Arbeit

ofraCar* Automobilnetzwerk e.V.

3 OPPORTUNITIES AND CHALLENGES FOR THE FUTURE: UNDERLYING TRENDS AND DEVELOPMENTS

Cities and regions throughout Germany are facing major challenges. Overriding trends and developments around the world are giving rise to technological, political, economic and social changes. With that in mind, it is important to meet the driving forces head on and prime the European Metropolitan region of Nuremberg for the future so that it can remain internationally competitive and safeguard jobs in the long term. At the same time, the fast pace of change is also opening up great potential for innovation and growth, as well as opportunities for moving into new markets.

Digitalisation has triggered fundamental changes in almost all areas of business and everyday life, enabling more efficient communication, improving access to information and encouraging innovations in both company management and customer service. Companies that adapt to the digital transformation can gain competitive advantages by automating their processes, making data-based decisions and creating personalised products and services. During the coronavirus pandemic, digitalisation received an additional boost, making digital and flexible forms of learning, collaboration and organisation central to everyday life. The digital transformation is also shaping consumer behaviour, learning methods and, of course, social interaction. In the field of artificial intelligence (AI) and big data, new application possibilities have established themselves and are leading to new business models. Accordingly, digitalisation is having an increasingly significant impact on economic and social conditions. It is essential to make full use of the great opportunities offered by digitalisation, particularly when it comes to the new potential for networking and creating value.

We are experiencing a strong **technological change** at a fundamental level. Automation, digitalisation and process optimisation are leading to new requirements within companies, boosting efficiency, reducing production costs and improving product quality. However, this also reduces the need for unqualified labour and changes the demands being placed on workers. In Germany, it is industrial centres that are under the most pressure. The people affected by this development need to be offered different prospects, which in turn would increase the need for retraining and further training and the requirements placed on them. The coronavirus pandemic imposed further demands on industry in particular. There is a growing risk of increasing competition – especially on Asian markets – which puts considerable pressure on companies to adapt.

For many people, everyday working life has changed greatly due to the coronavirus pandemic and the digital shift catalysed by it. The **transformation of the world of work** covers many aspects: lifelong learning is becoming increasingly important and is creating new demand for training in almost all professions. In many jobs, people can now work from home, which in turn is placing new demands on work and workplaces. For instance, it is expected that, in the long term, a high proportion of people will work from home, which is having an increasing influence when it comes to choosing where to live and in what kind of housing. This is also having an impact on the population's mobility behaviour.

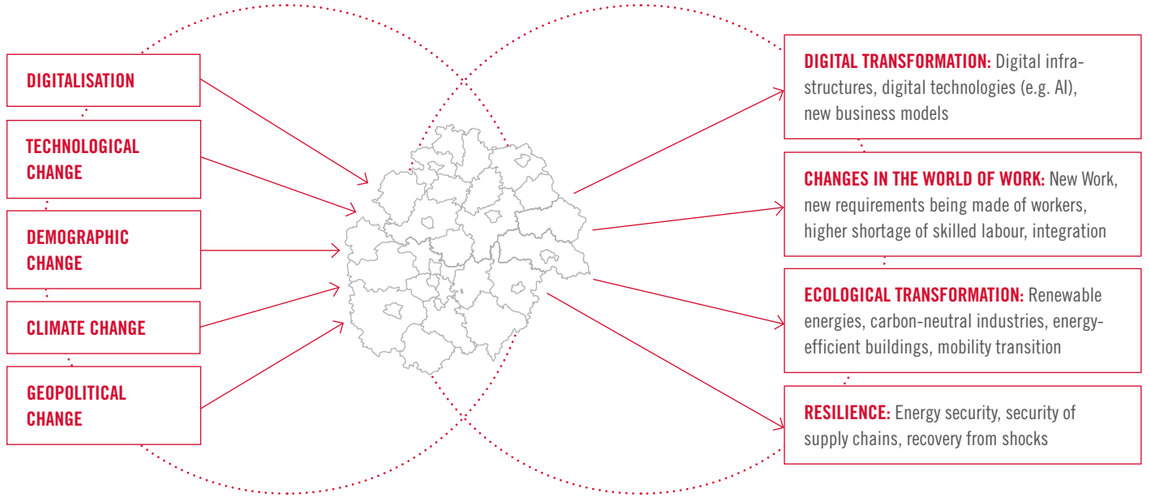
Demographic change will pose major challenges for business locations in the future. Many gainfully employed people in Germany will be retiring over the next few years and an even greater shortage of skilled labour is expected once the baby boomer generation reaches retirement age. Young people are becoming a scarce "resource" and increasingly important for the future viability of a business location. Due to the decline in labour force potential and the low appeal of certain professions (e. g. nursing and other healthcare jobs), securing skilled labour will become crucial in the coming years. To facilitate this process, the immigration of qualified skilled labour will also gain in importance. As well as the labour market effects, it is to be expected that – due to the ageing population – there will be an increase in chronic degenerative diseases and, in turn, growing demand for care and healthcare services. Given the growing competition for skilled labour and innovators, the metropolitan region of Nuremberg needs to develop locational advantages aimed at its target groups (e. g. in areas such as public services, integration capability and the vibrant cultural scene).

Migration is on the increase in many parts of the world as a result of global crises, wars and other emergency situations. Recently, many refugees came to Germany as a result of the **war in Ukraine** and because of this, integration is continuing to play an important role. The future viability of the education sector and, ultimately, of the labour market calls for vigorous efforts on the part of all key players. Different groups are shaped by varying and changing values, expectations and needs. The Ukraine war has also has a major impact on Germany's energy supply – as its **energy security** is at risk, energy-intensive companies in particular are confronted with major challenges.

German industry is also greatly influenced by geopolitical events at present. Global economic crises and disruptions to value creation and supply chains are resulting in a fundamental re-examination of international business relations. Political compartmentalisation, protectionist measures and a great many trade disputes between countries all restrict free trade and are detrimental to global competition. This means that supply chains need to change in order to become more resilient. At the same time, this increases location competition both within Germany and internationally. In addition, policymakers are aiming to establish a greater proportion of increasingly critical parts of value chains in Germany. Many regions have become far more aware of the importance of **resilience** in recent years. This relates firstly to being resistant to crises and being able to recover quickly from shocks, and secondly to being less dependent on global supply chains and energy from abroad.

Building on the Paris Agreement, various climate protection targets have been anchored in legislation in Germany and at European level over the past few years. Sector-specific reduction paths serve as binding guidelines for all industries. In response to the **climate crisis**, Europe is setting itself ambitious targets to be climate-neutral by 2050. Germany has set itself the goal of becoming climate-neutral by 2045. This is leading to significant changes at regional level because new energy forms and industrial carbon neutrality are changing existing business practices fundamentally. With its frequently energy-intensive operations, German industry depends on reliable and affordable energy. At the same time, positioning itself early on as a forerunner in carbon neutrality (and implementing the necessary steps) promises locational advantages, particularly for industry. An important step in achieving climate neutrality is the **mobility transition**, which aims to facilitate sustainable, environmentally friendly and efficient mobility. This calls for major investments, e. g. developing public transport, meeting new requirements for electromobility (e. g. charging stations) or providing sufficient space in the city for pedestrians and bicycle traffic.

OVERRIDING TRENDS AND DEVELOPMENTS WITH POTENTIAL AND CHALLENGES FOR THE METROPOLITAN REGION OF NUREMBERG



To respond to the trends and challenges outlined above, it is necessary for the metropolitan region to actively shape the conditions necessary for a future-viable development. Infrastructures need to be replaced and expanded in order to meet the new requirements relating to digital technologies or carbon neutrality. In addition, companies need to adapt to new statutory requirements and use digitalisation to remain competitive. It is vital to prepare workers for new requirements and to secure skilled labour. As well as this, developments in recent years have shown how important it is to have a resilient position, e. g. by being less dependent on energy imports and globalised supply chains. The adaptation measures outlined above are tasks that the metropolitan region of Nuremberg definitely needs to address. However, it takes more than adapting to changes to make a region truly viable for the future. It all comes down to actively using new market potential to position the region's economic structure effectively for the future. And to do this, it is imperative that we shape the digital and ecological transformation.

4 WABE 2024 – ANSWERS TO TRANSFORMATION DYNAMICS

Developing the "Leitbild WaBe" model involved determining its current status – in other words, how well it defines guidelines for developing the region, whether the questions it addresses are still relevant and to what extent it helps to position the metropolitan region. The dialogue and the analyses both demonstrated that the model from 2015/2016 is basically well positioned: the areas of competence highlight the main economic strengths of the region and their USPs. The competence initiatives linked with the areas of competence have been established for years. They have since developed into central players in the metropolitan region, making them the cornerstones of the model from a substantive and institutional perspective. Outwardly, the model is suitable for representing the economic competences of the metropolitan region. Inwardly, it creates a common understanding about the direction in which the region aims to develop economically.

At the same time, the dialogue and analyses also pointed to areas where **adjustment is needed and where potential is not being used**. Here, it was emphasised that the areas covered in the 2015/16 model were essentially correct and are, for the most part, still relevant, but that it is now necessary to examine these and align them with current developments and trends. For example, climate protection should play a greater role in the new model. The need for a stronger prioritisation was also determined in order to be able to reach a clearer focus, including in the short term. It was also made clear that the four areas of activity that were introduced during the last update could not be institutionalised as possible solutions to social challenges. Due to a lack of resources, it was not possible to tap unused potential. The need for another interface geared towards implementing the model was also made clear.

Focus of the model

In Chapter 3, we illustrated various trends and developments from recent years and concluded that these are important framework conditions for developing the metropolitan region. The chapter illustrates short- and medium-term trends such as the transformation in the world of work. By contrast, **digitalisation** and **climate change** are leading to fundamental changes, i. e. they have a **disruptive character**. And together with fundamental changes, this disruptive character is a key feature of transformations. The digital and ecological transformation is central for all companies in the region, which means that they must adapt to the upheaval but also that it is possible for them to develop new business fields and models at the same time. As digitalisation and climate change necessitate fundamental changes to structures, business models, processes and technologies, it is important to actively shape these transformations in the metropolitan region and to tap into new market potential to set the economic structure up for future success.

As well as this, there are challenges that the region also needs to address at a fundamental level. Key tasks here regard **workers** and it is essential to secure skilled labour and to create new prospects for those who are no longer able to pursue their original jobs. It is also important to make the region and its companies **resilient**, e. g. to establish energy security and to reduce dependence on global supply chains. However, the indicator analysis in Chapter 1 shows that actively funding growth areas and stimulating the **regional** economy are both essential for safeguarding the long-term competitiveness and future viability of the region. Accordingly, the model with the digital and ecological transformation focuses on the areas in which economic growth can be generated and future-viable jobs created.

→ What does this mean for the development of the "WaBe" model? The **focus** is on the **digital and ecological transformation**, which means that the model is being condensed from four areas of activity to two topics.

At the same time, it is essential to keep a close eye on interfaces between the two transformations: digital technologies play a key role in working towards climate neutrality, reducing environmental pollution and restoring biological diversity. The green transformation is also changing the digital sector. While there is potential for synergies between the two fields, conflicts of interest can also arise, e. g. through an increase in energy consumption as a result of the intensified use of digital technologies or the question of how to deal with growing electronic waste[2]. The **"twin transition"**, as it is known, aims to merge the digital and ecological transformation so that, ideally, they reinforce one other and allow synergies to be achieved. It also aims to avoid a situation where the two processes are inconsistent or even at odds with one another.

2 European Union (2022): Towards a green and digital future, Luxembourg.

→ What does this mean for the development of the "WaBe" model? The digital and ecological transformation processes must be merged as a twin transition so that synergies can be developed between the two processes and so that conflicts of interests and inconsistencies between them can be avoided.

WaBe missions

The "Leitbild WaBe" model's intention is stated in its basic orientation as a "Model of Sustainable Growth and Employment": i. e. to generate economic growth together, to retain high-quality jobs in the metropolitan region of Nuremberg and to create new ones. To achieve this, solutions to the digital and ecological transformation need to be found. The following missions demonstrate the direction the metropolitan region of Nuremberg would like to take in both transformation processes:

MISSION: "DIGITAL TRANSFORMATION"

As a metropolitan region, we provide solutions in the field of **digital innovative technologies**. A well-developed **digital infrastructure** in the metropolitan region of Nuremberg encourages the use of smart technologies, increases the economic efficiency of the region and helps to protect valuable resources. By promoting the research, development and application of **digital solutions in key sectors**, the metropolitan region is to establish itself as a pioneer in overcoming global challenges and creating a resilient, inclusive and digitally thriving economy. **Smart "living environments" in urban and rural areas** improve the quality of life for people in the region.

MISSION: "ECOLOGICAL TRANSFORMATION"

As a metropolitan region, we provide answers to the ambitious climate protection goals. The ecological transformation is the basis for the economic future of the metropolitan region of Nuremberg and also boosts the quality of life for its people. Building on our competences, we are establishing ourselves as a leading centre for environmentally friendly and climate-friendly **future technologies**. In this way, we will succeed in **decarbonising our economy**. We are increasing **energy efficiency in all our buildings** and using **renewable energy**. And we are also a byword for **future-oriented mobility and logistics concepts**.

Matrix: a flexible governance tool

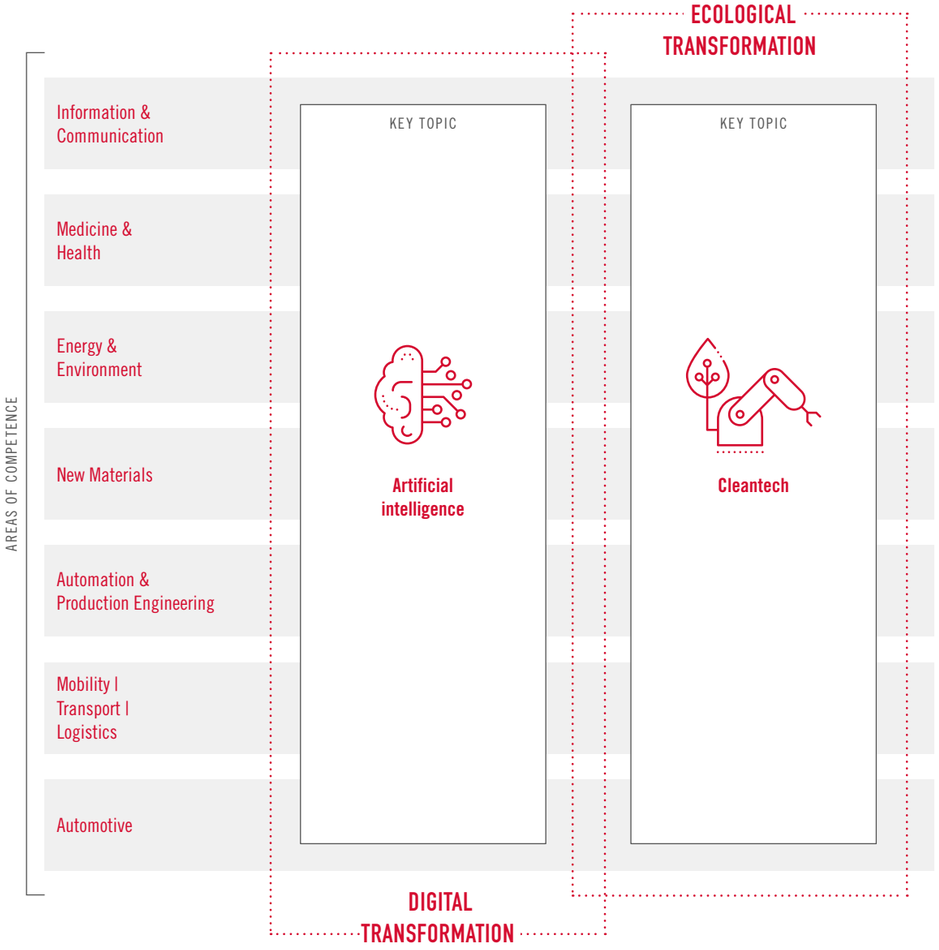
The areas of activity in the "Leitbild WaBe" model, which still greatly shape its focus, were defined with the most recent development of the 2015/16 model. However, the transformations are very dynamic. This can be seen from the example of cleantech, which was set up in the region in recent years in response to the requirements of the European Green Deal from 2019. The metropolitan region's aim is to develop technological solutions for reducing greenhouse gases. However, it has not yet been possible to integrate cleantech within the model as a key topic. This means that the areas of activity that have been incorporated to date are fixed and cannot be adapted dynamically to the latest topics.

In addition, the areas of activity were developed in order to demonstrate in which areas solutions can and should be found by different players working together. At the same time, the individual areas of activity are siloed even though there are many **interfaces** between them.

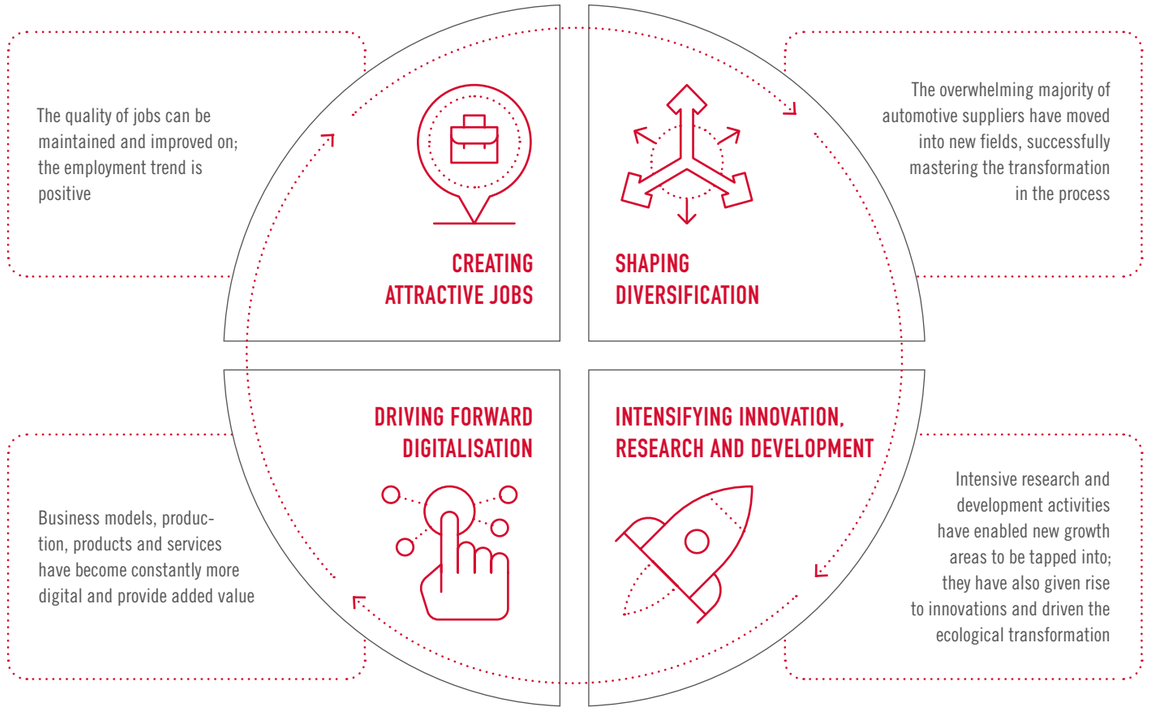
→ What does this mean for the development of the "WaBe" model? The model needs to be **more open** so that it can integrate new areas dynamically and map interfaces more effectively.

To make the model more dynamic, it is being transferred into a **matrix structure**. The basic building blocks of the matrix are the **areas of competence** (the cornerstones of the "Leitbild WaBe" model) and the two **basic transformations, i. e. digital transformation and ecological transformation**. The areas of competence are all influenced and changed by these two basic transformations. In this regard, they have a cross-sectional character with areas that are important for all areas of competence. As well as this, the basic transformations have a different depth of impact on the areas of competence. Accordingly, it is essential to develop – within the areas of competence and in cooperation – solutions for overcoming the digital and ecological transformation. This solution development harbours **new market potential** with common topics for the areas of competence.

BASIS FOR MATRIX STRUCTURE



MISSION "FUTURE TRANSFORM_EMN 2035"



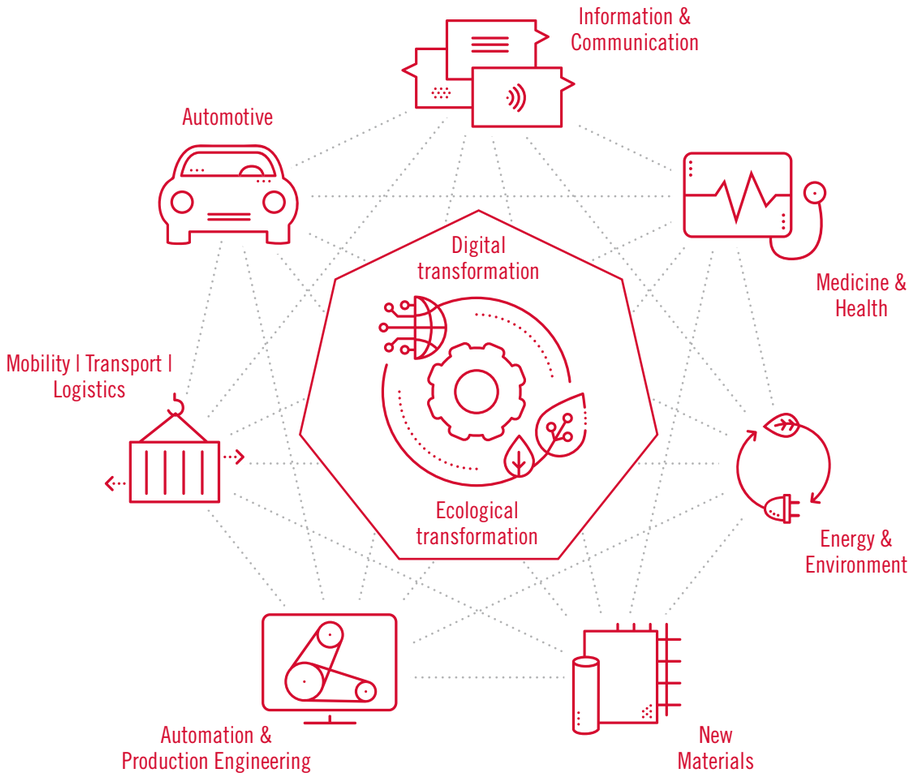
Source: Diagram based on Strategieprozess und Zielbildentwicklung transform_EMN, by Künneth, R. / Fuhrmann, O., published by the Nuremberg Chamber of Industry & Commerce for Franconia, 2023, p. 24.

All areas of competence contain **topics** – as a further component of the matrix – that show where there is future potential in each case. During the development process, topics were identified as a starting point and transferred into the first version of the matrix (see p. 29). For example, telemedicine is an important topic in the Medicine & Health area of competence when it comes to making healthcare viable for the future. Developing solutions for extracting green hydrogen as an alternative drive form (and for storing it and using it safely) is an important topic in the Energy & Environment, Automation & Production Engineering and Automotive areas of competence. These topics can be updated at regular intervals through the matrix structure[3]. This makes the matrix an **agile governance tool** that can be adapted continually to new conditions and therefore respond **quickly** to changes. Juxtaposing the topics in the matrix allows overlaps to be identified easily. This in turn makes it possible to find **flexible alliances** between different areas of competence in special topic areas and to develop these topics together. These alliances do not require any governance here but can take effect **through projects**, for example. Lastly, the collection of topics in the matrix also allows a number of **region-specific topics to be strategically developed**, which allows them to be actively addressed. One example of this is the *transform_EMN* transformation network funded by Germany's Federal Ministry for Economic Affairs and Climate Action. In this project, experts from the realms of industry, science, policymaking/administration, business development and trade unions put together a mission – *Zukunft transform_EMN 2035* – relating to the automotive topic area with a focus on the generic goals of the digital and ecological transformation[4].

3 This is explained in more detail in Chapter 6.

4 See diagram above.

5 OPENING UP MARKETS OF THE FUTURE WITH KEY THEMES

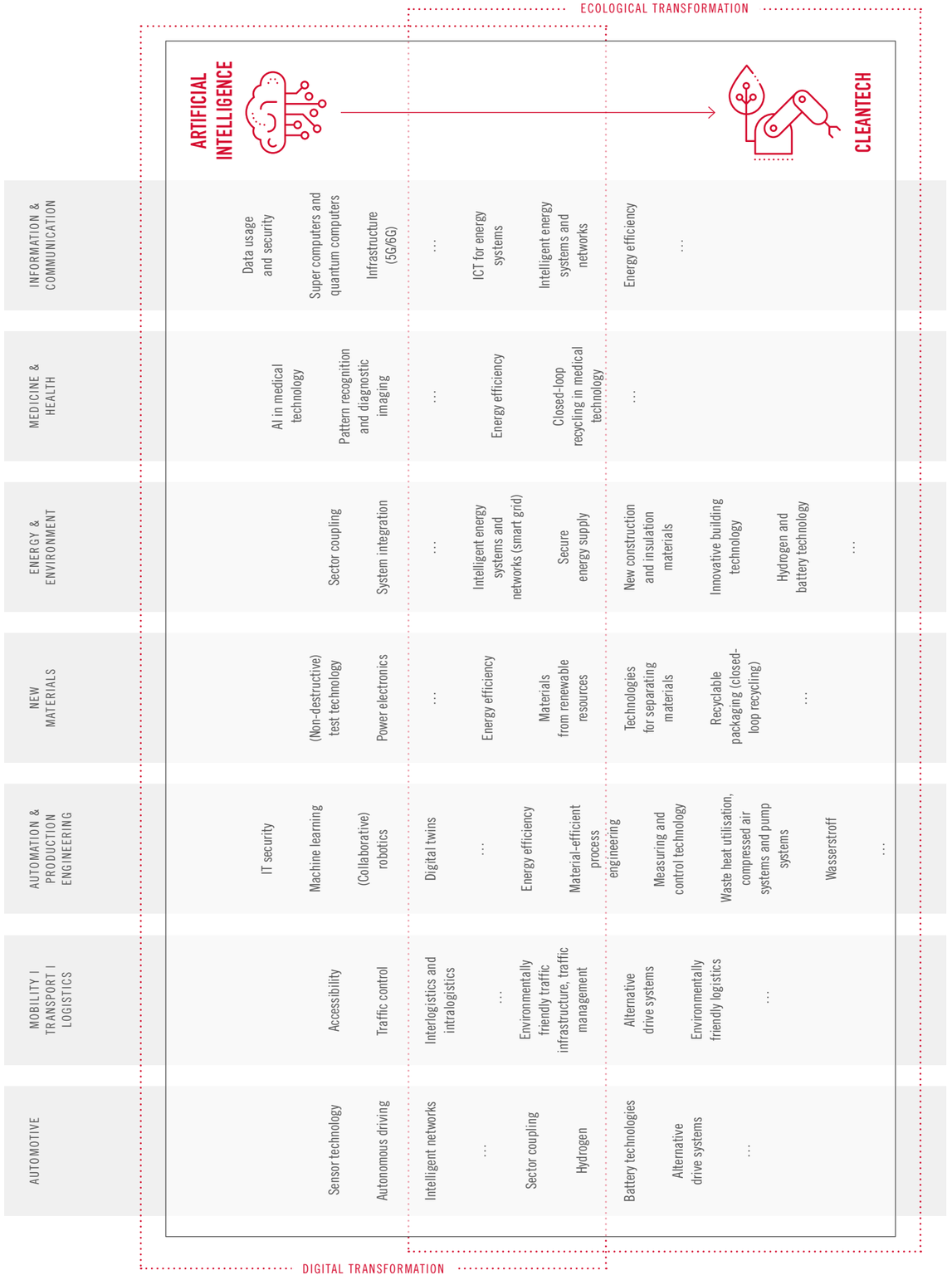


Using the matrix, we can take topics that are of relevance for several areas of competence and **bundle them into key themes**. In **digital transformation**, for instance, it is impossible to imagine certain key areas – such as pattern recognition and diagnostic imaging, machine learning, digital twins, interlogistics and intralogistics – in the future without **artificial intelligence**. Firstly, it is necessary to use AI to remain competitive on the global market. Secondly, AI has huge market potential and growth opportunities that should be tapped into. With its expertise in artificial intelligence, the metropolitan region of Nuremberg is already well positioned and should build on this so that it can help to actively optimise AI systems (see Chapter 5.1).

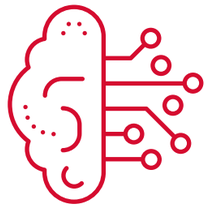
The area of **ecological transformation** contains different areas of competence in the metropolitan region that are developing alternative drive technologies like hydrogen and battery technologies – these include Energy & Environment, Automation & Production Engineering, Transport & Logistics and Automotive. These technologies aim to reduce the negative environmental impact, use resources more efficiently and protect natural resources. In addition to this, different areas of competence focus on material and resource efficiency (Medicine & Health, New Materials, Automation & Production Engineering). These environmentally and climate-friendly future technologies can be combined under the definition of **cleantech**. Here, too, there is pressure to adapt, e. g. through statutory regulations. As well as this, the metropolitan region has the competences in this area to develop new technologies and to use this topic for economic gain (see Chapter 5.2).

Accordingly, **artificial intelligence and cleantech were condensed into the first key themes**, which help to establish a focus and also to direct attention to the market potential. They set a (temporary) **focus** and therefore **reinforce** the model. Derived from this is the diagram opposite, which shifts the two key themes into the focus of the collaboration between the competence initiatives.

MATRIX WITH KEY THEMES



5.1 ARTIFICIAL INTELLIGENCE (AI)



The twin transition – linking digital and sustainable transformation – is shaping the future of business and society alike. Artificial intelligence (AI) is a central driving force here, merging the potential of digitalisation and sustainability. It offers wide-ranging possibilities for making the transition **more efficient, more innovative and more resource-friendly**. AI has a dual role in the context of the twin transition: it **optimises digital processes** and helps to **implement sustainable technologies** at the same time. AI is not only a tool for the digital transformation but also an **engine for growth and competitiveness** in a changing economy.

Types and potential of artificial intelligence

The development of artificial intelligence (AI) is a **milestone in technological progress**, comparable with the introduction of telecommunications and computers. In the same way that these technologies once revolutionised automation and efficiency in business and society, AI is now on the verge of ushering in a new era in this field. As well as permitting advanced data analysis and processing, they optimise processes and offer a wide range of further potential. AI analyses data and uses machine learning (or neural networks and deep learning) to aid decision-making or problem-solving. These technologies are already established in many areas today. In contrast to this, **generative AI** focuses on creating new content such as images, texts and designs, primarily unlocking its potential in creative industries (e. g. generating art or advertising) and prototyping (e. g. simulations or designs) and offering new possibilities for generating ideas and creativity. The diagram on page 31 shows the different types and potential of artificial intelligence and gives a non-exhaustive overview of the areas in which these are used.

While **Weak AI** is geared towards specialised tasks – for example in assistance systems or marketing applications – **Strong AI** aims to reach a human-like level of intelligence that can solve problems and learn independently. One application of AI that is already largely established is **machine learning**, a method by which systems learn from data without being explicitly programmed. This is used in areas such as robotics, predictive maintenance and automation, such as in Industry 5.0. The advancement of Industry 4.0 shifts the focus to intelligent and networked systems. AI allows repetitive tasks to be automated, saving time and costs. A specialist form of machine learning is **deep learning**, which manages complex tasks such as image and speech recognition. Here, AI is used in areas such as medical diagnostics, sustainable urban development and sensor technology. This sub-area of AI uses adaptive learning methods that make it possible to generate more precise results from large amounts of data. **Cognitive computing** also concentrates on systems that think like a human and can make decisions. This is used for example in cybersecurity, where such AI systems can recognise and analyse threats, or in image analysis, which is mainly used in medicine or for monitoring systems. Lastly, **neural networks**, which are inspired by how the human brain works, play a central role in applications such as virtual reality (VR) and augmented reality (AR). A further potential field for AI is **natural language processing (NLP)**, which deals with processing and interpreting natural language. This is relevant for example in language assistants, translation programs or chatbots.

AI can analyse **large amounts of data** in next to no time and can also recognise patterns and help users to make well-founded decisions. This is a particular advantage in industry and in the energy sector for optimising processes and using resources efficiently, but also in data-intensive sectors like the finance industry or logistics. **Small and mid-sized companies** in particular can use AI to boost their efficiency and, in turn, increase their competitive advantage over large corporations. **Quantum technologies and quantum computers** have the potential to increase computing power and speed many times over. If the full power of AI is to be unlocked, quantum computers will be essential for providing new capacities for larger amounts of data. The market for quantum computers is still in an early stage of development in which, to date, only component and equipment manufacturers are generating profit through sales to research institutions, universities and technology companies. However, it is expected in future that quantum computers will find their way into commercial usage and trigger a revolution in data processing, especially in areas such as materials research, optimising complex supply chains or developing new medication.

In addition to the wide and varied potential of AI, there are concerns about the rationalisation of jobs. However, this fear is put into perspective by the demographic change, which is set to reduce the workforce potential. **AI is fundamentally changing the world of work** by not only transforming existing occupations but also by creating new jobs. There is a particularly great demand for people with skills in fields like data science, AI development and mechanical engineering. At the same time, generative AI is expected to redefine the work mix by automating routine tasks and putting a greater focus on creative and strategic jobs.

The metropolitan region of Nuremberg should make use of artificial intelligence and tap into its diverse future markets in order to safeguard sustainable growth and future-viable employment in the region.

AI in the European Metropolitan Region of Nuremberg

There are already many touchpoints for artificial intelligence in the metropolitan region. With strong research institutions, innovative companies and a growing infrastructure, it is increasingly offering ideal conditions for harnessing the potential of AI and extensive investments are already being made in this growth field. With the creation of the *AI Campus Nuremberg at the University of Technology Nuremberg (UTN)*, the city now has a forward-looking centre for AI research and teaching. The campus is to serve as a central base for IT study programmes with an AI focus and to concentrate on the development of AI fundamentals and their practical applications. Here, work is carried out in innovative research fields like robotics, cybersecurity and natural language processing (NLP). At the same time, the AI Campus is to form an interdisciplinary platform that combines technical, social and ethical perspectives and promotes the development of AI in science and in society in general. In addition to the use of AI in scientific disciplines such as biology, chemistry and physics, the AI Campus will research specific AI applications in the next generation of manufacturing technology and put them into practice.

TYPES AND POTENTIAL OF ARTIFICIAL INTELLIGENCE

Since being founded in 2004, the **Bamberg Centre for Artificial Intelligence (BaCAI)** has played a key role in AI research and development. The centre specialises in different areas of artificial intelligence such as machine learning and has a clear focus – to develop intelligent technologies that help people rather than replacing them. With its method-oriented basic research, the centre enjoys an excellent international reputation and makes a key contribution towards advancing AI, particularly with regard to the interaction between people and machines. This means that the BaCAI is not just a pioneer in research but also an important partner in the development of innovative, people-centric AI applications. For example, the KMU-KI-Erfahrungszentrum project currently assists SMEs with their digital transformation. The project is taking place at the Cleantech Innovation Park (see page 35 f.).

Another important scientific pillar in the metropolitan region is **Fraunhofer IIS, the institute for integrated circuits that has facilities in Erlangen, Nuremberg and Fürth** and leads the way in developing advanced AI technology, especially in the field of language and image processing. Here, innovative solutions are developed that are not only used in research but also in industry and commerce. The institute plays a key role in promoting AI solutions in a wide range of areas, from medical image processing and speech technology to advanced audio and multimedia technologies. By working closely with business and research, Fraunhofer IIS is instrumental in further expanding the metropolitan region of Nuremberg as a key location for artificial intelligence and implementing the potential of these technologies into practice-oriented solutions.

The regional economy is also increasingly turning to artificial intelligence as a key technology. A prime example of this is **Erlangen being established as a nucleus for technology activities relating to the industrial metaverse**. With an investment volume of €500 million, Erlangen is being expanded as a centre for innovation and research in this forward-looking field.

The innovative capacity of the metropolitan region can also be seen in the dynamic networks and facilities that bring companies, research institutions and start-ups together to work on forward-looking solutions that are making a significant contribution towards establishing the region as a key location for artificial intelligence. A prime example of such strong networks is the **Center for Responsible Artificial Intelligence at Coburg University**. The interdisciplinary exchange that is encouraged here puts the focus on the responsible development and application of AI technology. It also serves as a bridge to the companies in the region to help them integrate AI throughout their business processes and to become more competitive. The centre also promotes networks and interaction in the innovation triangle Coburg-Kronach-Lichtenfels, thereby strengthening AI expertise in the region.

Another important network in the region is **AN[ki]T in Ansbach**, which helps local SMEs to successfully integrate digital technologies – including artificial intelligence – into their business processes. With a focus on practical consultation and customised solutions, the centre encourages the digital transformation among regional companies, thereby helping to make them more competitive. Here, AI is seen as a key technology that not only increases efficiency but also paves the way for new business models. With the support that it provides, the centre is positioning itself as an important partner for SMEs and is instrumental in further expanding the region as a future-viable and innovative location for digital technologies and AI.

There are a great many other competences and projects relating to artificial intelligence in the metropolitan region of Nuremberg, including the TI-Modellregion Franken model region programme in the Franconian healthcare network, the **XR Hub Nürnberg**, the **Digital Festival** and **OM7**. All of these promote interaction between different disciplines and the use of AI in various sectors as well as offering companies, research institutions and start-ups valuable platforms for cooperation and growth. Support for start-ups also comes in the form of the **Zollhof Tech Incubator** which, as the leading business incubator for digital companies in the region, plays an important role in implementing AI. AI is helping to shape the digital transformation while also creating new economic perspectives. It is just a question of seizing these opportunities and maximising the potential.

Market opportunities

The market opportunities for artificial intelligence are growing steadily, which can be attributed to the fast, ongoing development of the technology and the wide range of applications in various sectors. With the arrival of ChatGPT in 2022, most people found out for the first time what AI is and what it can be used for. Within six months, approximately 60 to 70 percent of people working in companies had already used AI. More than two thirds of companies also expect to step up their investments in AI considerably[5]. Investments in generative AI in particular are increasing rapidly, which reflects its abilities and potential for future growth. Artificial intelligence has established itself as one of the most promising business fields and **growth markets – and sectors** such as healthcare, mobility, logistics and production are already benefiting massively from AI solutions. Companies that adopt AI early on can secure competitive advantages.

According to a study from 2024, the **global AI market** is set to grow from US$540 billion in 2023 to US$1,270 billion in 2028[6]. In other words, the market is expected to more than double, with growth in the region of 135 percent. This would be the equivalent of three times Austria's GDP in 2023[7]. The forecast for annual growth in the AI market is around 19 percent[8]. Differentiated for the various application potential of AI, the following picture emerges with regard to market and growth potential:

- **AI FOR MACHINES:** The use of networked sensors facilitates a quantum leap in collecting, integrating and processing data. These technologies allow industrial processes to be rendered more efficient, production processes to be optimised and resource usage to be reduced. At the same time, the market for industrial AI is growing continually and will reach an estimated volume of **US$330 billion** by 2028. With an average **annual growth rate of around 13 percent**, this area is one of the central driving forces behind digitalisation in industry.
- **AI FOR PROCESSES:** Artificial intelligence for processes offers enormous potential, particularly for providers of automation and workflow management solutions and for major ERP providers. Intelligent process automation can optimise management activities ushering in a new wave of automation. These technologies are used above all in financial services, public administration and in central corporate functions such as HR, finance and compliance. At the same time, the market for AI-based process solutions is growing continually and will reach an estimated volume of **US$390 billion** by 2028, with an **annual growth rate of around 18 percent**.
- **AI FOR PEOPLE:** Artificial intelligence for people includes tools that aid decision-making processes and also virtual assistants. These applications are being very well received, especially in sectors such as financial services, healthcare, e-commerce and media. They help people to carry out complex analyses, improve communication and increase efficiency in everyday activities. The market for AI-based solutions geared directly towards people is experiencing particularly dynamic growth. It is set to reach an impressive volume of **US$380 billion** by 2028, with an average **annual growth rate of around 25 percent**.
- **AI FOR SOFTWARE:** Artificial intelligence for software focuses on tools that automate the IT development process and help to generate code. These technologies make it possible to shorten development times, reduce costs and greatly increase efficiency in software development. The market for AI-based software solutions is growing dynamically and will reach an estimated volume of **US$170 billion** by 2028. With an average **annual growth rate of around 25 percent**, this is one of the most innovative fields in the IT sector.

What do we need to address?

In the final workshop, participants outlined areas of activity and ideas illustrating how the key theme in AI can be defined and addressed for all areas of competence.

As outlined above, one of the metropolitan region's central strengths relating to AI is its **strong scientific base** and numerous research institutions. One particularly remarkable factor in this regard is the high applicability of AI research with a clear **focus on industrial AI, medical applications** and **digitalisation among SMEs** in IT. At the same time, there is a growing need to further develop forward-looking technologies like autonomous robotics for specific purposes.

The region is also home to **many start-ups in the field of artificial intelligence**, which are developing forward-looking solutions with innovative approaches and high-level competence. These young companies are bringing fresh new ideas into the region's economy and strengthening its innovation ecosystem. Start-ups need suitable platforms, testing environments and cooperations in order to make their products visible and establish them successfully on the market. Partnerships with major companies are especially valuable as they not only offer access to extensive resources but can also make their **large databases** available. The region has a high level of **data competence in various companies** – with the possibility of using AI to develop new business models and, in turn, to create value. Opening up these data sources in the form of cooperations with emerging start-ups or other companies can make a significant contribution towards the digital transformation and end up being a win-win situation for the region.

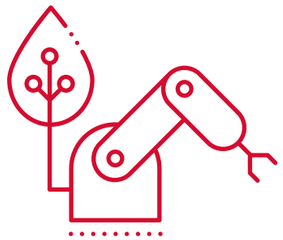
While the metropolitan region is well positioned in research, there are still shortcomings in the broad practical application of AI in business. Currently, many companies are focusing their attention on standard software and basic technologies that are not always geared towards the specific needs of the region and its companies. Particularly in areas such as **IT security** and language models, there is often a lack of **customised solutions** that give the region a real competitive edge internationally. In addition, the importance of **cybersecurity** as a basis for trustworthy AI applications is growing as digitalisation and networking increase. By funding research and development in this area, the metropolitan region can play **a pioneering role and create innovative security solutions** that have an impact far beyond the region itself. A stronger connection between IT security research and practice-oriented applications could help to establish the metropolitan region as one of the leading locations for secure AI implementations.

There is also potential in closing **the AI gap among SMEs and skilled trade** companies. Many companies in these areas are still in the very early stages of digital transformation and need assistance in increasing the maturity level of their AI technology. Adapting to the digital transformation can also help to create **attractive and future-viable jobs** and there are already initiatives in place to do this, such as AN[ki]T in Ansbach and the KMU-KI-Erfahrungszentrum project in Bamberg. The many companies in the metropolitan region of Nuremberg's digital economy offer further starting points for helping SMEs and skilled trade companies. Here, it is vital to develop clearly defined and practice-oriented use cases that make the added value of AI tangible.

One other important starting point in the key area of artificial intelligence is the **sustainable design of AI solutions**. This involves developing and using AI applications in such a way that they fulfil both ecological and social criteria. Energy efficiency plays a key role here since AI systems often require enormous computing resources. The metropolitan region can build on its established strengths in energy to promote innovative approaches for resource-friendly technologies. At the same time, taking a sustainable direction will help the region to become a pioneer in developing responsible AI solutions that also create added value for society.

5 Chui et al. 2023: The state of AI in (2023): Generative AI's breakout year, QuantumBlack AI, by McKinsey.
6 Sopra Steria Next SE (2024) (Ed.): AI Study – 4 business-centric categories to leverage performance
7 Austrian GDP was around US$473 billion in 2023. Data based on: Eurostat 2024.
8 Sopra Steria Next SE (2024) (Ed.): AI Study – 4 business-centric categories to leverage performance

5.2 CLEANTECH



The term cleantech is the abbreviation of “clean technologies” and is used to describe **environmentally and climate-friendly future technologies**. These technologies aim to reduce the negative environmental impact, use resources more efficiently and protect natural resources. In this context, “technologies” not only includes products but also services and processes.

At EU level, cleantech is at the heart of the plan for industry in connection with the Green Deal. European Commission President Ursula von der Leyen is quoted as follows:

> “We have a once-in-a-generation opportunity to show the way with speed, ambition and a sense of purpose to secure the EU’s industrial lead in the fast-growing net-zero technology sector. Europe is determined to lead the clean tech revolution. […]”
>
> Ursula von der Leyen,
> President of the European Commission

In Bavaria, cleantech is part of the **high-tech agenda** being pursued by the Ministry of Economic Affairs. In the Hightech Agenda Bayern, the main focus is on developing clean technologies – such as synthetic fuels, state-of-the-art battery research and hydrogen – as energy sources of the future.

Cleantech – a future market

Cleantech[9] is a **cross-sectoral industry** that consists of various **lead markets.** Some of these markets – water management, for example – are entire industries that can be considered part of cleantech. Other lead markets concern areas of conventional industries and therefore also the areas of competence in the metropolitan region of Nuremberg. In the automotive sector, for example, key developments are pushing forward alternative drive technologies and renewable fuels. Here, cleantech is **paving the way for the ecological transformation** and, from an economic perspective, has developed into a **key market** with significant potential for growth[10]. A study conducted in the federal state of Hesse shows that the sector is not only growing faster than the overall economy but is also creating more stable, long-term jobs[11]. This is exactly where the focus of cleantech as a key theme lies in the model: cleantech is seen as a cross-sectoral industry that creates economic growth and potential for jobs. Among other things, this potential stems from the fact that companies and other institutions are required by law to implement climate change adaptation measures. The aim of the key theme is not just to respond passively to these legal regulations but, as a market, to actively use and help shape demand for suitable goods and services.

The cleantech sector is divided into different lead markets. The diagram on page 35 shows lead markets that offer touchpoints for the areas of competence within the metropolitan region of Nuremberg on the key theme of cleantech. Here, the aim is to build on existing cleantech competences and strengths in the metropolitan region and to develop these further.

Cleantech in the European Metropolitan Region of Nuremberg

There are already numerous touchpoints for the aforementioned lead markets in the metropolitan region, which has a strong position in energy research and technology. Since 2020, a total of €273 million has been provided to fund federal research projects in this area in the metropolitan region of Nuremberg. This is equivalent to 19 percent of all federally funded projects in the region. This means that the proportion of energy research and technology projects is higher than in Bavaria (15 %) and Germany as a whole (14 %)[12]. This topic is at the interface between the lead market of environmentally friendly energy generation, storage and distribution and the area of sustainable mobility. **Battery research** is located at this exact interface between energy storage technologies and alternative drive technologies. Here, the **Bavarian Centre for Battery Technology at the University of Bayreuth** is a nucleus in the metropolitan region of Nuremberg. The Bavarian Centre for Battery Technology (BayBatt) is a national competence centre that bundles battery-specific expertise in physics and chemistry, materials science, engineering, IT and economics. As well as research, the topics are included in the university curriculum, thereby training specialists for the region.

In addition to battery research, the metropolitan region of Nuremberg is ideally positioned in the area of developing **hydrogen** as a future energy form. An important institution here is the **Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (HI ERN)** in Erlangen. HI ERN researches and develops material- and process-based solutions for a climate-neutral, sustainable and low-cost utilisation of renewable energies. The focus here is on solutions in the field of hydrogen and solar technology. A total of 14 universities and research institutions in the metropolitan region have expertise in hydrogen. This puts the metropolitan region in second place in the national comparison of regional density of hydrogen research institutions[13].

9 In other federal states – for example in Baden-Württemberg and Hesse – the cross-sectoral industry is sometimes referred to as “GreenTech”, which is equated with cleantech here.

10 See Hessen Trade & Invest GmbH (2024): GreenTech in Hessen, UTBW (2023): Analyse der Greentech-Branche in Baden-Württemberg, BMU (2021): Green Tech made in Germany 2021. Umwelttechnik-Atlas für Deutschland.

11 Hessen Trade & Invest GmbH (2024): GreenTech in Hessen

12 In-house analysis by Prognos. Data based on list of funding by the German government (Fökat), effective date 19 April 2024. Projects starting on or after 1 January 2020.

13 See https://www.hyplus.de/

LEAD MARKETS IN WHICH MARKET POTENTIAL IS OPENING UP FOR THE AREAS OF COMPETENCE WITHIN THE METROPOLITAN REGION

Environmentally friendly energy generation, storage and distribution

- Renewable energies
- Storage technology
- Intelligent energy systems and networks
- Electrification in industry

Sustainable mobility

- Alternative drive technology
- Intelligent traffic infrastructure and traffic control
- Technologies for increasing efficiency
- Renewable fuels

Energy efficiency

- Energy-efficient production processes
- Energy-efficient buildings
- Efficient power grid

Material and raw material efficiency

- Use of measuring and control technology in industrial production
- Material-efficient and circular production processes

Circular economy

- Circular and material-efficient production processes
- Renewable raw materials and environmentally friendly materials

Source: Diagram based on UTBW (2023): Analyse der Greentech-Branche in Baden-Württemberg, BMU (2021): GreenTech made in Germany 2021. Umwelttechnik-Atlas für Deutschland, Hessen Trade & Invest GmbH (2024): GreenTech in Hessen

With the largest electrolysis plant in Bavaria for generating green hydrogen, **Energiepark Wunsiedel in Fichtelgebirge** is seen as a flagship project in the shift towards renewable energy. The electrolyser was developed by Siemens Energy. Around 90 companies in the metropolitan region of Nuremberg are working on new technologies and solutions for the hydrogen economy[14]. Over 150 players from the region are networked in the pioneering field of hydrogen via the **Wasserstoff-Metropolregion Nürnberg hy+** platform. Siemens Energy, a key player in the energy sector, is also working on large-scale research projects together with other institutions, e. g. on the series production of electrolysers (H2-Giga) and generating hydrogen on the high seas (H2Mare). In Bamberg, Bosch is expanding the series production of solid oxide fuel cells. The project received €17 million in funding from the Bavarian Ministry of Economic Affairs and €40 million from the German federal government (IPCEI hydrogen programme).

Energie Campus Nürnberg is developing new technologies for a holistic energy system. As an independent research network, four research institutions from the metropolitan region of Nuremberg are working together as an interdisciplinary think tank. Apart from renewable energies, energy storage and electrical networks, the focus here is on **energy efficiency**. In construction, both new materials for insulation and new building technologies and systems are being developed. In the industrial sector, new electrical drive concepts are being developed while existing systems and products are being optimised and advanced. Further key players include the Chair of **Manufacturing Automation** and Production Systems at the University of Erlangen, which helps companies to increase (energy) efficiency in individual processes and in process chains, production facilities and entire factory floors.

Cleantech is already being advanced throughout the metropolitan region of Nuremberg. Since 2023, the **cleantech cluster** in Hallstadt (near Bamberg) has been helping small and mid-sized companies from the region to shift towards more sustainable and innovative technologies. The cluster is closely linked with the expansion of the **Cleantech Innovation Park**, which is also located there. Here, the development of sustainable technologies is actively encouraged, and research institutions and companies are provided with a platform for networking and collaborating on topics such as renewable energies, alternative drive concepts and sustainable production. A further component is the **Cleantech Innovation Summit**, which was organised for the first time in 2023 and is to take place every year in the Cleantech Innovation Park in Hallstadt. The aim of the summit is to network the regional economy, science and policymakers on each key issue and to work together to drive forward sustainable technologies. The Cleantech Innovation Summit is also part of the Cleantech-Kompetenz project, which is based in the offices of the metropolitan region of Nuremberg.

14 vgl. https://www.hyplus.de/

Market opportunities

The cleantech lead markets already have a relevant market volume and are essentially growth markets with high growth rates. The Environmental Technology Atlas for Germany[15] expects the **total global market volume to more than double** between 2020 and 2030, i. e. from €4,629 billion in 2020 to €9,383 billion in 2030. Globally, this corresponds to an annual growth rate of 7.3 percent. On the German market, **annual growth as high as 8.1 percent** is expected for all lead markets (2020: €392 billion; 2030: €856 billion).

Differentiated for the lead markets, in which the metropolitan region of Nuremberg has particular growth potential based on its competences, the following picture emerges:

- According to the Environmental Technology Atlas, the lead market **ENVIRONMENTALLY FRIENDLY ENERGY GENERATION, STORAGE & DISTRIBUTION** is set to triple in Germany from €40 billion (2020) to €121 billion (2030). This is equivalent to an **annual growth rate of 11.7 percent**. All market segments in the lead market are recording dynamic growth. Annual growth in storage technology (12.4 %) is just ahead of renewable energies (12.0 %). This is also substantiated by estimations from the International Energy Agency, which expects the world market for clean energy to triple to a volume of US$650 million (approx. €600 billion) by 2030. It also expects global employment in this market to more than double from 6 million to 14 million in 2030.[16]
- According to the Environmental Technology Atlas, the lead market **SUSTAINABLE MOBILITY** will more than double in Germany from €91 billion (2020) to €195 billion (2030). This corresponds to an **annual growth rate of 7.9 percent**. Growth in the field of alternative drive technologies is particularly strong at 20.8 percent.
- According to the Environmental Technology Atlas, the lead market **ENERGY EFFICIENCY** will more than double in Germany from €117 billion (2020) to €266 billion (2030). This corresponds to an **annual growth rate of 8.6 percent**. The greatest growth potential is in the Energy Efficiency in Buildings market segment with 12.1 percent per annum.
- The lead market **MATERIAL & RAW MATERIAL EFFICIENCY** is set to double in Germany from €78 billion (2020) to €155 billion (2030). This corresponds to an **annual growth rate of 7.1 percent**. The strongest growth is being recorded by the Cross-Sectional Technologies market segment – e. g. biotechnology, nanotechnology and organic electronics – with 11.3 percent annually.
- In a study conducted for the Federation of German Industry (BDI), Deloitte estimates that gross value added in the **CIRCULAR ECONOMY** lead market will increase by **€5 billion annually** in the recycling industries directly and by €7 billion in upstream and downstream sectors, e. g. in logistics. It also expects employment in this area to increase by 71,000 people in Germany.[17]

What do we need to address?

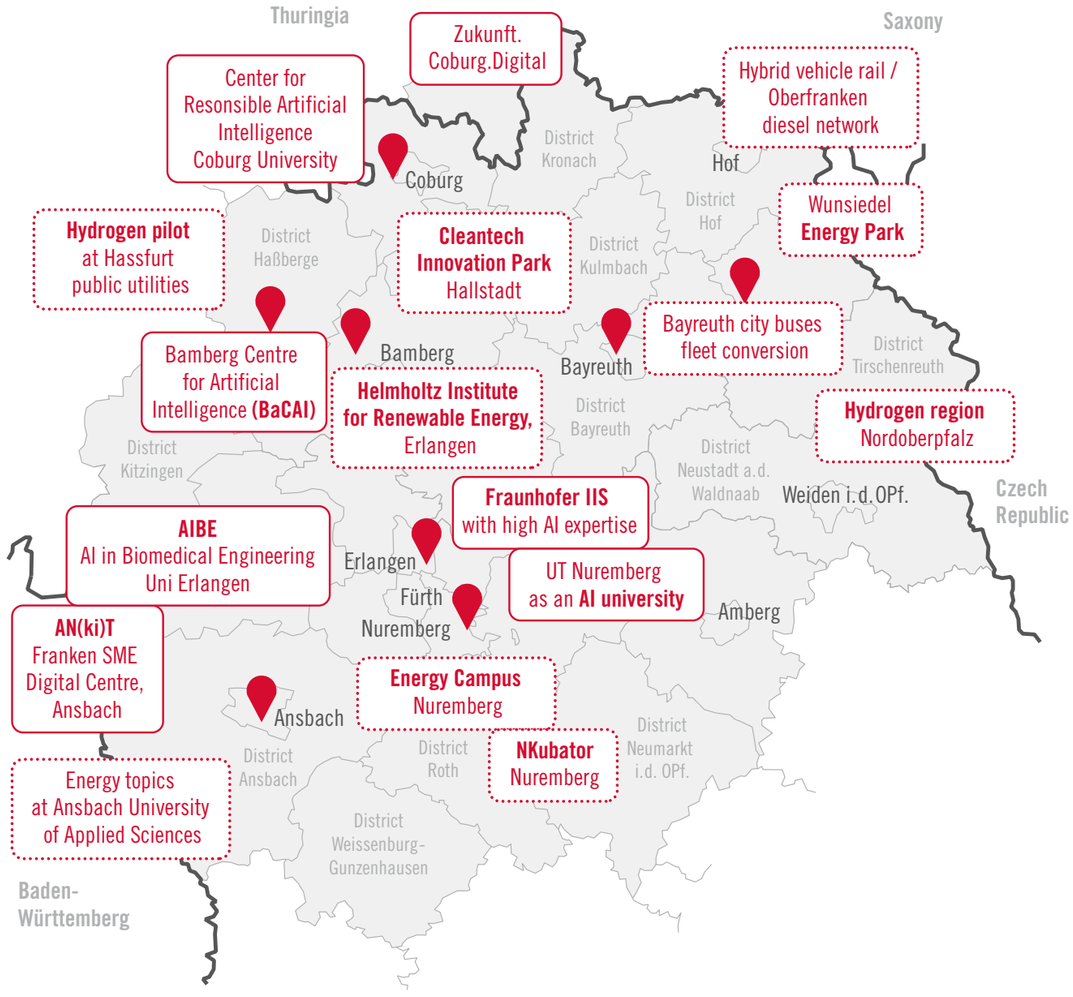
In the final workshop, participants outlined ideas that can be set and addressed as key areas of focus in the field of cleantech for all areas of competence. The first idea consists of establishing a **value chain for hydrogen-powered trucks** in the metropolitan region of Nuremberg. To this end, competences can be bundled in the region in the field of drive technology, mechanical engineering and lightweight construction/material applications and in the Campus Future Driveline. The outstanding competences in hydrogen in the metropolitan region of Nuremberg have already been emphasised above. The campus is a cooperation between FAU Erlangen-Nuremberg, the Nuremberg Institute of Technology and MAN Truck & Bus. Laboratories for joint research in future mobility are available on the grounds of the MAN factory in Nuremberg, which produces diesel engines and is now developing technologies for battery packs, fuel cells and electric motors.

A second project idea concerns **energy-efficient and circular production**. The metropolitan region of Nuremberg has a wide range of competences for developing components for product providers and machine manufacturers that allow more energy-efficient or circular (i. e. more material-efficient) production. Here too, the region is extremely well positioned with the fields of automation technology (e. g. with the Chair of Manufacturing Automation and Production Systems in Erlangen), sensor technology, AI, lightweight construction and material applications. The NKubator also plays a key role as a business incubator.

15 all of the following figures have been taken from the Environmental Technology Atlas: BMU (2021): GreenTech made in Germany 2021. Umwelttechnik-Atlas für Deutschland
16 IEA (2023): Energy Technology Perspectives, EU KOM (2023): Industrieplan zum Green Deal
17 Deloitte & BDI (2021): Zirkuläre Wirtschaft. Herausforderungen und Chancen für den Industriestandort Deutschland

5.3 FUTURE LOCATIONS OF THE METROPOLITAN REGION OF NUREMBERG OPEN UP KEY THEMES

Finally, the map of the key future locations in the metropolitan region of Nuremberg shows that the two key themes – cleantech and artificial intelligence (AI) – are being cultivated throughout the entire metropolitan region. This regional diversity illustrates that the competences are widely distributed throughout the region and that the region as a whole can benefit from the key themes.



6 OUTLOOK

The “Leitbild WaBe” model serves as a guideline for sustainable growth and employment in the European Metropolitan Region of Nuremberg. It specifies basic principles for economic, technological and scientific developments in the metropolitan region and is an important part of its strategic orientation. It is essentially a compass that shows the way from the current situation to long-term development prospects for the region, creating a framework in which the key players in the regional economy can network as well as consolidating and expanding the regional value chains. The model will help to build a positive image and strengthen the profile of the metropolitan region of Nuremberg – both in Germany and abroad – as a dynamic and innovative economic region with a high quality of life.

In the “Leitbild WaBe” model, there are **seven areas of competence** that stand for sectors in which the metropolitan region of Nuremberg is particularly strong by international comparison. These sectors are not viewed individually but integrated into generally defined technological areas of competence within the scope of value chains. The areas of competence are the cornerstones of the model with production and technology, specific services, and research and development closely linked together:

- Information & Communication
- Medicine & Health
- Energy & Environment
- New Materials
- Automation & Production Engineering
- Mobility I Transport I Logistics
- Automotive

Since the “Leitbild WaBe” model was last revised in 2015/16, the **digital and ecological transformations** have emerged clearly as the two **fundamental transformations of the 21st century**. These two basic transformations are essential for all companies in the metropolitan region that need to adapt to changes but that can also tap into new business fields and models in these fields. Here, the revised model focuses on the market potential that arises during the transformations.

The evaluation of the model from 2015/16 showed that the areas of activity that had been introduced at the time are not flexible or agile enough to respond to today’s highly dynamic topics and developments. Because of this, the revised model has been transferred into a **matrix** – an **agile tool** that can be aligned continually with new conditions – and updated at regular intervals. At the same time, it makes it possible to find **flexible** alliances between different areas of competence in special topic areas and to develop these topics together.

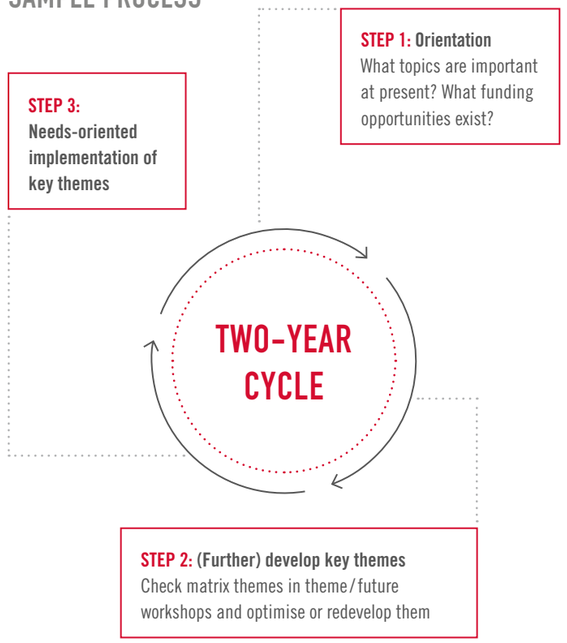
However, in the course of developing the model, it also became clear that **more resources** would be needed to put it **into practice**. Providing the right resources – financial, human and technical – will prove crucial for the successful implementation of the “Leitbild WaBe” model. Such a process is complex and calls for a long-term, well-organised collaboration between many key players involving strategic planning and clearly defined measures in different fields.

Owing to the growing challenges and increasing complexity, the **management** of **interfaces between the seven areas of competence** and the solutions through **digital and ecological transformations** is becoming more and more labour-intensive. This is due to the multidimensional tasks that call for specific competences and make it necessary to coordinate the various stakeholders. An ever-growing focus on a region-specific strategy and regional identity requires detailed analyses and differentiated programmes. Setting up cooperations and networks and maintaining a dialogue with stakeholders needs **extensive time and human resources**. Digitalisation and decarbonisation call for **additional expertise**, while long-term, sustainable projects and changes in **financing** are increasing the need for resources.

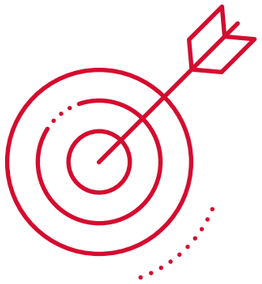
Establishing **clear responsibilities** and **allocating exact roles** is key to successfully implementing the revised model. In order for the model to be put into practice actively and effectively, responsibilities for individual areas or projects must be defined and communicated transparently. Through clear roles, double structures can be avoided and processes made more efficient. In addition, an institution or committee that is responsible for the process could act as a steering body and continually drive forward the optimisation of the model and the attainment of its objectives. The potential of the model can only be fully utilised through precise organisation and clear responsibilities.

The following **process** is proposed in the form of a rough outline so that the model can be used as a kind of agile tool. In order for the process to be successful, **a responsible institution must be defined**. The aim must be to initiate a process at regular intervals, e. g. every year or every two years. The first mandatory step here is to get a clear idea of which topics are relevant at which point in time and which funding opportunities offer touchpoints. In the second stage, key themes for the following period of time are developed as part of **themed/future workshops** in a compact work phase. The third step involves implementing the developed key themes in a needs-oriented way. Possibilities include, for example, key areas of focus about events in order to raise awareness of specific topics or to develop projects with various project partners. Large-scale invitations to tender can also be used for event-related profiling.

SAMPLE PROCESS



WE WANT TO …



… Actively shape the digital and ecological transformations.

… Use the market potential that comes from the digital and ecological transformations and position our economic structure effectively for the future.

… Undertake interdisciplinary **collaborations** to develop solutions together.

… Safeguard employment and create sustainable jobs in the metropolitan region.

Through the joint efforts of all key players in the regional and social consensus, we endeavour to safeguard and strengthen the European Metropolitan Region of Nuremberg internationally as an attractive, dynamic and innovative location. By doing so, we will create sustainable growth, future-viable employment and, in turn, an excellent quality of life in the region.

PUBLISHING DETAILS

Published by
IHK Nürnberg für Mittelfranken
www.ihk-nuernberg.de
Person responsible: Dr. Udo Raab
Contact name: Simon Preiß

Scientific and strategic support
Prognos AG
www.prognos.com
www.linkedin.com/company/prognos-ag
Authors: Dr. Olaf Arndt, Dr. Anna Heugel,
Markus Mahle

Produced by
KonzeptQuartier GmbH
www.konzeptquartier.de

In cooperation with

WaBe Wachstum & Beschäftigung

IHK Industrie- und Handelskammer Nürnberg für Mittelfranken

IHK für Oberfranken Bayreuth

IHK zu Coburg

Supported by

Regionalmanagement Bayern

Bayerisches Staatsministerium für Wirtschaft, Landesentwicklung und Energie