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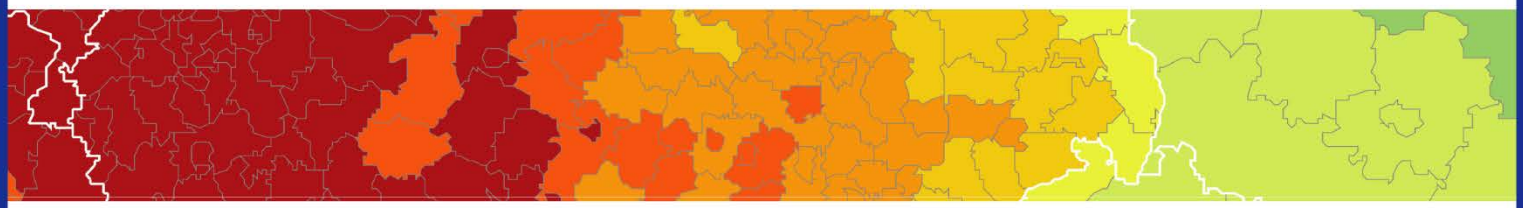

MISTA
Metropolitan Industrial Spatial Strategies & Economic Sprawl

Targeted Analysis

Annex 3.4
Case study report: Stuttgart (DE)

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This targeted analysis activity is conducted within the framework of the ESPON 2020 Cooperation Programme.

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.

This delivery does not necessarily reflect the opinion of the members of the ESPON 2020 Monitoring Committee.

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Version 23/03/2021

Table of Contents

List of Maps

List of Figures

List of Tables

Executive summary

Considered as a global hub for production and technological development, Stuttgart represents a case of a robust and heavily industrialised region that is strongly specialised in automotive construction and that, starting from an already high level of economic development, has experienced rapid growth in recent years attributed particularly to a high level of private R&D investment. Stuttgart's manufacturing sector is firmly embedded within the regional economy which makes it unique, containing many aspects of the production process at a regional scale. This includes capacities for design, research and development, prototyping, manufacturing, assembly, distribution and sales. With the advent of automation, processes are increasingly becoming services oriented. The two main production clusters, vehicles and mechanical engineering, are complementary and interrelated in terms of skills, technology and production processes. Stuttgart is also a case of a region where an extensive number of large multinational enterprises, partnering with SMEs, have created a strong basis for economic development grounded in innovation and technological leadership. The agglomeration of manufacturing, including a rich diversity of businesses, has allowed the region to successfully adapt and evolve while other comparable centres (such as Detroit and Turin) have struggled. With production concentrated along Stuttgart's narrow valleys, the region is now facing both growth efforts and evolutionary challenges to adapt to 21st century socio-technical trends.

The region's production process, particularly for vehicle production, is based on horizontal integration which means that there are many business-to-business relationships. This creates a business ecosystem which allows the industry to be resilient however it also means that the sector has many separate moving parts and can be challenging to adapt and change. Finally, as the economy focuses on global supply chains and a narrow area of specialisation, it is exposed to potential fundamental shocks which are outside of the businesses or the region's control. The ongoing substantial technological change (primarily in the automotive industry as well as in other industries) are a certain threat to the region, if the main producers should not be able to accommodate this change. In addition, due to the large number of multinational enterprises in the region, global tendencies of digitisation and globalisation have more fundamental and direct impact on the region than in most others in Germany.

Regardless of global dynamics, the production sector is still growing and attracting skilled workers. The shift to new technology (such as electric vehicles) is requiring additional space. While older and smaller spaces are available, larger contiguous sites near existing production infrastructure are in short supply or highly contested by local community actors. Therefore, access to space, particularly large plots suitable for production, is in frustratingly low supply which is impinging on the capacity for larger businesses to adapt their production systems. With an also short supply of housing, potential sites can compete for space. Where land is suitable and available, it may still be rejected by local authorities or contested through the plebiscite system. As a result, the space-intensive aspects of the manufacturing sector risk being pushed out of the region which could result in a reduction in competitivity and innovation. Thus,

industrial policy strategies to maintain technological leadership, while also not stopping the development of newly emerging sectors are likely to remain high on the policy regional agenda. While this is well understood by all actors at a regional scale, getting local buy-in from the 179 municipalities remains a challenge.

At the metropolitan scale, there are a number of organisations that help bring together the manufacturing sector and stimulating innovation that include the likes of forums, regional industrial action groups, research funding and businesses support. Research and development organisations such as the 'Strategiedialog Automobilwirtschaft' (an initiative of the state government) and '"Wirtschaftsförderung Region Stuttgart GmbH' (a subsidiary of the VRS) help stimulate development in the region as a whole. This helps also to find links between production processes and the demand for space, anticipating slow planning processes.

An additional feature of the region is the regional governance system, which is based on a powerful organisation responsible for the development of the entire metropolitan region (the VRS). The VRS, a meso scale level of government (between regional and local) which is unique for Germany, helps facilitate metropolitan scale planning. This organisation has been highly successful in providing better coordinated economic development and the regional planning activities, prioritising regional interests over the local ones and has also provided better legitimacy for planning policies. However, it is the 179 municipalities (kommunes) and their constituents who ultimately hold the balance of power and who do not necessarily share a metropolitan scale economic vision. This has put the VRS into a weak or reactive position, referred to as an institution having "brakes but no gas pedal". More recently, with reduced political support for industrial development and an increasing shortage of land, the VRS' powers are proven to be limited. In addition, the ongoing changes in the automotive industry, along with the significant structural change in the region's economic structure have reduced the effectiveness and reliability of traditional planning instruments. In particular, here the central policy issue is how land for productive uses can be activated in times of vanishing political support for such policies.

Hence, while the region has a unique metropolitan planning and governance body, the Verband Region Stuttgart (VRS), decision making remains in the hands of the 179 local authorities and residents. Stuttgart's future depends on the capacity to bridge global trends, with metropolitan scale resources that can be clearly and convincingly translated into a value proposition for local communities. Regardless of the health and evolution of manufacturing, some of the greatest challenges for planning involve the way metropolitan or regional scale challenges concern local communities. Residents are ultimately affected by the regional economy while businesses depend on being clustered within the region. Tensions are inevitable and will require reasonable levels of compromise. The balance of planning power held at a local level could lead to the industry's stagnation. The challenge for Stuttgart is to find the most suitable forum and governance platform where both the metropolitan economy and community interests can be mediated while helping to ensure the local economy remains internationally competitive. The

main conclusions of the case study, resulting from the interviews and desk research, can be summarised in the SWOT table below:

Table 1: Results of the SWOT analysis.

Strengths ▪ Strong foundation in industrial engineering, distribution and associated services. ▪ Strong industrial employment base - ~30% of the region. ▪ Manufacturing within the region is coupled with associated services: research, design, development, distribution. ▪ A wide variety of business sizes: from micro to large. ▪ Existence of research and development (businesses, know-how, etc.) ▪ Strong political attention given to economic issues. ▪ organisations such as the 'Strategiedialog Automobilwirtschaft' and '"Wirtschaftsförderung Region Stuttgart GmbH' that helps stimulate development in the region as a whole. This helps to plan for industry development in relation to demand for space.	**Weaknesses** ▪ Focus on vehicles, hard to change track, challenging to adapt (such as the EV technology) and consumes ~17% of the employment base. ▪ NIMBYism and strength of residents who do not have a clear understanding or concern for the regional economy. ▪ Real estate limitations: availability of (large contiguous) sites, high prices. ▪ Fragmented land ownership structure.
Opportunities ▪ Horizontal integration (B2B production) means that smaller businesses can explore innovative solutions for their respective. ▪ Transitioning service-oriented production. ▪ A metropolitan scale actor - the Verband Region Stuttgart. ▪ Guarantee of mobility needs in conurbation areas is a global issue. Stuttgart Region could be a model for new solutions because it has the money, know-how, businesses, etc.	**Threats** ▪ Dense development. ▪ Lack of available developable land. ▪ Geography is undulated which means mobility is challenging. ▪ Consensus driven community engagement. ▪ Power of local municipalities, and high number of municipalities (179), ⅔ with under 10,000 residents, limiting the capacity for the metropolitan region to act cohesively. ▪ Strong dependence on international markets. ▪ Horizontal integration (B2B production) which means that innovation depends on many actors. ▪ Complex development procedures. ▪ Strong environmental regulation. ▪ Activities that have a heavy amount of road-based traffic or result in noise pollution.

Source: ESPON MISTA (2020).

Finally, the data analysis confirms that Stuttgart is a deeply manufacturing region. Nonetheless, it is focused largely on the automotive industry. There are also significant specialisations in other sectors (e.g., mechanical engineering, electrical engineering, etc.).

Between 2012 and 2019, employment in these core industries grew very well for the most part. The industries that grew the most in percentage terms were: 'manufacture of communication equipment', 'manufacture of optical instruments and photographic equipment,' manufacture of batteries and accumulators". Additional potentialities seem to exist in some sectors of the electrical and electrical engineering industry and metal processing. In addition, there are relevant specialisations in the toy industry and in the area of printing, publishing and reproduction, which are not yet so strongly integrated into existing networks. Therefore, to sum up:

- The city has some fast-growing services.
- There is no inclusion of consumer industries (such as food and the like) emerging in the region, it is all “German engineering” tout court.
- Strengths are all in manufacturing (cars, machinery optics and electronics).
- Same applies to opportunities.

Arguably, the difference with Turin (which seems to be the only “comparable” city among the seven metropolitan areas analysed within the MISTA research) seems to be that there are quite a few other industries, and it is a more diverse network of branches. The hypothesis is that it not as “rigidly” networked towards one industry as Turin.

The results of the interviews and statistical analysis were presented back to stakeholders in a ‘futures workshop’ held in November 2020, in order to gauge their feedback of the portrait that emerged through the MISTA project research and to also contribute feedback on development opportunities. The stakeholders stressed two key points. Firstly, the region has already a very well-oiled economic planning machine that has allowed the automotive sector to flourish and become a global standard in production. The main question here is how to ensure space remains flexible to ensure production is not unnecessarily impacted. In contrast, this also presents certain vulnerabilities in terms of global markets and lock-in to the automotive industry. If the Stuttgart region depends on a high level of metropolitan governance, spatial planning tools will offer limited power to grant a strategic vision on the location of new productive activities, which may reduce its competitive capacity.

Abbreviations

AA	Agglomeration Areas
ARDECO	Annual Regional Database of the European Commission
COVID-19	Coronavirus disease 2019
DG REGIO	Directorate General for Regional and Urban Policy
EC	European Commission
ELFS	European Labour Force Survey
ESPON	European Territorial Observatory Network
ESPON EGTC	ESPON European Grouping of Territorial Cooperation
EU	European Union
EU 15	European Union countries that were member states prior to 2004 (incl. UK)
EU 13	European Union countries that joined after 2004
FDI	Foreign Direct Investment
FUA	Functional Urban Area
GDP	Gross Domestic Product
GVA	Gross Value Added
HR	Human Resources
IAB	Institut für Arbeitsmarkt- und Berufsforschung, Die Forschungseinrichtung der Deutschen Bundesagentur für Arbeit (Institute for Employment Research, The Research Institute of the German Federal Employment Agency)
ICT	Information and communication technologies
ISTAT	Istituto Nazionale di Statistica (Italian National Institute of Statistics)
JRC/EC	Joint Research Centre of the European Commission
LAU	Local administrative units
KIBS	Knowledge intensive business services
LQ	Location quotient
MISTA	Metropolitan Industrial Spatial Strategies & Economic Sprawl
MR	Metropolitan Regions
NACE	Nomenclature of Economic Activities for Statistics
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
POLIMI	Politecnico di Milano
R&D	Research and Development
SME	Small and medium-sized enterprises
SBS	Structural Business Statistics
SWOT	Strengthens, Weaknesses, Opportunities and Threats
US	United States
WIFO	Austrian Institute of Economic Research
WIOD	World Input Output Database

1 Introduction

The MISTA project aimed to develop an understanding of the current contrasted and complex relationship between the city and industrial land, manufacturing and productive activities. The project does so through producing an updated and critical understanding of how the sector has evolved over the last decades across Europe and in particular in large urban areas.

The project intends to support (re-)developing a strategic relationship with manufacturing and production systems within the contemporary urban economy and life. In this perspective, the project aims at considering critically the complex debate on the consequences of deindustrialization and changing of the urban economic base. In doing so it heavily builds on the experiences of the seven stakeholder cities/urban areas (Berlin, Oslo, Riga, Stuttgart, Turin, Vienna and Warsaw).

In Stuttgart intensive research and consultation activities were conducted between October 2019 and December 2020. Firstly, a questionnaire was prepared by the research team and filled in by the local stakeholders in November 2019. This was followed by an online interview with the main representatives of the city and urban area in December. On the basis of the desk research, data analysis, the results from the questionnaires and interviews, a summary paper has been elaborated. This served as a starting point for the extensive, 2-day long mission in February 2020, where MISTA researchers visited Stuttgart and conducted a series of on-site discussions with the local stakeholders. As a result, the first draft of the Stuttgart case study report has been prepared by May.

According to the original plans this report should have been validated by an on-site futures workshop in Stuttgart in the course of May-June 2020. However, COVID-19 made this impossible, thus the workshop had to be postponed to November and even then, could only be organised online. Despite this difficulty, the seminar organized gave a good opportunity to share the results of the empirical research, get feedback on the findings of the report and also gave the possibility to further develop it in a co-creative way, using inspirational cases as the basis for creative, future-oriented thinking. The final results of the city case studies are used in the MISTA project in two major ways. Firstly, a comparative analysis has been included in the main text of the final report. Secondly, city case study reports are annexed to the final report as self-standing descriptions and critical discussions of the case of the given city/metropolitan area.

The Stuttgart case study report on the following pages summarises all the knowledge gathered in the different activities during the one year of the research. The report does not intend to provide ready-made suggestions for the city, as the local stakeholders are very well aware of the local situation – even if different local actors have different viewpoints in some issues. MISTA rather aims to investigate the transferability of the major statements distilled from the comparative analysis, and the potential validity of inspiring practices of innovative metropolitan

areas of the EU, taking into account the particular local conditions of the Verband Region Stuttgart.

As mentioned, the MISTA research has been conducted under very special circumstances, dominated for more than half of the time by the restrictions caused by the pandemic. The spread of COVID-19 has impacted not only the workflow and organisation of the project, but also in a more fundamental and challenging way the relevance of the results when the socio-economic fallout becomes more apparent. The empirical data, the interviews and also the site visits reflect the situation before the pandemic. Moreover, the longer-term effects of the pandemic, the changing context for industrial areas and manufacturing, are not fully known yet, there are only different hypotheses raised which are partly contradicting each other. From all these it follows that the MISTA report cannot address the most recent challenges and opportunities presented to the urban areas and to the local manufacturing and production activities.

The Stuttgart case study report begins with the description of the state of manufacturing in the city region. This is followed by the evaluation of the potential of productive sectors, based on sub-sectoral data analysis. The next section summarises the outcomes of the futures workshops. The main body of the report is followed by an annex, including further details of the data driven SWOT analysis.

2 State of manufacturing in the city-region

2.1 Main demographic/social and spatial development trends

The Verband Region Stuttgart (VRS) which comprises 179 municipalities, covers a surface of 3654 Km2 resulting in a quite a highly dense (733inh/km), polycentric as well as administratively fragmented urban region[1]. Actually, in spatial terms, VRS is quite a small urban region if compared to the traditional international economic competitors that Stuttgart is usually associated to. Despite its size, it is one of the innovation islands which have dominated the innovation process in Europe for decades. Its economic importance grew steadily along the last century, despite not particularly favourable spatial conditions: in particular after the second world war, the shift from consumers' good originally located in the eastern urban sectors to investment goods on the western urban sector, opened a new axis of development between Stuttgart and the districts of Böblingen and Esslingen.

The competitive labour-market along with the area's economic performance and the concentration of world-leading enterprises contribute to feeding population growth, that – on account of an ageing resident population and low fertility rates - is exclusively due to immigration. This is no new development, as work-related immigration has always represented an engine for growth for the region over time. Indeed, over the last century VRS, because of its strong economic role, kept growing at a higher pace than the federal state of Baden-Württemberg, based in particular on important migration fluxes towards the region. Today, with an estimated population at around 2.7 million, Stuttgart region is one of the still-growing territories, in a country in which, many other urban regions are experiencing a durable process of shrinkage and decline. Higher rates of growth are registered in the municipalities around the city of Stuttgart, as the result of a process of suburbanisation which dates back to the second post-war period, when the new infrastructural network allowed for the relocation of both manufacturing spaces and residents. Nonetheless, the recent immigration from outside the region has contributed to an extremely tense housing market[2] and a substantial increase in housing prices. Especially for low- and average-income individuals it is difficult to find appropriate housing for reasonable prices in the central locations. However, it is evident that to ensure its competitive strengths it is crucial for the region to stay attractive not just as a location for investment but also as a place where people are willing to live in and want to move to.

In terms of internal structure – despite substantial variation among the surrounding regions - the region can be analytically separated into the city of Stuttgart and its five surrounding Kreise (Böblingen, Esslingen, Göppingen, Ludwigsburg and Rems-Murr-Kreis). In this division the city of Stuttgart is the central location for services and headquarters of the many enterprises in the

[1] See https://www.region-stuttgart.org/andere-laender/english/?noMobile=

[2] Population growth in the region was 2,4% in the years 2014 to 2016 and thus slightly lower than in Munich and Berlin, but higher than in the German average (1.7%) and in most other German metropolitan regions.

region and has been described as a service economy clustered around an industrial core. The city hosts 5 of the 12 largest enterprises of Baden-Württemberg and (after Bremen) is the second most heavily industrialized metropolitan region of Germany. The city also hosts 22.5% of the population of the region but – due to intensive commuting flows - accounts for 32% of the employment and 36% of the gross value added of the region and is thus economically the dominant city in the region. Among the remaining Kreise of the region, Böblingen and Ludwigsburg, which are also important locations for industrial production, account for a further 16% to 17% of GVA each, while the contribution of Esslingen, Göppingen and the Rems-Murr Kreis, that are slightly less industrial, ranges between 5% to 15%. The city of Stuttgart has also been growing more rapidly than the surrounding areas in terms of employment in recent years. Employment growth in the city was 2,8% in 2018 and ranged from 2.1% to 2,5% in the surrounding areas. These differences are also reflected in the settlement structure of these areas. While the city of Stuttgart - also compared to other German metropolitan areas - is highly condensed, in the overall region there is still 75% vacant plots (used for woods, agriculture, etc.) on account of a substantially lower population density in the surrounding areas.

All in all, despite the large amount of available plots of land, the economic success is creating high pressures on the spatial and socio-economic system due to the limited availability of land to accommodate both the continuously expanding industry and the housing demands. Under increasing housing prices population has been progressively pushed out from inner-city locations towards the periphery. As a consequence, the greater distance from the workplace implies an increased use of transportation networks, which therefore result under a high pressure. This decentralization is further reinforced by the fact that locations with metro or rail access are more expensive, such that once such connections are built incentives for further decentralization are created.

2.2 Main trends in the development of the economy and manufacturing

In economic terms, the central strength of the Stuttgart region is its strong industrial base. Manufacturing contributes one-third of the total employment in the region and is strongly oriented towards two clusters: automobile production and mechanical engineering. These two key industrial segments represent the main engines driving the development of the regional economy. Since the last century, VRS has become famous for vehicle manufacturing and has managed to retain the automotive sector as the most important economic driver in the region until today: it is home to the headquarters and major production sites of several global players in car manufacturing (Daimler and Porsche) and component supply companies (Bosch, Siemens and many others). Next to these two central clusters, the region is also characterized by an important electrotechnical and metalworking industry, which is to a large degree linked to the two dominant sectors. In addition, the region presents a high share of production-related services and a growing IT sector (specifically the enterprise software) and creative industry sector, that is specialised in industrial design, architecture, publishing, music and animation films. Such industrial base makes the region a central location for innovation.

The strong competitive position of VRS also relies on the links among research and development competencies and the production capacities of complex goods. In particular, the excellent academic environment and the research activities of internationally renowned research institutions in the biotechnology cluster makes Stuttgart one of the top German BioRegions.[3] As anticipated, the region has experienced substantial economic growth over the last decade. This has not only included the automobile cluster but has also affected many of the other branches. Over the period from 2014 to 2016 the region's gross value added has grown by over 10%, with the manufacturing sector growing more rapidly than the service industries.[4] As a consequence the share of manufacturing in the overall gross value added has increased from 38.9% in 2008 to 41.6% in 2016. In 2018, the unemployment rate of the Stuttgart region was only 3.3%, well below the national average of 5.2%. During the last two decades, the employment of the region has steadily increased, except for the economic recession years (2003-2005 and 2008-2009). Between 2007 and 2018, 39.700 new manufacturing jobs were created (+10.5%). Moreover, the employment in the business-oriented services has grown by 51.1% in ten years, being the more dynamic area in the tertiary sector.[5]

One important characteristic of the region's entrepreneurial fabric is the successful network of global players and innovative small, medium-sized businesses (usually scattered all over the region, in small or medium-sized cities, not just in the centre).[6] In consequence, given also the huge concentration of multinational companies, the area stands out as one of the strongest exported-oriented economies at the national level being one of the main regions contributing to Germany's high export share. This exposure to the global market along with the high concentration of multinational enterprises, also implies that the region is strongly affected by international developments accelerating the transmission/transfer of these accordingly.[7]

Although the wide spectrum of industries at the crossroads between innovation and tradition characterizing the regional business dimension, the automotive industry – including retailing, delivery companies and the associated logistic businesses – remains to be the dominant cluster.

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[3] For further details see Regional Cluster Atlas. Baden-Württemberg, 2015, available at www.clusterportal-bw.de

[4] In the same time period only some of the urban regions located in Eastern Germany have shown more rapid growth. These regions have, however, grown from a substantially lower level of GDP per capita than Stuttgart.

[5] For further details see Dispan J., Koch A., König T., 2019, Strukturbericht Region Stuttgart 2019, Entwicklung von Wirtschaft und Beschäftigung. Schwerpunkt: Mobilitätsdienstleistungen in der Region Stuttgart.

[6] Most of the large manufacturers, OEMs and the R&D facilities are usually located close to the bigger cities as they benefit from the positive externalities generated from the spatial proximity and geographical clustering.

[7] One example of this is the recent Corona crisis which arguably affected the region earlier than most other regions on account of the close economic contacts in particular to the Asian market.

The automobile cluster according to recent estimates accounts for over two thirds of the manufacturing sector's turnover and 17,1% of total employment[8] in the Stuttgart region and has seen substantial employment growth (of +12,8%) in the decade from 2007 to 2018. The mechanical engineering cluster, by contrast, contributes another 6% to total employment but has been characterized by a decline in turnover and more modest employment growth, in recent years.

Under the rise of e-mobility, one major trend affecting the automotive industry in the region, mentioned by most analysts, is the reorganization of the existing plants to accommodate a second line of production for the manufacturing of electric engines. This has made necessary the introduction of new facilities along with the relocation of logistics, suppliers and warehouses. Furthermore, according to many analysts, vehicle electrification will result in less labour-intensive process as compared to a combustion engine fewer component are needed in electric engine production. Hence, given the increasing global competitiveness of the already advanced electromotor industries (i.e., the Chinese market), the manufacturers linked to the future of traditional auto motors production of combustion engines (such as those manufacturing components like pistons, seals, valves, etc.) are a major concern to policy makers in the region. One threat repeatedly mentioned is that an important technological development could be missed, which may lead to a reduction in employment in car manufacturing and potentially also in the region. At the current time, there is, however, still little insight as to when a consistent diffusion of electric vehicles will happen. There is a general consensus among interviewees that this uncertainty is largely dependent upon the final consumers' choices and preferences, that is the consumers' interest in such product.

As a consequence, despite massive investments to make electric vehicles a cost-effective and competitive product it seems that Baden-Württemberg is afraid to be late on technological development. In particular, it is witnessed the risk that this process of technological innovation will not be adequately supported by the local established system of automotive industry supply-chain made up of medium size enterprises (unable to follow the market evolution). For instance, analysts emphasize that Tesla's (as a main producer of e-cars) competitive advantage on the market is to be found not exclusively in a different approach in car manufacturing (with a very powerful artificial intelligence steering unit as the centre of the car) but most importantly in the process of knowledge production. This implies having a solid and comprehensive knowledge base of the car intended as an 'ecosystem' enabling the acceleration of innovation processes. Within the German automotive industry, the big companies rely on a structured suppliers' network (a network that has been built up over the last 20/30 years). Therefore, drawing on this peculiar B2B approach/solution it is clearly evident that the innovation of big companies inevitably comes via the innovation of the entire regional automotive ecosystem that has to be

[8] This figure applies to the companies affiliated with the automobile cluster (i.e., the automobile cluster and all of its affiliated firms). Within this cluster the automobile industry (i.e., mainly the car manufacturers account for over half of the manufacturing sectors turnover.

developed at the same time (this applies in particular when considering the linkages between various supply-chains serving the high-tech auto sector). This phenomenon is even more accentuated in the case of Stuttgart because its industrial ecosystem is dominated by the car industry. Against this background, it is worth noting that although there is a widespread agreement among interviewees that the region in undergoing massive structural changes, local stakeholders disagree on whether the automotive industry has been sufficiently reactive to accommodate these changes in due time. Daimler, for instance, was an early adopter of alternative mobility concepts, having produced the first e-car over two decades ago, but at that time there was absolutely no interest by politics nor customers in such technologies.

A further underlying long-term trend related to the dynamic of progressive digitization of the economic base is an incremental transformation of the "manufacturing capacity" towards services, head-quarter functions and R&D activities. This includes a shift of occupational structure in manufacturing towards service occupations. For instance, the annual structural report on the Stuttgart region published by the metal-workers union (IG-Metal) observes the continued trend towards an increased employment in service occupations even within the manufacturing. According to this report 38,2% of the employees in the secondary sector are employed in service occupations in the Stuttgart region and this trend will continue in future. In particular it will require the adoption of new approaches in developing land and industrial structures as it will require different adaptable space (i.e. prototype lines and pilot production methods, mixed uses offices and apartments, etc.).[9] One consequence of this is that the employment structure in the manufacturing sector (in particular the automotive sector) offers many well paid (and thus attractive) jobs, but has also substantially shifted to an increasing demand of high-skilled jobs.

Finally, due to its strong internationalisation and the presence of a large number of headquarters of multinational companies in the region (e.g., Bosch, Daimler, Porsche, etc.) the area is also much more strongly integrated in the worldwide location competition. In the past this has led to relocation of many of the routine tasks (e.g., assembly) within the multinational enterprises to other countries such that an increasing share of the production in the multinational enterprises is related to the development of prototypes and thus very close to R&D. It also leads to a continued concern of many actors, in particular trade unions, that in the face of a shortage of land for the further development of existing enterprises and higher wages than in many other countries, local companies may decide to further relocate parts of their production abroad. As such, in particular trade unions and the social partners, as two very important further actors in regional development,[10] aim to motivate firms to strategic

[9] This is of particular relevance for Stuttgart region as much of the production located in the region (in the automobile production, but also in the other sectors) is related to the production of prototypes and the development of new products, which require a close link between production and more service-oriented parts of the enterprises (e.g., design, marketing and R&D).

[10] An example of the important role played by trade unions is the reaction to the economic and financial crisis in 2008. During this, trade unions put in place negotiations on a part-time work scheme with the

investments in the region of Stuttgart rather than elsewhere both in wage negotiations as well as through a number of policy initiatives.[11]

Main challenges and conflicts of future development in manufacturing

Throughout the last decade, which was marked by solid economic and demographic growth, the demand for industrial land was relatively constant in Stuttgart and amounted to around 150 ha per year for the overall region. Current projections, however, suggest that the development for the next years to come is substantially more uncertain, because of the ongoing disruptive developments and massive structural changes in the region's economic structure driven by progressive digitization and e-mobility trends (and most recently by the corona crisis). In particular, according to all of the interviewed experts, the rise of e-mobility is undoubtedly posing urgent and pressing challenges for the region, both in terms of regional economic organisation and cohesion, and in relation to the availability of spaces to develop new technologies. In fact, the implementation of this new form of engine production implies the establishment of two parallel technologies, resulting in more land-use intensive production sites. As such, this new production paradigm requires on the one hand new spaces for investments, and on the other hand, the reorganization of existing spaces according to the new production needs. There is often a strong demand for land from companies that aim to run production sites for two technologies (both electric and combustion engines) in parallel.

There is, however, still significant uncertainty as to whether this demand will be sustained in the medium and long-term.[12] In particular, one scenario is that the two technologies will co-exist also in the long-term. In this case increased demand will also be sustained in the long run. By contrast another scenario is that e-mobility will replace the combustion engine rather quickly, with this scenario assuming a transition phase of somewhere between 15 and 20 years. In this case land demands for industry should peak in the next decade and then start declining hand in hand with the emergence of dominance for e-mobility.

However, in spite of the rapid structural changes, the availability of adequate spaces (in excess of 15 hectares) for large scale industrial use in the Stuttgart region appears rather limited, [13]

objective to prevent the deskilling of the workforce through (potentially long-term) unemployment and to maintain purchasing power (i.e., demand) in the region. This measure was unequivocally seen as highly effective in preventing mass unemployment.

[11] Examples of this are a bi-annual structural development report, which contains an analysis of recent regional developments as well as a set of policy recommendations that are agreed upon between the social partners and the organization of various regional alliances (Regionsbündnisse) involving the social partners and firms for specific topics (E.g., Machine building. Industry 4.0, high skilled labour and others).

[12] This uncertainty is underlined by the fact that next to e-mobility fuel cells are considered a 3rd option and there are also initiatives on their way to develop this technology further.

[13] Estimates suggest that while overall 880 hectares of land in Stuttgart could be used for productive uses, only 97 hectares are actually available immediately.

constituting a crucial problem for the often-large investors in the region.[14] The major observable trend, as referred to by some of these investors, is that “we take whatever we get”. Indeed, considering that the demand for land is very much exceeding the supply (to date just five municipalities have suitable industrial zones for new development), all available land that producers can get is taken.

For smaller enterprises, by contrast, there are considerable development options (also within existing settlement structures). Here the issue seems to be more related to suitable spaces in urban locations that are highly attractive for certain industries. Given the scarcity of land and the limited resources, a viable solution for companies is to be found in the effective maximization of the existing properties by densification. These solutions are, however, often problematic because of the structural conditions of the existing buildings and the resulting high prices for such an increase in density. Therefore, they are considered to be unlikely to solve the upcoming challenges for the region on their own. Indeed, here the concern voiced by some interview partners is that inner urban development (i.e., upgrading and transformation of existing structures, densification etc.) – although important – alone will not solve the anticipated needs of the future.

The issue of land shortage, in particular for large scale development, is intensified by a number of further factors such as:

- Lacking public and political support for industrial development and in particular the rezoning of agricultural land for industrial uses as well as difficulties in mobilising land from owners. Here informal evidence suggests that on the one hand the population in smaller municipalities is difficult to convince of industrial development on account of the anticipated negative environmental effects of such development and that existing owners of land are difficult to motivate to sell existing land. As a reaction to this also municipalities are often reluctant to engage in the development of land for productive uses, despite their tax revenues being very closely linked to the number of workplaces on their territory.
- Lacking incentives of owners to sell land as the returns on land (through price increases) are higher than interest rates or returns on most other assets. This is of particular relevance in Stuttgart, because a large share of the land is still.
- Competing uses for land which are mainly residential uses in the city of Stuttgart, but also include agriculture and recreational or protected land in the surrounding area that are supported by the sustainable development approach of the region[15].
- A challenging topography of the region that is located in a very hilly part of Germany, such that large parts of the territory cannot be developed for industrial use (or can be developed only at a prohibitive cost).

[14] For instance, according to the accounts of some interview partners Porsche is looking for a 15-ha production site and Daimler is continuously looking for areas in Stuttgart, with the search being rather lengthy and difficult and often requiring intensive support of politics to avoid conflicts.

[15] In particular, soil protection is a highly political topic in the region which is seen guiding the foreseeable development future of the area (which is directed at lowering the environmental impact of productive activities).

- A rather fragmented ownership structure of the available spaces. For instance, a recent study indicates that in average there are over a hundred owners to each hectare of developable land in the Stuttgart region.

Next to the challenges faced by the automotive industry digitization is a further concern to the region that applies to all sectors. As most other regions worldwide VRS is in a process of digitization of its economic base, that amongst others, is leading to the development of mobility services being exploited by companies that are progressively breaking into the market no longer as producers of cars but as the owners of platforms (e.g., the UBER platform which has a turnover of billions of US dollars). This implies the adoption of new technologies, marketing channels and forms of organizations by which these companies are characterized. To this regard, many local stakeholders voiced concern about the extent to which the companies in the region will manage to accommodate the aforementioned changes.

2.3 Main factors affecting locational choices of manufacturing

Among the many factors that influence the locational choices of new manufacturing activities, the scarcity of suitable land for further industrial development (especially for large commercial uses) and land prices features prominently. Others are:

- A lack of contingent land plots of adequate size for major industrial development, as there are no significant brownfield opportunities of sizable plots in both urban and suburban areas. The only remaining plots of an adequate size for major industrial developments are conversion areas (i.e., the very few former-military grounds that have not regenerated into civil use yet[16]) and areas in the vicinity and property of railways, that are not needed for transport infrastructure anymore.
- The lengthy planning procedures for larger projects that are also caused by the many partners involved in such planning and may take up to 5/6 years and thus, very often exceed the expectations of companies. Next to this, an emerging problem concerns building permissions which are sometimes not flexible enough for accommodating innovation (i.e., the permission for new materials).
- Soaring land prices (in particular in the city of Stuttgart and its immediate surroundings) in recent years and that according to the assessment of some developers are unrealistically high to justify development for production such that realistic prices can be found only at a distance of over 50km from Stuttgart.
- The rather heterogenous situation with respect to accessibility and provision of transport and communication infrastructures which lead to congestion becoming an additional concern for many enterprises. [17]
- Increasing shortages of skilled workers in certain fields (e.g., IT-developers and experts and almost all kinds of service workers, along with workers in the handicraft and many others are very difficult to find in the region).

[16] Almost all of these plots have, however, already been transformed.

[17] The traffic density is partly attributable to the fact that 75% of employees do not work where they live (commuters), and that the production-oriented economy entails a large volume of road transport linked to logistics/delivery services (resulting in traffic congestion accordingly).

2.4 Development preferences of the city (region) leadership

Further to factors applying to all industries there are a number of factors that make particular productive uses more attractive than others. Here in particular uses associated with additional traffic and large land use are less attractive (e.g., logistics). This is also reinforced by the system of fiscal transfers and municipal revenues. According to this system for all of Germany the main source of income for municipalities are the share of the income tax they receive. This – despite a number of further complicating issues – in general implies that municipalities get higher revenues for more and better paid jobs (of employed residents), such that in the past this has ensured an urgent wish of most municipalities for both growth in terms of residents and commercial areas.

More recently, increased public concerns about environmental and traffic issues, have, however, led to a more selective process, such that uses (e.g. logistics and warehouses) with low employment densities and low salaries, as well high traffic and environmental burdens, are increasingly unpopular, as they (all else equal) lead to smaller increases of revenues, than high employment density and wage activities and more public concerns than activities associated with lower traffic and environmental burdens. Thus, in addition to how to address the future of the car manufacturing sector, the location of large-scale logistics and storage necessary for production is seen as a major issue by observers in the region. In fact, it is becoming increasingly difficult to find suitable sites to accommodate logistics not only in central locations but also in more peripheral areas, thus ending having logistics sites scattered all over the region. This spatially fragmented structure poses further pressure on the regional transportation networks. Next to this, the extreme volatility of the logistics sector and the continuously evolving market makes it difficult to accommodate the needs of this industry due to the lengthy planning procedures. Against this background, many interviewees advocate for the implementation of tools directed at the acceleration of planning procedures and the introduction of supporting measures.

2.5 Tools through which the municipality is able to control the development processes

Institutionally the central actor in the design and implementation of spatial planning and economic development strategies for the Stuttgart region is the Verband Region Stuttgart (VRS), but land use planning and development is in the competence of the municipalities. The VRS covers 5 Kreise (districts), that, however, have only very few competencies, and comprises 179 municipalities that are responsible for implementing land use plans and zoning. The competencies entrusted to the VRS by law are the open space development, the organization /operation and planning of the regional public transport system, regional planning, economic/business development of the region and tourism marketing. In addition, the VRS also organizes a number of conferences and fairs of regional importance through its legal competence for the building of the Stuttgart fair. The VRS has been established by a law of the federal state of Baden-Württemberg in 1994 and represents a rather unique institution in

Germany as it is governed by a directly elected regional parliament, that is responsible only for a part of a federal state. It thus represents a middle tier elected body between federal state and municipalities, which are usually the only directly elected government levels in Germany (alongside county assemblies).

In particular the VRS is responsible for drawing up the regional development plan for its territory. This is a binding document for all of the municipalities, who, however, retain the power of designing zoning laws (Bebauungspläne) and to develop construction plan. This plan constitutes the framework within which municipalities can design zoning laws and construction plans. The current plan reaches to 2030 and contains detailed development for various subspaces of the region as well as a definition of central projects in regional development. This regional plan is also the central instrument available to the VRS in spatial development planning at the regional level as it lays out the areas dedicated for industrial development. Through this therefore municipalities that are interested in developing excess industrial land of a certain acreage are appointed to do so, in a planning procedure that involves a series of procedures (e.g., an environmental impact assessment) and may also result in additional conditions and requirements[18]. The plan is then submitted to the regional parliament, that will take a decision.[19]

The existence of this autonomous parliamentary assembly and this decision process is seen by many analysts as key to ensuring effective decision-making on regional issues and for the democratic legitimation of these agendas (e.g., regional development plans). It is also considered to be instrumental in providing a strong and well-established co-ordination of regional spatial planning and development strategies, despite the relatively fragmented decision-making structure of the region (which would otherwise require the co-ordination of 179 municipalities), in ensuring a homogeneous development vision, and in regulating as well as restricting unwanted developments at the level of municipalities whenever this is deemed necessary. Further, this specific model of regional governance is also considered to provide a high legitimacy to the planning process and to enable bottom-up forms of governance directed at the empowerment of residents.

Nonetheless the institutional set-up of the VRS has also been criticised. In particular; as underscored by many interviewees, the VRS is seen as rather ineffective in accelerating

[18] These conditions often include the requirement for neighbouring municipalities to co-operate in the development of the land int the form of inter-communal industrial zones (interkomunale Gewerbegebiete). This condition is usually made to ensure that concerns of neighbouring municipalities (related e.g., to traffic and noise) are adequately considered in the planning process and to spread financial risks involved in the development of major projects.

[19] An example of this is a recent project in Schwieberdingen, which will develop 25 hectares of land for the first Porsche e-motors production site in Germany. This exceeds the maximum space available for the autonomous use of municipality by far. Therefore, a precondition for this was the cooperation of neighbouring municipalities to develop a so-called inter-communal industrial zone (interkommunales Gewerbegebiet) an obligation which was seen as an asset by most of the partners involved as the financial costs and associated risks of the project could only be carried jointly by the involved municipalities.

development against the interests of the municipalities as the VRS is active only upon the request of the municipalities and cannot oblige them to develop land against their will. A situation described as having “brakes but no gas pedal” by many observers. This is seen an important limitation for the development of production in a time when political support for industrial development at the local level is very low and when thus municipalities are often reluctant to develop such land.

In addition, policy, - in particular the VRS - has been actively trying to convince many municipalities to provide more area for industrial development. To date, the region can, however, primarily only rely on its bargaining position and expertise built on “information policy” in trying to encourage industrial development at the local level, convincing municipalities to prioritize the wider regional interests over the local ones. Such attempts are supported by a small program of incentives, of about 3 million euros distributed over a period of five years, mainly directed at overcoming technical problems to meet environmental regulations rather than overcoming political barriers.

Furthermore, drawing on a more pro-active approach, for the first time the regional body is considering developing land on its own. This initiative aims to constitute a joint venture with the cities that are willing to cooperate with the regional body which will be 50% partner in developing land providing directions for the transformation. The region intends to implement this approach only for a few big projects (for instance battery factory or giga-factory) which are deemed essential for the promotion of the regional business development ensuring its competitiveness.

Finally, at the more local level one reaction of municipalities and mayors, faced with increased public opposition with respect to the development of land for productive uses, has been to increasingly rely on plebiscites to legitimize development such plans. This has the advantage of providing for a democratic conflict resolution in controversial decisions and in some instances has led to such projects being realized.[20] It has, however, also led to some criticism on account of leading to increased fragmentation rather than reinforcing cooperation in cases where only citizen of the affected municipality are allowed to cast a vote, and for being used both excessively and very early in the political process such that controversial decisions are delegated to the general public through the plebiscite/referendum instrument.

2.6 Potentials for metropolitan area cooperation

At the level of the federal state, policy has reacted to these challenges facing the automotive industry by inter alia establishing the so called ‘Strategiedialog Automobilwirtschaft’ (‘Strategic Dialogue on the Automotive Industry’). This is an institutionalised collaboration to foster strategic dialogue of the automotive sector in Baden-Württemberg with politics, industry, universities, employee associations, consumer organisations, environmental associations and

[20] One example of this is Schwieberdingen where the development of the Porsche plant was supported by a 54% majority in a plebiscite.

society. This initiative is essentially directed at supporting the transformations occurring in the automotive sector of Baden-Württemberg by intercepting the emerging trends and by mobilizing projects and policies capable of projecting the automotive industry into a “new climate-friendly age of mobility” accordingly (Baden-Württemberg, 2018, p.5). Therefore, in order to facilitate the close cooperation between different stakeholders and to properly disentangle the transformative process concerning the automotive cluster, the initiative was structured according to “six different topics[21] covering the entire value-chain” (Ibidem, 2018).

Currently, for each identified subject, working groups are discussing the state of the art and the future trends of the industry in the next 7/10 years in order to implement targeted strategies and projects which are aimed at easing and supporting the disruptive changes affecting the automotive sector. Some funding programs have already been set up based on the first results of this program. Thus, this initiative is definitely helping industries to catch up on what is happening worldwide and to enable them to develop the right strategies looking at future trends.

In addition, in the field of economic promotion, the “Wirtschaftsförderung Region Stuttgart GmbH” (WRS), as a subsidiary of the VRS and a number of further regional actors[22], building on a comprehensive approach directed at the maintenance as well as the enhancement of the structural economic strengths of the territory, takes on various important tasks (in close consultation with the VRS). Among these is the support of the industrial and entrepreneurial activities of the region - by providing a platform for the cooperation facilitating the dialogue and linkages between the industry clusters, regional networks and the academic and research institutions. Next to this, there is the strategic approach on developing land through research and monitoring which constitutes a crucial input from the regional planning process. Thereby, future projections of regional development trends in terms of spatial distribution are translated into the question of land demand.

2.7 Potential inspirational cases from the stakeholder city-region

- Political steering and regional agenda. The introduction of a regional parliament in the form of a directly elected Regional Assembly puts Stuttgart Region on such a level of political action. Unlike the usual delegation of regional decision-makers from district assemblies, this creates an autonomous regional agenda that is manifestly more complex than the sum of individual rural district perspectives.
- Binding stipulations and funding. The Verband Region Stuttgart functions as a public body at a supra-municipal level and is responsible for comprehensive regional planning. The regional plan is legally binding for all public planning bodies and for local land-use planning and zoning. Besides that, financial incentives can be given to foster measures and projects on local level, especially with regard to the development of green infrastructure.

[21] These are (1) Research and Development, Production and Suppliers, (2) Sales and Aftersales, (3) Energy, (4) Digitisation, (5) Traffic Solutions, (6) Research and Innovation Environment (Baden-Württemberg, 2018 p.6).

[22] These include regional development and real estate agencies of the federal state and the city of Stuttgart as well as the social partners

- Regional planning and economic development. Close collaboration between regional planning and economic development allows for coordinated strategies.
- IBA 2027. The underlying idea of IBA 2027 is based on the disruptive times the region is experiencing. After the IBA 1927 held in Stuttgart about 100 years ago, the idea is to build a time-line narrative between the two events by looking both at the historical evolution and future development. In particular, IBA 2027 intends to explore the foreseeable future of three urban dimensions, living, working and mobility, and the way in which these will be integrated. As such, businesses in the region are encouraged to investigate, test and validate potential solutions able to capture and anticipate the evolution of the urban ecosystem 10 years above time. This approach to innovation is encouraged by a couple of means such as the total visibility that companies will get (whereby companies can get the IBA label on their buildings). Next to this, the introduction of regulations will allow being a little more flexible in exploring innovative solutions, check for new materials, etc.; so as to push the frontiers a little forward in the construction and integration of mobility, working and living together in one comprehensive ecosystem.
- The system of revenue sharing and join development of larger industrial zones (interkommunale Gewerbegebiete). A lot has been written on this approach and it was hyped both in Germany and Austria about five years ago. There is observable a certain disenchantment with this instrument in both Vienna and Berlin. A closer investigation of the pre-condition of success of this system is deemed to be worthwhile, more specifically around the reasons for which the system does work in Stuttgart but not elsewhere.

3 A data-driven SWOT analysis for Stuttgart

3.1 Introduction and Methodology

The following chapters provide an analysis of the employment structure of Stuttgart metro-region. They are based on the analysis of shares and number of employees being employed in different sectors of productive economy (measured at NACE 3-digit level).

The detailed analysis has three main parts: 1) displaying and analysing the productive sectors that provide the biggest employment in the region – compared to the national average - 2) displaying and analysing the sectors that resulted in the fastest growth – compared to the national average - between 2012-2017 and 3) highlighting the sectors that represent the biggest potentials and the highest threats for the local economy.

There is a well-established methodological background behind Part 3 that follows the approach to the analysis of the regional network of branches pioneered by Otto et al. (2014) and Neffke et al (2017A, 2017B). The basis for this approach is the common recognition that innovation (and thus growth) is driven by the exchange of knowledge between firms, having a complementary knowledge base, in the form of labour flow between branches (labelled as “embeddedness”). In addition, the development potential of a production branch is also based on the existence of a “critical mass” of employees in the metropolitan area being metered by the share of employees exceeding the national average (labelled as “specialisation”).

Table 2: Categories of the empirical SWOT analysis.
Development potentials according to degree of specialisation and embeddedness

		Regional embeddedness of branch *i*	
		high $LQ_{ir}^{rel} > 1{,}1$	low $LQ_{ir}^{rel} < 0{,}9$
Regional degree of specialisation in branch *i*	High $LQ_{ir} > 1{,}1$	High localisation and well embedded (Strength S)	High localisation but weakly embedded (Threat T)
	low $LQ_{ir} < 0{,}9$	Low localisation but weakly embedded (Opportunity O)	Not localized and weakly embedded (Weakness W)

Source: Otto et al. (2014), ESPON MISTA (2020).

Overall, both the degree of specialisation and the embeddedness in the regional sectoral structure are decisive for an assessment of the development potential of a branch., According to Otto et al. (2014) economic branches in a region can be classified into four different categories, by differentiating, according to the values of their localisation quotient and their embeddedness indicator (Table 2):

1. If the branch under consideration is heavily localized in the region and if this branch is also well embedded in "related" branches, the branch is large relative to the regional economy and it is likely that it will also strongly profit from localised knowledge transfers across industries in the region. As a consequence, its future development prospects

should be favourable, and the branch can be considered to be a "strength" of the regional economy.

2. By contrast, a branch with a low degree of specialisation and embeddedness is unlikely to profit substantially from localized knowledge transfers but is also small in terms of the regional economy. Despite the fact that such branches may be of importance for the other reasons (e.g., the presence of natural resources or the satisfaction of local demand) such branches have therefore been regarded as a regional "weakness" in previous analysis from a technological development perspective.
3. Branches that are lowly localised but well embedded are faced by a favourable regional environment of technologically or cognitively "close" branches (and thus diverse opportunities to use a common knowledge base) but are still relatively small. Such branches could thus offer special "opportunities" to develop new strengths through structural policy initiatives in the future.
4. Finally, branches which are highly localized, but only weakly embedded in complementary in the region, tend to be seen at risk which could be reduced by strengthening complementary branches through structural policy initiatives. This is because they are relatively large but are unlikely to profit substantially from their regional knowledge base.

(A more detailed explanation on this methodology can be found in the Annex.)

Two types of analysis are presented in this chapter. The first represents the sectoral employment shares and growth rates of productive activities at the level of NACE 3-digit branch groups. The second type of analysis presents the SWOT profiles for productive activities. It allows to identify viable sector specialisations and areas of opportunity for innovation-driven economic growth in the region. These results thus provide essential direct inputs for structural and cluster policy.[23]

3.2 Spatial scope of data analysis

Since, as already highlighted in the background report to task 1 of the MISTA project, urban regions are open systems and may thus also profit from knowledge spillovers from nearby regions, we present results for three different regions: The city of Stuttgart, the environs of the city of Stuttgart and the Stuttgart metropolitan region, which is the sum of the city of Stuttgart and its districts. While the city of Stuttgart is defined from a purely administrative perspective, as the territory covered by the Stuttgart city administration, the Stuttgart environs were defined in the course of the project in co-operation with the respective city administration. In defining this region three criteria were applied:

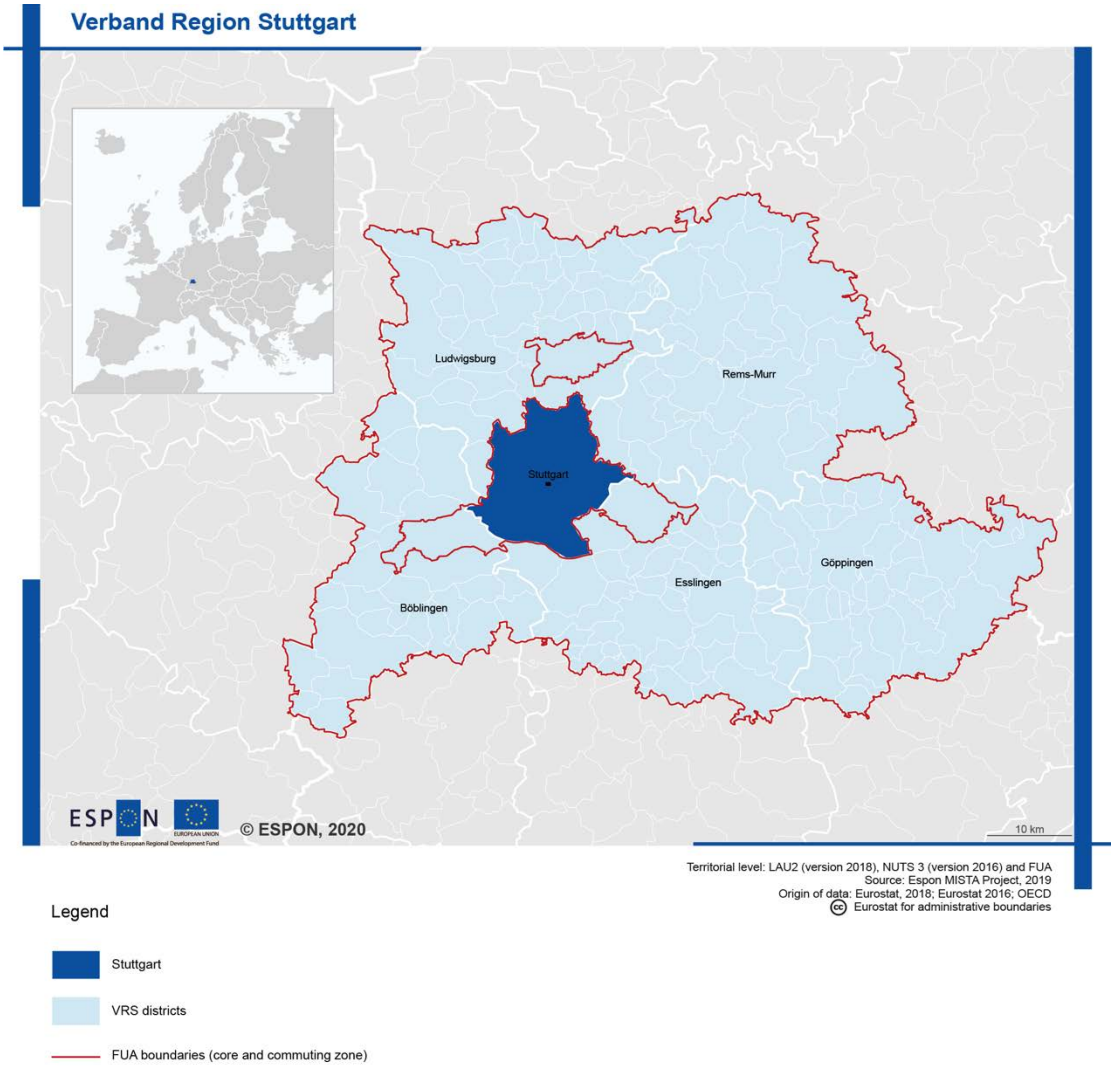
1. The most important of these was an administrative criterium according to which the chosen definition should to some degree reflect the administrative boundaries of existing institutions (or mechanisms) for inter – regional co-operation in the city. This

[23] Note that strengths, weaknesses, etc. are identified according to their degree of specialisation and embeddedness in the regional economy and not based on their degree of technology, R&D intensity and other factors evaluating the complexity and sophistication of a branch. Rather, being labelled as a “strength” can be regarded as a measure of revealed competitiveness of a branch in a specific region. Employment is reported at plant level and not at company level. This means that their assignment is to branch and region of the plant and not to that of the company headquarters.

criterium was chosen to ensure to the best possible degree that the analytic results are useful for existing urban planning processes.

2. The second criterium was based on data availability. Since the analysis conducted below requires detailed information on the development of employment at a NACE 3-digit level at a highly granular regional disaggregation level, this criterium prove to be the most constraining in the analysis
3. Finally, the third criterium was based on analytical consideration and was derived from the fact that knowledge spillovers as the central analytical concept guiding the current analysis in all likelihood exceed the regional scope of travel to work areas, which speaks in favour of using larger regions rather than smaller ones for the current analysis.

Map 1: Definition of the metropolitan region of Stuttgart.



Source: ESPON MISTA (2020).

In the case of Stuttgart, it was decided to take the territory of the Verband Region Stuttgart (VRS) as a definition for the Stuttgart metropolitan region, as this represents a well-established administrative area with a common planning agency and even an own regional parliament. To analyse the economic structure of this region the research team obtained employment data at the NACE 3-digit level on this region from the Bundesagentur für Arbeit. This data is originally

available at the Kreis[24] level for all of Germany. To avoid potential issues with the confidentiality of the data, however, it was aggregated to the level of Stuttgart city (consisting only of one Kreis) and the Stuttgart environs (consisting of five Kreise[25]) by the Bundesagentur. The data contain the number of employees (excluding marginally employed) in each of the NACE-3-digit industries located in these regions and in all of Germany for the years 2012 and 2019, such that they can be used to calculate all the indicators considered in the current study (i.e., employment shares, localisation, employment growth and embeddedness.

Two issues related to the data are that it does not contain self-employed and misses some industries to ensure confidentiality of the data. Both these issues are, however, of minor relevance in the current context, as the production sectors we look at are usually characterized by rather large-scale enterprises and few self-employed. Similarly censoring due to confidentiality issues as a rule affects only branches with a low number of employees that are unlikely to substantially bias the overall picture of productive industries in the region.

3.3 Size and growth of individual productive activities

3.3.1 Sector shares

When considering the employment shares of individual NACE 3-digit branches in the Stuttgart region according to this data the region as a whole as well as its individual parts (i.e., the city of Stuttgart and its environs) are unambiguously identified as automobile regions. The largest sector in the entire region (with a share of 6.4% of overall employment) is “manufacture of motor vehicles” and the second largest in the city and the third largest in the environs is the “manufacture of parts and accessories for motor vehicles” (3.08% of total employment). In addition, the third, fifth, seventh and eighth rank are taken by classical machine building branches (“manufacture of other general-purpose machinery”, “manufacture of metal forming machinery and machine tools”, “manufacture of other special purpose machinery” and “manufacture of general purpose machinery”) that are closely related to the automobile industry as a substantial part of their production consists of machines that are used by the large car manufacturers in the regions (and all around the world).

Table 3: Top 10 branches in terms of size (2019).

NACE	Name	Empl.	Share in %
Total metropolitan region			
C29.1	Manufacture of motor vehicles	81686	6,38
C29.3	Manufacture of parts and accessories for motor vehicles	39443	3,08
C28.2	Manufacture of other general-purpose machinery	27269	2,13
F43.2	Electrical, plumbing and other construction installation activities	22360	1,75
C28.4	Manufacture of metal forming machinery and machine tools	18493	1,44
H52.2	Support activities for transportation	18322	1,43

[24] Kreis is the name to NUTS 4 regions in Germany.

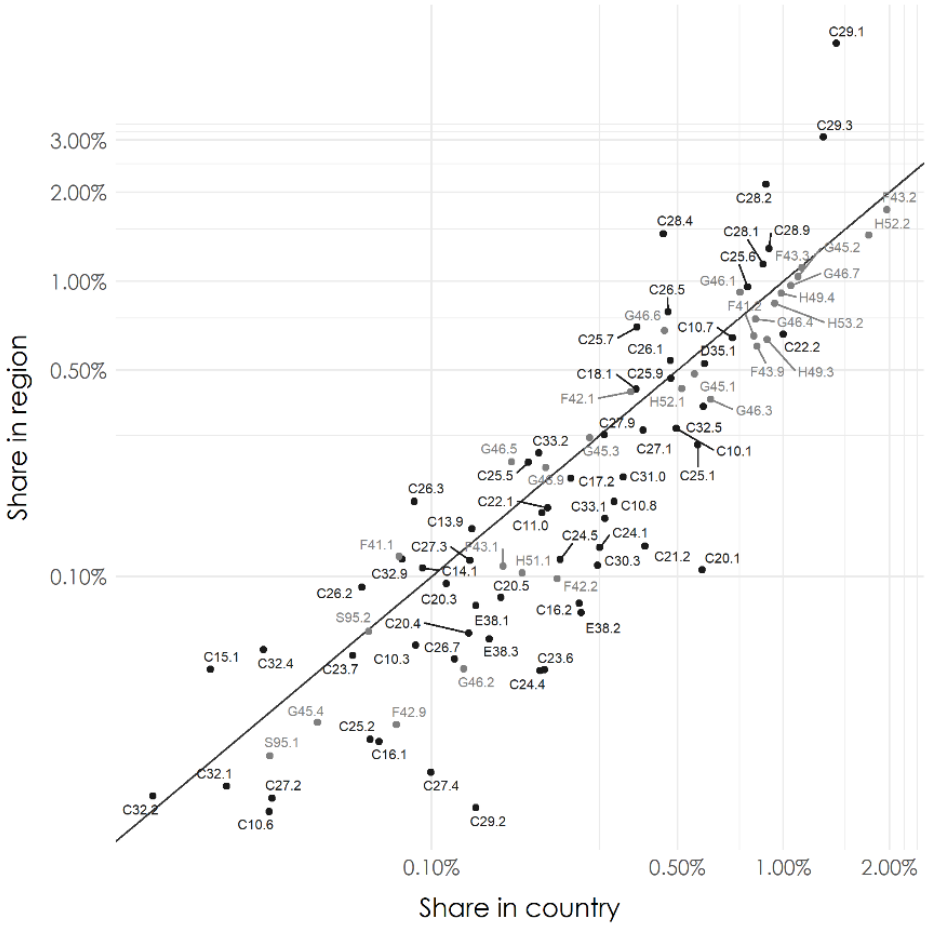
[25] These are: Böblingen, Esslingen, Göppingen, Ludwigsburg, Rems-Murr-Kreis.

C28.9	Manufacture of other special-purpose machinery	16488	1,29
C28.1	Manufacture of general-purpose machinery	14633	1,14
F43.3	Building completion and finishing	14237	1,11
G45.2	Maintenance and repair of motor vehicles	13250	1,03

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Separate illustrations for the city and its environs are provided in Table A1 in the annex.

Furthermore, the high share of the "support activities for transportation" is probably driven to a large degree by the demand for transport of the automotive industry while the "maintenance and repair of motor vehicles" – although more geared towards the local demand of the population and not a highly internationalised branch in general, is also clearly linked to the dominant automotive industry in the region. Thus, the only branch in the top 10 in terms of employment that is not clearly linked to the automotive industry is "electrical, plumbing and other construction installation activities".

Figure 1: Sector shares of productive activities (total Stuttgart metropolitan area).

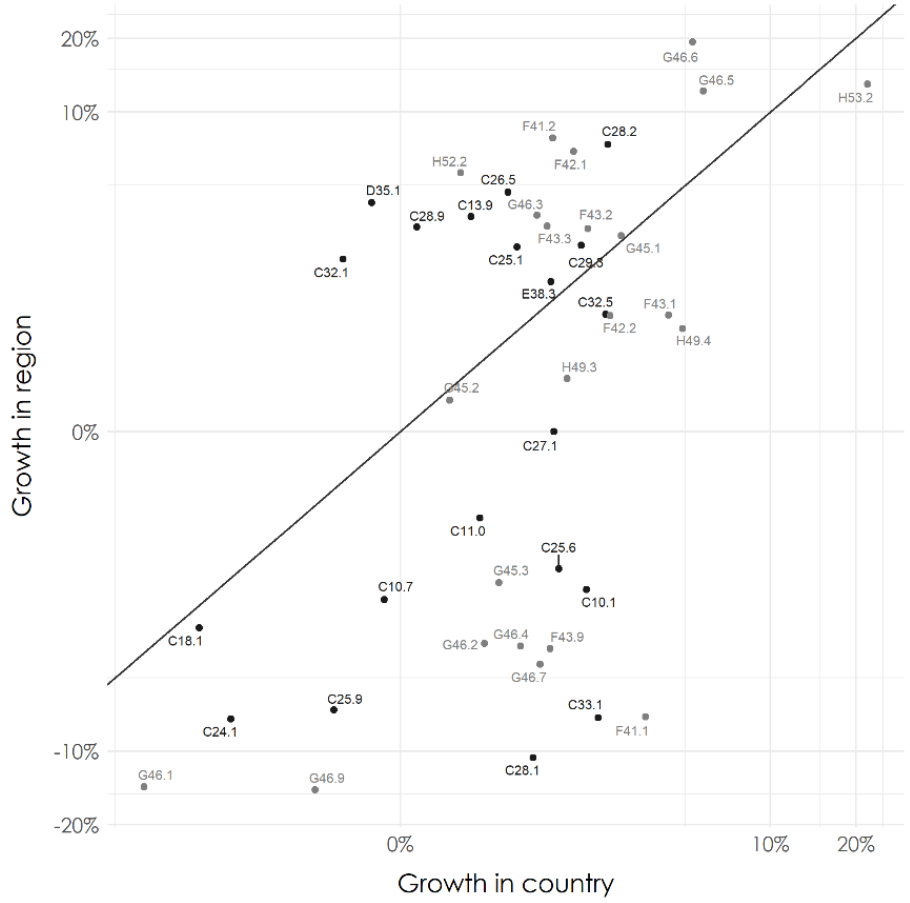


Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey); For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

The dominance of the automotive industry applies to both the city of Stuttgart as well as its environs. In the city of Stuttgart as well as in the environs the "manufacture of motor vehicles"

is the largest employer and the “manufacture of parts and accessories of motor vehicles” is the second largest. This said, however, the city’s employment structure is noticeably more diverse than that of the environs. In the environs 7 of the 10 largest NACE 3-digit industries are in manufacturing mostly in machine building and/or metal working and thus closely related to the dominant automobile industry, in the city next to the two large automobile branches the remaining branches in the top ten are construction (“electrical, plumbing and other construction installation activities”, “construction of residential and non-residential buildings, building completion and finishing”), logistics (e.g. “other passenger transport”) or wholesale (e.g. wholesale of household goods) branches or utilities (e.g. “electric power generation, transmission and distribution”). In this respect therefore Stuttgart city shares the structural characteristics of many of the MISTA case study cities. [26]

Figure 2: Sector shares of productive activities (city of Stuttgart).



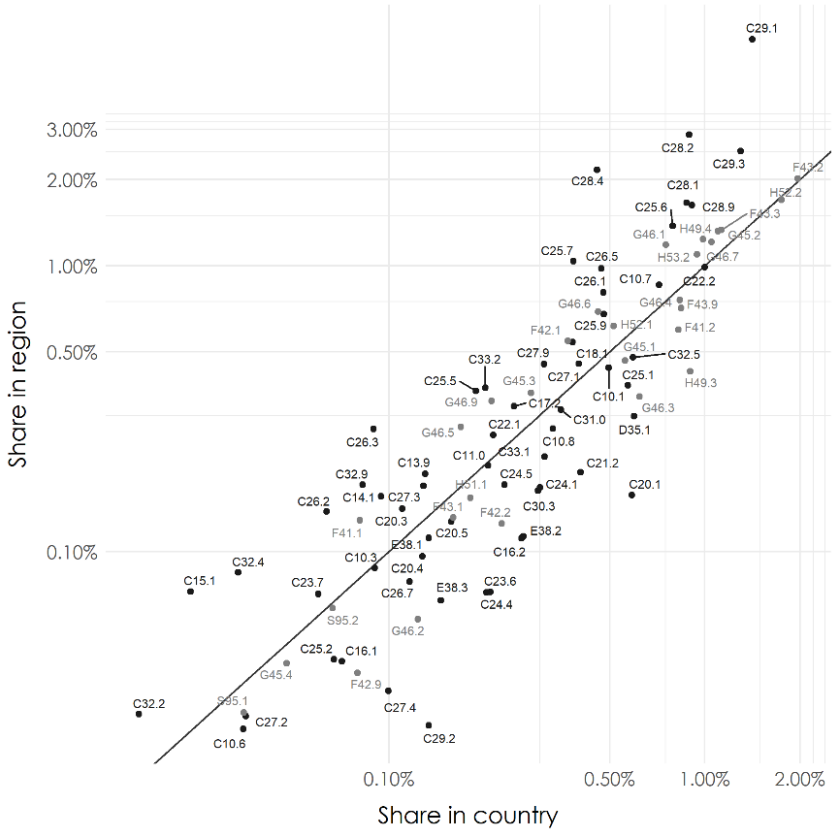
Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

[26] Nonetheless even among these branches there is sometimes a visible link to the automotive and machine building industry. For example, the wholesale of other machinery, equipment and supplies is the 8th largest employer in the city of Stuttgart.

Further, this dominance of the automotive cluster is also reconfirmed when considering the size of individual NACE 3-digit branches relative to the national average by focusing on the location quotient. Thus, in the city of Stuttgart the share of the “manufacture of motor vehicles” in employment is about 4.8 times and environs 4.4 times the share in the German average. In the city in addition the location quotient of the “manufacture of parts and accessories for motor vehicles” is around 3.3. For all other branches it is substantially lower. The third ranking “electrical power generation and distribution” only reaches a location quotient of 1.3.

Interestingly, however, in this perspective also a number of smaller branches emerge as large relative to the German average employment. This points to a number of “niche” specialisations within Stuttgart. These include “manufacture of jewellery, bijouterie and related articles” with a total employment of only 175 persons in the city, but also a number of production branches in construction “development of building projects” or the “wholesale of information and communication equipment”.

Figure 3: Sector shares of productive activities (environs).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

For the environs by contrast this focus on the relative employment share highlights the broad industrial base of the Stuttgart region. Indeed, in this perspective the most localised branch in the Stuttgart environs is the “manufacture of metal forming machinery and machine tools” and the third most localised is the “manufacture of other general-purpose machinery”. Overall, in

the environs all of the 10 most localized branches are manufacturing branches and for all of them the coefficient of localisation is above two. This implies that in all these branches the employment share of the respective branch is double as high in the Stuttgart environs than in the German average.

This heavily industrialized structure of the environs also dominates the structure of the overall Stuttgart metropolitan region, when considering the location quotient. Next to the automobile industry there are important specialisations in the metal working industry ("manufacture of metal forming machinery and machine tools"), machine building ("manufacture of other general-purpose machinery", "manufacture of cutlery, tools and general hardware") electronics and electrotechnics ("manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks", "manufacture of communication equipment") and also in a number of consumer goods producing manufacturing branches ("tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur" and "manufacture of games and toys").

Table 4: Top 10 branches in terms of specialisation (location quotient, 2019).

NACE	Name	Empl.	LQ
Total metropolitan region			
C29.1	Manufacture of motor vehicles	81686	4,52
C28.4	Manufacture of metal forming machinery and machine tools	18493	3,17
C28.2	Manufacture of other general-purpose machinery	27269	2,39
C29.3	Manufacture of parts and accessories for motor vehicles	39443	2,37
C15.1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur	620	2,06
C26.3	Manufacture of communication equipment	2296	2,01
C25.7	Manufacture of cutlery, tools and general hardware	8946	1,82
C32.4	Manufacture of games and toys	723	1,70
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	10073	1,67
G46.6	Wholesale of other machinery, equipment and supplies	8710	1,48

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Only industries with at least 100 employees are considered. Separate illustrations for the city and its environs are provided in Table A3 in the annex.

In sum, in terms of economic structure the Stuttgart region as well as its subregions are therefore unambiguously manufacturing regions with a dominant by the automotive industry, that, however, hides some important additional specialisations in smaller sectors.

3.3.2 Growth

A consideration of the growth rates of individual branches over the period 2012 to 2019 also suggest that the automobile industry has been growing rather rapidly over our observation period. Thus – despite its already large employment level in 2012 -"the manufacture of motor vehicles" - ranks ninth among the fastest growing NACE 3-digit industries in the Stuttgart metropolitan region in terms of percentage growth and - given its size – is also the fastest growing industry in production in absolute terms.

In addition, some of the Nacre 3-digit branches that have been growing more rapidly than “the manufacture of motor vehicles” in percentage terms are also closely linked to car manufacturing. Thus, the fastest growing NACE 3 – digit branch in percentage terms in the Stuttgart metropolitan region over our observation period has been the “manufacture of air and spacecraft and related machinery”, which is technologically closely linked to the automobile industry and in which some of the major car producers of the region are themselves active.

Also, other manufacturing branches such as the “manufacture of communications equipment”, “manufacture of optical instruments and photographic equipment, “manufacture of batteries and accumulators” and “manufacturing n.e.c.,” which includes a wide range of producers from reaching from specialised safety equipment over a variety of consumer goods to the production of coffins have been growing more rapidly in percentage terms than the automotive Industry.[27]

Table 5: Top 10 branches in terms of growth (2012-2019).

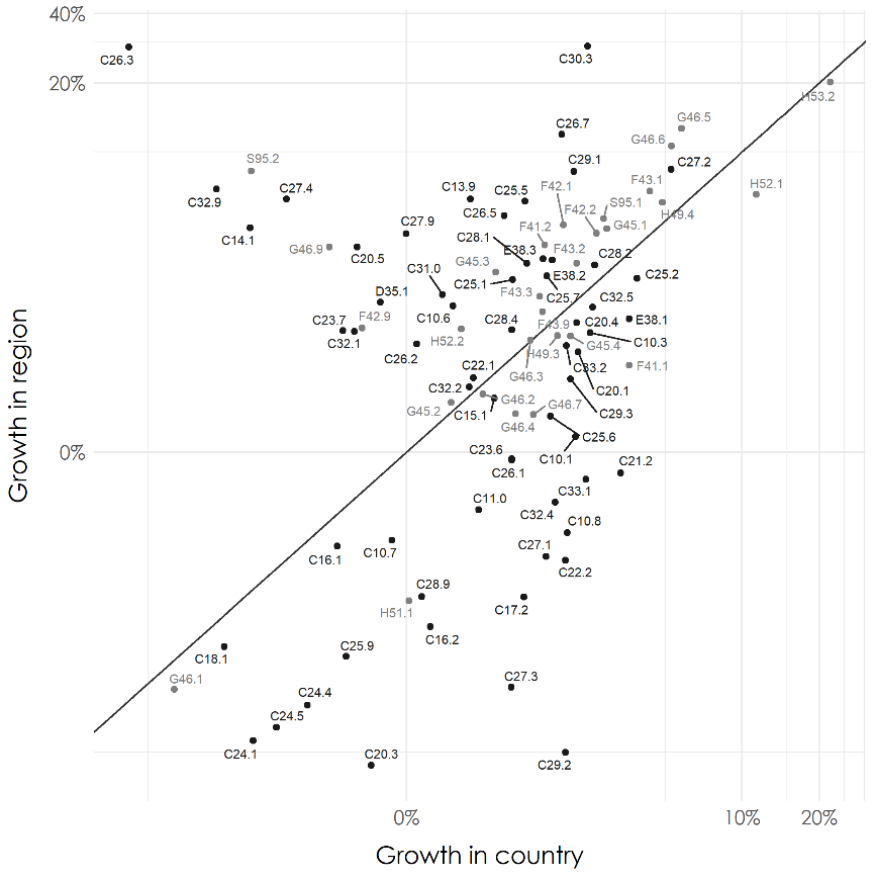
NACE	Name	Empl.	Growth p.a. in %
Total metropolitan region			
C30.3	Manufacture of air and spacecraft and related machinery	1395	28,82
C26.3	Manufacture of communication equipment	2296	28,68
H53.2	Other postal and courier activities	10747	20,19
G46.5	Wholesale of information and communication equipment	3134	12,65
C26.7	Manufacture of optical instruments and photographic equipment	672	11,95
G46.6	Wholesale of other machinery, equipment and supplies	8710	10,62
C27.2	Manufacture of batteries and accumulators	227	8,41
S95.2	Repair of personal and household goods	835	8,26
C29.1	Manufacture of motor vehicles	81686	8,22
C32.9	Manufacturing n.e.c.	1464	6,88

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Only industries with at least 100 employees in 2019 are considered. Separate illustrations for the city and its environs are provided in Table A2 in the annex.

[27] According to standard international definitions this class includes: manufacture of protective safety equipment, manufacture of fire resistant and protective safety clothing, manufacture of linemen's safety belts and other belts for occupational use, manufacture of cork life preservers, manufacture of plastics hard hats and other personal safety equipment of plastics (e.g. athletic helmets), manufacture of firefighting protection suits, manufacture of metal safety headgear and other metal personal safety devices, manufacture of ear and noise plugs (e.g. for swimming and noise protection), manufacture of gas masks- manufacture of pens and pencils of all kinds whether or not mechanical- manufacture of pencil leads- manufacture of date, sealing or numbering stamps, hand-operated devices for printing, or embossing labels, hand printing sets, prepared typewriter ribbons and inked pads, manufacture of globes, manufacture of umbrellas, sun-umbrellas, walking sticks, seat-sticks, manufacture of buttons, press-fasteners, snap-fasteners, press-studs, slide fasteners, manufacture of cigarette lighters, manufacture of articles of personal use: smoking pipes, scent sprays, vacuum flasks and other vacuum vessels for personal or household use, wigs, false beards, eyebrows- manufacture of miscellaneous articles: candles, tapers and the like; artificial flowers, fruit and foliage; jokes and novelties; hand sieves and hand riddles; tailors' dummies; burial coffins etc., manufacture of floral baskets, bouquets, wreaths and similar articles, taxidermy activities.

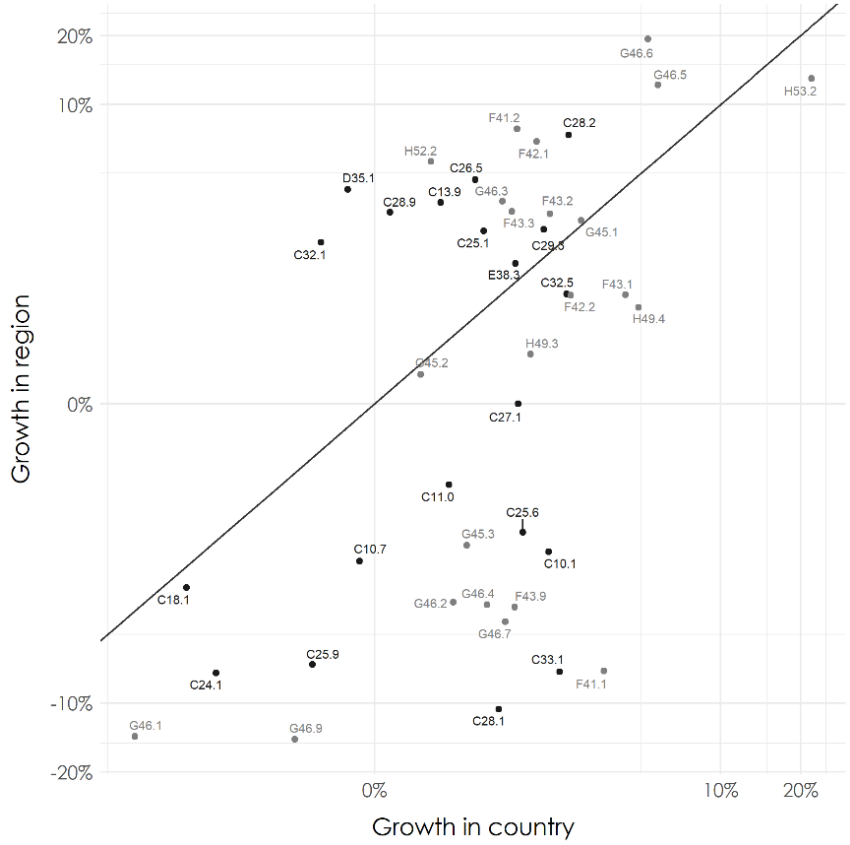
Interestingly and in contrast to the other metropolitan regions covered in the MISTA project, only few of the service sectors (i.e., logistics, wholesale trade and construction) and consumer goods industries, that are found to have been the growth poles of urban production in other cities, belong to the fastest growing branches in the Stuttgart metropolitan region. The only branches from the wholesale and logistics group that feature among the top 10 in terms of employment growth are “other postal and courier activities”, “wholesale of information and communication equipment and “wholesale of other machinery, equipment and supplies”. Among the more consumption-oriented production sectors only the “repair of personal and household goods” belongs to this group.

Figure 4: Growth of productive activities (total Stuttgart metropolitan area).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

Figure 5: Growth of productive activities (city of Stuttgart).

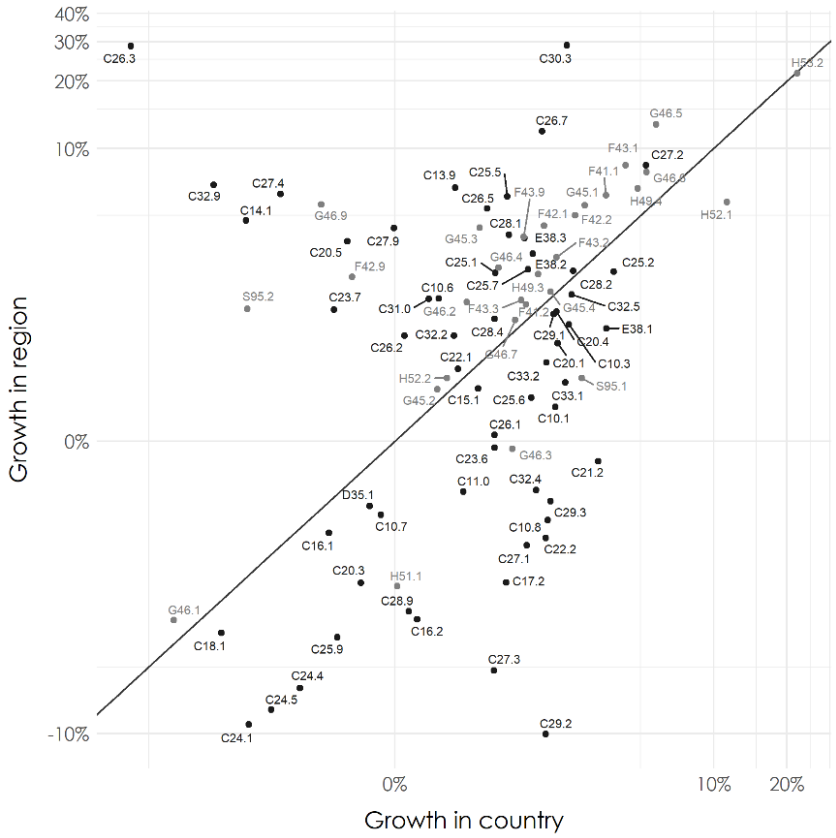


Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

Within the Stuttgart metropolitan region, the growth of these production sectors has been limited mainly to the city of Stuttgart. In the Stuttgart environs the two fastest growing branches are “manufacture of air and spacecraft and related machinery” and “manufacture of communication equipment” and six of the 10 fastest growing branches belonging to the manufacturing sector. of these only the “manufacture of textiles” and potentially the manufacture of optical instruments and photographic equipment” are more closely related to consumer goods industries.

In the city of Stuttgart by contrast the three fastest growing production branches in the period 2012 to 2019 (“wholesale of machinery, equipment and supplies”, “other postal and courier activities” and wholesale of communication and information equipment”) are all wholesale and logistics branches. In addition, only two of the 10 fastest growing branches belong to the manufacturing sector (“manufacture of other general-purpose machinery” and “manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks”.

Figure 6: Growth of productive activities (environs).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

3.4 SWOT profiles of productive activities

Given the very strong position of the manufacturing sector it is not surprising that the network analysis conducted in the empirical SWOT analysis of the MISTA project points to rather tightly knit knowledge networks in the manufacturing sector in the Stuttgart metropolitan region. Thus, when considering the 10 most strongly embedded branches in the metropolitan region, all but two of them are in manufacturing. In addition, among the exceptions the high embeddedness of “sale, maintenance and repair of motorcycles and related parts and accessories” as well as “maintenance and repair of motor vehicles”, as the most strongly embedded branches, arises only because these branches are closely connected to both the car producers in the city as well as to most wholesale trade branches.

Table 6: Top 10 branches in terms of embeddedness (2019).

NACE	Name	Empl.	Embed.
Total metropolitan region			
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	410	1,82
G45.2	Maintenance and repair of motor vehicles	13250	1,74
C29.3	Manufacture of parts and accessories for motor vehicles	39443	1,60
C30.3	Manufacture of air and spacecraft and related machinery	1395	1,59

C28.1	Manufacture of general-purpose machinery	14633	1,49
C26.1	Manufacture of electronic components and boards	6900	1,49
C29.1	Manufacture of motor vehicles	81686	1,48
C29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	211	1,41
C33.2	Installation of industrial machinery and equipment	3361	1,39
C28.9	Manufacture of other special-purpose machinery	16488	1,36

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Only industries with at least 100 employees are considered. Separate illustrations for the city and its environs are provided in Table A4 in the annex.

The remaining most strongly embedded branches are all associated with manufacturing of automobiles or strongly related to the car industry ("manufacture of parts and accessories for motor vehicles", "manufacture of air and spacecraft and related machinery", "manufacture of motor vehicles", "manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers") or to machine building industry (e.g. "manufacture of general-purpose machinery", "installation of industrial machinery and equipment", "manufacture of other special-purpose machinery"). These heavily localised industries in the Stuttgart area are on the one hand closely linked to each other. On the other hand, they are also strongly linked to many of the other localized sectors described in section 3.1 above.

The strong position of the automotive industry in the knowledge networks of the region apply to both the city of Stuttgart as well as its environs. In the city of Stuttgart among the automotive industry branches very much the same NACE 3-digit groups appear as the well embedded ones, as when considering the region as a whole. The difference here is that many of the machine building branches are replaced by wholesale and construction as well as logistics branches (e.g. "electrical, plumbing and other construction installation activities", "other passenger land transport", "support activities for transportation", "construction of residential and non-residential buildings", "wholesale of household goods", "building completion and finishing") and utilities ("electric power generation, transmission and distribution"). Next to the tightly knit knowledge networks of the automotive industries, thus also these branches have close knowledge connections to the sectors operating in the core economy.

Table 7: SWOT Profiles for the total metropolitan region (2019).

NACE	Name	Employment
Embedded and localized		
C29.1	Manufacture of motor vehicles	81686
C29.3	Manufacture of parts and accessories for motor vehicles	39443
C28.4	Manufacture of metal forming machinery and machine tools	18493
C26.3	Manufacture of communication equipment	2296
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	10073
C25.7	Manufacture of cutlery, tools and general hardware	8946
C28.1	Manufacture of general-purpose machinery	14633
C28.9	Manufacture of other special-purpose machinery	16488

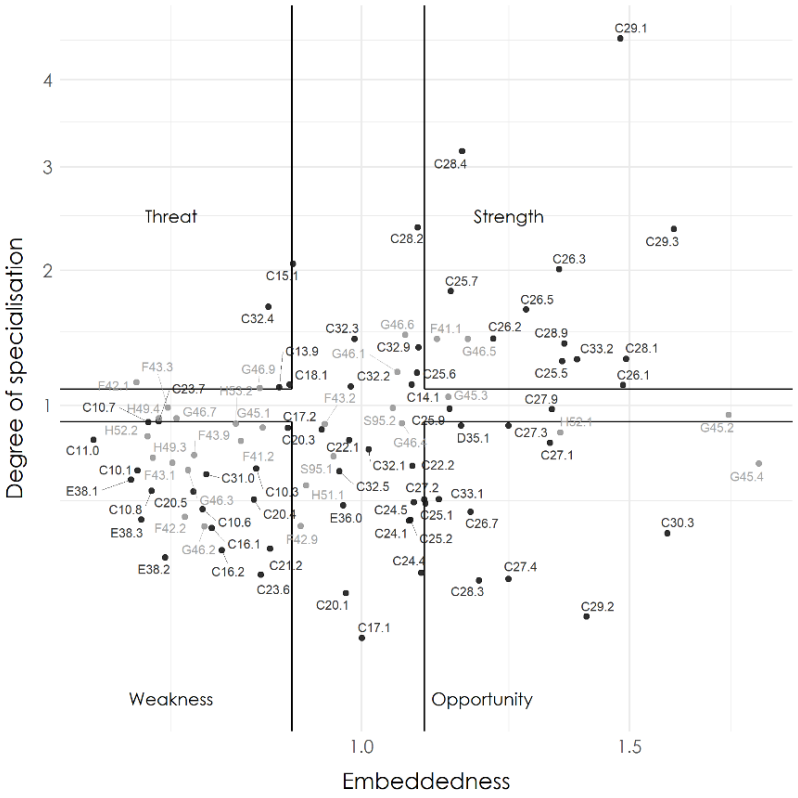
C33.2	Installation of industrial machinery and equipment	3361
C26.2	Manufacture of computers and peripheral equipment	1179
Embedded but not localized		
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	410
H52.1	Warehousing and storage	5537
C27.3	Manufacture of wiring and wiring devices	1450
C27.1	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	4004
D35.1	Electric power generation, transmission and distribution	6721
C30.3	Manufacture of air and spacecraft and related machinery	1395
C33.1	Repair of fabricated metal products, machinery and equipment	2009
C27.2	Manufacture of batteries and accumulators	227
C25.1	Manufacture of structural metal products	3570
C26.7	Manufacture of optical instruments and photographic equipment	672
Not embedded but localized		
C32.4	Manufacture of games and toys	723
C18.1	Printing and service activities related to printing	5513
C13.9	Manufacture of other textiles	1857
G46.9	Non-specialised wholesale trade	2993
F42.1	Construction of roads and railways	5399

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Only industries with at least 100 employees are considered. Separate illustrations for the city and its environs are provided in Tables A5 to A7 in the annex.

By contrast, in the environs next to the automotive sector the machine building sector is most strongly embedded, while only few branches outside manufacturing ("electrical, plumbing and other construction installation activities", "support activities for transportation", "building completion and finishing") show closer connection to it within the region.

Given these features it is also clear that the embedded and localised branches in the Stuttgart regions, which may be considered the current strongholds of the region's industrial base are manufacturing branches that are associated with the automotive, metal working, machine building and electronics and electrotechnics industries. This strength profile is also only slightly more differentiated when considering the subregions of the Stuttgart metropolitan region. In this respect the list of embedded and localized branches in the city is somewhat shorter than in the environs and also contains branches (e.g., "electric power generation, transmission and distribution", "development of building projects", "wholesale of information and communication equipment") outside the manufacturing sector. In the environs, by contrast, the localised and well embedded branches are all in the manufacturing sector and also exclusively connected to the car, machine building and metal working industries.

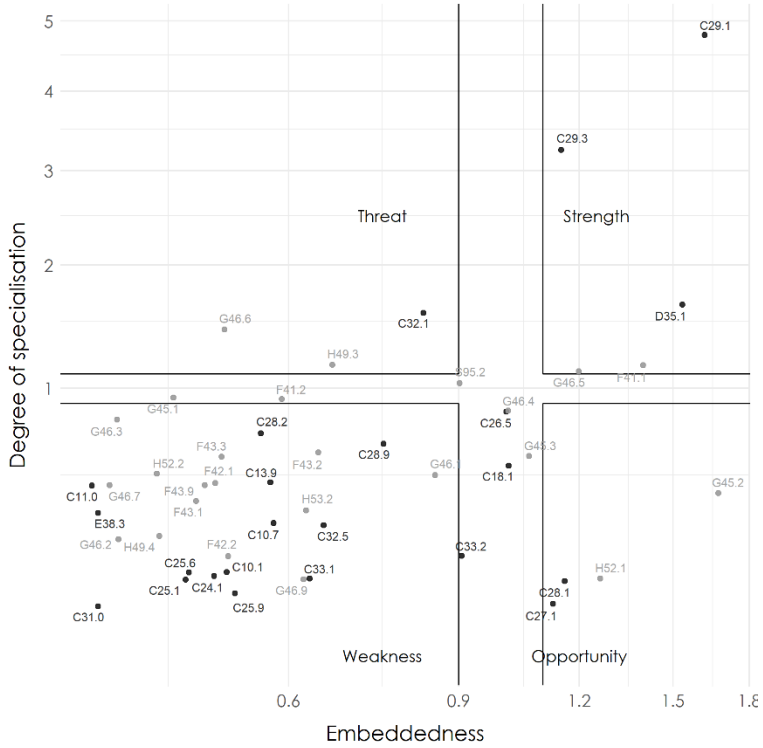
Figure 7: SWOT Profile (total Stuttgart metropolitan area).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

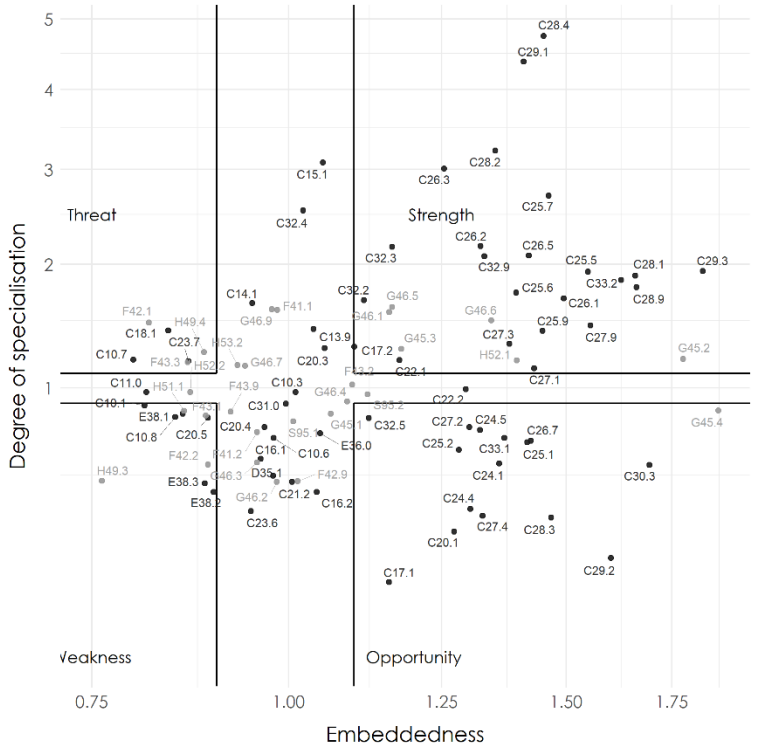
Also many of the branches that are embedded but not localised in the Stuttgart metropolitan region and could thus be seen as branches along which future technological development paths could develop are often in the manufacturing sector and include branches such as “manufacture of electric motors, generators”, “transformers and electricity distribution and control apparatus”, “electric power generation, transmission and distribution”, “manufacture of batteries and accumulators” that are related to the electronics and electrotechnics industry or are technologically close to the car industry (e.g. “manufacture of air and spacecraft and related machinery”). Next to this only “warehousing and storage” and the “electric power generation, transmission and distribution” are well-embedded but not localised branches.

Figure 8: SWOT Profile (city of Stuttgart).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations; Industry (service) activities in black (grey); For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

Figure 9: SWOT Profile (environs).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations; Industry (service) activities in black (grey); For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

This list of opportunities, however, differs slightly between the city of Stuttgart and its environs. As with the localised and embedded branches also the list of non-localised but embedded branches in the Stuttgart region is shorter and next to the “manufacture of general-purpose machinery” and the “manufacture of electric motors, generators and transformer and electricity distribution and control apparatus” also contains “warehousing and storage”. In the environs, by contrast, exclusively manufacturing branches in the electronics and electrotechnics and machine building industries as well as in medical technics and the optical instruments production belong to the embedded but not localised branches.

Finally, the not embedded but localised branches include those branches that are of economic relevance for the Stuttgart region in terms of employment shares but are not closely linked to the knowledge base in other important industries. Among these the manufacture of games and toys and the printing and service activities related to printing, that are closely related to the creative industry cluster in the region stick out as an important “island” in the industrial landscape of the Stuttgart metro-region. In addition, this group of activities also includes a rather mixed groups of branches (“manufacture of other textiles”, “non-specialised wholesale trade”, “construction of roads and railways”) whose development is, however, often driven by the demand of the local population.

3.5 Main take-aways

- An analysis of employment shares in the Stuttgart region clearly identifies the Stuttgart region and both of its subregions as classical car producing regions where the automobile producers take a rather large share of overall employment. A more detailed consideration of the specialisation patterns of the region, however, also highlights that next to the automobile producers the region hosts a rather large and varied number of other main manufacturing branches (mostly in machine building, electronics and electro-technics and metal working) that are of high importance for the overall German economy. Although these branches are to some extent also linked to car producers, this suggests a rather broad industrial base in that region.
- In contrast to many of the cities analysed in the MISTA project manufacturing is also of very high importance in the city of Stuttgart, even though here service industries do play an important role too. By contrast the Stuttgart environs are almost exclusively specialised in manufacturing industries.
- In terms of employment growth over the period 2012 to 2019 the automobile industry has shown good growth and “the manufacture of automobiles” has been a major contributor to employment growth in absolute terms. In relative terms, however, the “manufacture of air and spacecraft and related machinery”, has been the fastest growing industry. Also, other manufacturing branches such as the “manufacture of communications equipment”, “manufacture of optical instruments and photographic equipment, “manufacture of batteries and accumulators” have been growing more rapidly in percentage terms than the automotive Industry.
- Due to the strong position of the manufacturing sector Stuttgart is also a region in which the automotive industry is well embedded. In addition to the metal working, also machine building and electronics and electrotechnics industries are well embedded strongholds of the economy of Stuttgart.

- In terms of opportunities again mainly manufacturing branches in the “manufacture of electric motors, generators”, “transformers and electricity distribution and control apparatus”, “electric power generation, transmission and distribution”, “manufacture of batteries and accumulators” that are related to the electronics and electrotechnics industry or are technologically close to the car industry (e.g. “manufacture of air and spacecraft and related machinery”) are well embedded but not localised. Next to this “warehousing and storage” and the “electric power generation, transmission and distribution” are well-embedded but not localised branches, that may be present potential for future development.
- Finally, the region of Stuttgart is also marked by a number branches that are of economic relevance for the Stuttgart region in terms of employment shares but are not closely linked to the knowledge base in other important industries. These could be the focus of industrial policy initiatives. Among these the manufacture of “games and toys and the “printing and service activities related to printing” sticks out as two branches that are closely related to the creative industry cluster.

4 Outcomes of the future workshop-seminar

4.1 Workshop structure

Motivation

The workshops were intended as an exploratory and self-reflective process for MISTA's seven stakeholder cities to review how their planning policy, plans, regulation and technical capacity reflect their ambitions in terms of research from the MISTA project. Each workshop followed a similar structure and contained similar ambitions, including:

- Helping to expose motivations and priorities for each of the cities.
- Seeking feedback on how research could be applied to decision making processes.
- Exploring the relevance of the Inspirational Cases, based on a shortlist of 27 cases.
- Showcasing how to facilitate stakeholder co-creation based on the outcomes of the MISTA project and to create 'Metropolitan Industrial Spatial Strategies' related to 'Economic Sprawl'

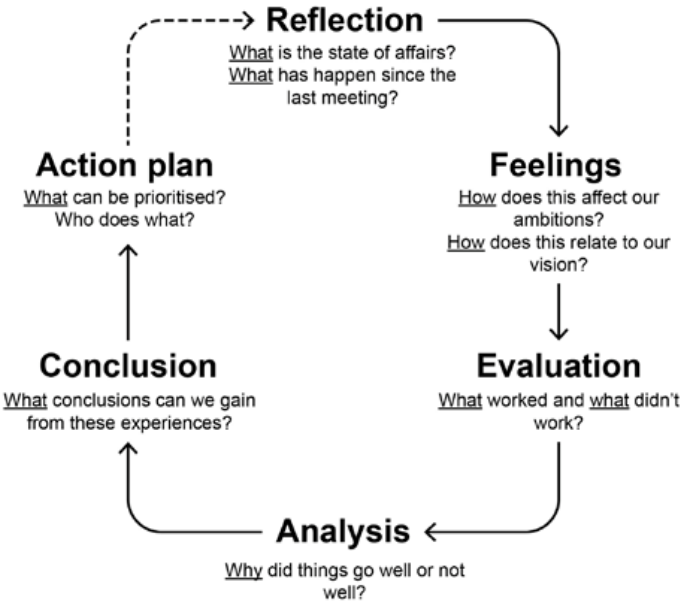
The workshops were not expected to generate exhaustive results but were designed to help create conditions for collaboration, exchange and expose what issues were most relevant to each city. The workshops also provided participants with a range of tools that could help to facilitate the use of the MISTA research for discussion and collaboration in the longer term.

Workshop program

Knowledge transfer can depend on a number of factors. This could include the technical skills of those involved, the institutional capacity to interpret and apply the knowledge to the local cultural context, the planning environment, the economic conditions and the political landscape. As noted in the main MISTA report, the public sector at a city and metropolitan level across Europe has rarely been involved in shaping urban production networks. To be more actively involved in shaping the local (production) economy would require public authorities adopting new knowledge, developing new forms of collaboration (both inter-institutional but also outside the public sector) and in some cases new skills. Organisational change management offers a useful pathway. A development process where challenges are unclear, where shared meaning is required and where the end is poorly defined, can benefit from a reflexive approach based on co-creation and learning, what has been referred to as a 'community of practice'.

The MISTA futures workshop was based on 'experiential learning' methodology developed by Graham Gibbs 1988. The program was built around a six-step process, illustrated in the diagram below. The ambition of using this methodology was to bring together local actors within a community of practice and based on experiential learning, while showcasing a methodology that could be applied after the MISTA project was completed.

Figure 10: The two axes that define the policy scenarios.



Source: MISTA adaptation, based on Graham Gibbs 1988.

4.1.1 Workshop-seminar structure for Stuttgart

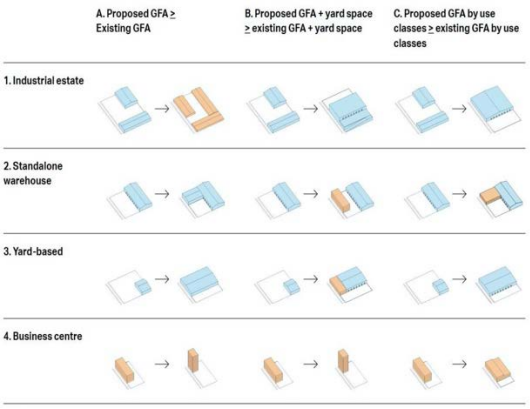
The Stuttgart workshop was hosted on the 30th of November with local actors for two hours. The event was hosted by Christoph Hemberger and Thomas Kiwitt from the Verband Region Stuttgart (VRS). The event included ten attendees from: The Region of Stuttgart, from the FH Aachen (University of Applied Sciences), University of Stuttgart, Hanover Region and organisations focused on economic development.

Due to challenges with the online format and a pressing election (City of Stuttgart and Federal State of Baden-Württemberg), only a few steps of the workshop format described above were able to be followed. The event began with a reflection on the MISTA team's interviews and analysis. This was followed by an open discussion, which was concluded with a presentation of inspirational cases. The methodology proposed above remains highly relevant considering Stuttgart's close relationship with its industrial activities.

4.1.2 Inspirational cases selected

Five inspirational cases were selected for the workshop which provide an indication of the kind of interventions that were considered a priority.

Figure 11: The inspirational cases presented and discussed within the workshop.

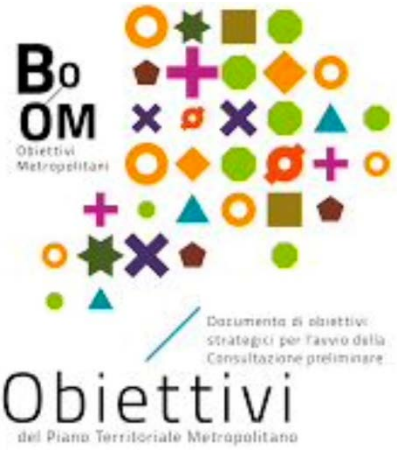


Greater Manchester Local Industrial Strategy

Stuttgart has a well-established metropolitan government and governance system, however, lacks the capacity to implement plans due to the power of local governments. The example of how Greater Manchester developed its Combined Authority offers an alternative example of metropolitan cooperation and governance.

Industrial intensification and co-location study (London)

Stuttgart's limited amount of space requires more effective use of land. London's intensification study provides Stuttgart with a good example of the kinds of guidelines and development opportunities to apply locally.



Metropolitan Fiscal Equalisation Fund (Bologna)

Because of the issues with possible winners and losers resulting in economic develop and equalisation fund could be an effective tool to reduce tension or provide some kind of compensation for economic development that has regional benefits.

Oslo Development Plan

Development requires multi-level collaboration in Stuttgart. The Oslo Development Plan provides the basis for dialogue and even collaboration during the planning process, which can help reduce tension related with economic development.

I3P business incubator (PoliTo), Turin

Incubation is essentially to breed local fresh ideas and business. the IP3 is a strong example particularly related to IT.

Source: ESPON MISTA (2020).

4.1.3 Outcomes and discussion

The Region of Stuttgart is an exemplary case of metropolitan development that has embedded production into the heart of economic planning while already actively employing many strategies that would be recommended to other regions. In some ways the discussions that occurred amongst the stakeholders present in the workshop focused on very specific issues. This should be seen as both a strength and weakness.

One of the strengths highlighted in the workshop showed how successful Stuttgart's strongly integrated public-private economic model works. The main discussions focused around finding suitable space for new development and dealing with the complexity of having production distributed across the region without having much space remaining for businesses to adapt or evolve. Industrial intensification offers a solution but will likely require new collaborative ways of dealing with partnerships between regional scale actors (both public and private) and local scale stakeholders (local public authorities and residents). Participants also argued that due to the industrial specialisation of the region, Stuttgart (or rather the region as a whole) is even more strongly affected by global and European developments than other cities and areas. This should imply a stronger focus on and potentially a more active role of the region in in particular European debates.

What emerged as a central topic of debate was how precisely the focus of the region on a car production affects the development perspectives of the region. Empirical evidence suggests that next to the car industry there are a number of technologically related branches with a high

localisation in the region. Nonetheless the vehicle industry is likely to increasingly demand more space and investment in the region in future. On the one hand the automotive industry sector has faced some criticisms, by some actors, regarding the slow movement towards electric drivetrains, which in part is a result of the lack of space for new production lines. In addition, a concern was voiced that the strong position of large scale (not just automotive) industry in the region, puts a limit on the developments in other (more small scales) sectors where there would also be potential (e.g., the creative industries and/or crafts).

On the other hand, participants also observed that Stuttgart shows some diversity, and that the region's land shortage is also a result of the past success of the large-scale production enterprises in the region (including the automotive industry). Observers, however, agree that a blow to the automotive sector would clearly have fundamental consequences on the region's economy.

A final point emerged, in relation to the capacity of the VRS institution to steer and implement an economic development strategy. The Verband Region Stuttgart has one of the most interesting governance models among EU cities and metropolitan areas. Despite this, the German law does not provide clear tools or norms to implement pro-active local spatial strategies and visions, while there is therefore a multitude of instruments available to prevent undesired developments in the region, there is also a need to develop new instruments that allow the VRS to encourage desired spatial developments in a more proactive way.

5 Annex: further details on the methodology of the SWOT analysis used

5.1 Detailed description of the methodology

The methodology follows the approach to the analysis of the regional network of branches pioneered by Otto et al. (2014) and Neffke et al (2017A, 2017B). The basis for this approach is the common recognition that innovation (and thus growth) is driven by the exchange of knowledge between firms. According to increasing empirical evidence[28], knowledge exchange (and thus innovation) does not occur primarily within branches along narrow technological paths, as assumed by traditional approaches to agglomeration theory (beginning with Marshall, 1890) – and as referred to by a long tradition of "picking-the-winner" approaches to identifying sectoral strengths or "lead branches", which shaped regional economic policy until the 1980s. More recent results rather show that sectoral diversity is more likely to be positive for knowledge spillovers, because a broad spectrum of branches offers access to different knowledge bases. Consequently, innovations are often generated by applying existing technological solutions (from one branch) to new problem areas (in another branch) by recombining knowledge from different areas (initially Jacobs, 1969).

Companies can, however, only absorb and process new knowledge if this knowledge is not too far away from their own knowledge base. Consequently, a central issue in the related varieties analysis conducted below is the measurement of the “embeddedness” of a branch. In this respect several approaches have been proposed in literature.[29] Most of them, however, are only able to identify proximity and define relatedness within the manufacturing sector or within the service sector. This makes them unsuitable for the present project as they are unable to measure the increasing linkages between services and production that characterize the economic “ecosystems” of urban agglomerations. For this reason, the current analysis relies on an approach by Neffke and Henning (2013). This approach argues that the exchange of personnel between branches (i.e., the direct movement of employees from one branch to another) is a good measure of the proximity of their knowledge base as such flows show that workers from one branch can meaningfully apply their knowledge base (gained in the source branch) in the destination branch. The approach therefore derives the measure of the proximity of the knowledge flow from flow data of employees between branches across all economic sectors.[30] This is because human capital of the workforce is highly job-specific, so that individuals (necessarily) lose part of their human capital when they move to a branch in which

[28] For an overview of the results of the meanwhile numerous relevant studies see, for example, Baudry and Schiffauerova (2009) and Boschma (2017).

[29] For a more detailed description of these approaches and their methodological advantages and disadvantages see Firgo and Mayerhofer (2018).

[30] This is the only approach that allows to consider the integration of and interdependencies between industry and services in the definition of proximity and relatedness, which is one of the central topics of the present project.

they cannot or can hardly make use of their previously accumulated (job- or branch-specific) knowledge (Neal, 1995; Parent, 2000). Such job changes between cognitively distant branches are rather unlikely. Rather, employees prefer to switch between branches that share a common knowledge base (i.e., are technologically or cognitively related to each other) and therefore need workers with similar skills, so that the employees can transfer a large part of their human capital when changing jobs between branches (and thus avoid losses of human capital and therefore income).[31]

Thus, the degree of cognitive or technological relatedness between two branches can be deduced from the probability of labour flows between these branches. Of course, this requires complete information on all job changes between branches at a very disaggregated sectoral level. Such data is provided by the results of a major research project conducted by the Institute for Employment Research (IAB) in Germany (Neffke et al., 2017A, 2017B), which examined labour flows between branches at a highly disaggregated level on the basis of the IAB dataset on employment history (BeH)[32] in order to define technologically or cognitively "close" branches for Germany (referred to here as "skill-relatedness"). The application of the labour-flows between branches obtained for Germany to regions of other countries seems justified. It can be feasibly assumed that branches (groups) that prove to be technologically or cognitively "close" or "skill-related" in Germany on the basis of inter-sectoral labour market flows at the level of NACE 3-digit branches, will be so in other highly developed parts of Europe as well: In fact, it can be rather ruled out that the same NACE 3-digit branches in Germany and regions in Austria, Norway or (Northern) Italy - that are subject to the present analysis - as regions with very similar levels of economic and technological development, differ substantially from each other in terms of production technology, qualification structure, input-output interdependencies etc., such that they would require systematically different knowledge bases.

We therefore use the matrix of branch-relatedness obtained from intersectoral job changes, the resulting sectoral connections for the analysis of the stakeholder city regions of the project. IAB distinguishes a total of 265 branch groups at the NACE 3-digit level in Germany. This means that a symmetrical matrix can be used to map a total of more than 70,000 target-source relationships between branches. For each of these bilateral relations a "Skill-Relatedness" index (*SRij*) is formed, which depicts the relative magnitude of the respective flow of labour between two branches i and j as a measure of their "skill-relatedness". The basic idea here is

31 An empirical confirmation of this hypothesis is provided by Neffke et al. (2017A) for Germany. They show that job changes between branches are restricted to a limited spectrum of target branches that are cognitively "related" to the respective branch of origin.

32 In principle, the results were calculated at the 4-digit level of economic activities, but for our purposes they were aggregated to the level 3 branches. We are very grateful to Anne Otto of IAB Nuremberg for providing the data and additional processing for the purposes of our analysis. The BeH data set (for a more detailed description see Bender et al., 2000) represents a complete survey. The employee history contains comprehensive personal information on all employees and companies in Germany subject to social insurance contributions as of 30 June each year. Information on employees and companies can be linked by means of anonymous personal and company numbers, so that on this basis (also) changes of job of employees can be identified.

that comparatively "large" labour flows between two branches are an indication that workers from branch i tend to move to branch j without any problems and can reuse their knowledge or skills from the old branch i quite easily. In this case the pair of branches under consideration can be qualified as cognitively/technologically "close" (or "skill-related").

What is meant by "comparatively large": In addition to their cognitive proximity, other factors are responsible for the extent of job changes between two branches, especially their size, but also their dynamics, wage levels or similar. An observable bilateral labour flow can thus be considered "relatively large" (and only then) if the number of job changes between the two branches is greater than would have been expected taking all the factors mentioned into account. Consequently, the "Skill-Relatedness" index compares the actual number of job changes measured with those that would have occurred if job changes between the two branches (given the characteristics of the branch) had been purely random. This (in the case of random changes) "expected" labour flows thus represents the benchmark for the classification of the observed labour flows. It can be easily calculated based on probability theory (cf. Otto et al., 2014).

Specifically, the "skill-relatedness" indicator as a measure of the cognitive "proximity" between two branches i and j is thus denoted as

Equation *(3)* $SR_{ij} = \frac{F_{ij}}{\hat{F}_{ij}}$,

where F_{ij} denotes the observed job changes between branches i and j, and $\hat{F}_{ij}$ denotes the expected job changes between i and j. If this "skill-relatedness" index is > 1, the actual flows between the two branches are greater than would be expected in the case of purely random job entries and exits, which means that the pair of branches can be regarded as technologically or cognitively "related" or "skill-related". With index values < 1, on the other hand, job changes between the two branches are less frequent than would be expected, and a technological or cognitive relatedness obviously is not high in this case.[33] On the basis of the matrix of these 70,225 indicator values for the 265 branch groups of the NACE classification (level 3) it is now possible to represent the entire network of cognitively or technologically "related" branches and to use it subsequently for the calculation of the embeddedness (see above) as part of the empirical SWOT analysis for the individual branches in each stakeholder region.

Against this background, the starting point of the analysis is that the development potential of a productive branch in a region is determined not only by its own "critical mass" (i.e., its degree of specialisation), but also by the extent to which it can rely on a fertilising environment of complementary, (technologically or cognitively) "related" branches. Thus, following Otto et al. (2014), a branches potential in a region can be empirically assessed along two dimensions.

[33] In the further analysis, a normalized "skill-relatedness" index is used, which assumes values between -1 and +1. Positive values thus indicate cognitive proximity, whereas negative values do not indicate such proximity.

The first is the size of the branch in the regional economy, which is measured by the location quotient (LQ_{ir}) as a measure of the relative regional of branch *i* in region *r.* If this indicator is larger than one the branch is localized in the region, otherwise it is not.

The second is the embeddedness of a specific branch *i* in the "knowledge environment" of the region. This, similarly, to its own size, can be measured by the (weighted) regional specialisation of related branches (LQ_{ir}^{rel}) in the region. If its value of is larger than 1, then branch i is well embedded in the economy of region r, as it can draw on a large pool of "related" branches with a similar knowledge base. Values smaller than 1, on the other hand, denote branches that do not have such a regional "ecosystem" of related activities, which can affect their stability and resilience.

Table A1: Categories of the empirical SWOT analysis.
Development potentials according to degree of specialisation and embeddedness

		Regional embeddedness of branch *i*	
		high $LQ_{ir}^{rel} > 1{,}1$	low $LQ_{ir}^{rel} < 0{,}9$
Regional degree of specialisation in branch *i*	High $LQ_{ir} > 1{,}1$	High specialisation and well embedded (Strength S)	High specialisation but weakly embedded (Threat T)
	low $LQ_{ir} < 0{,}9$	Low specialisation but well embedded (Opportunity O)	Not specialised and weakly embedded (Weakness W)

Source: Otto et al. (2014), ESPON MISTA (2020).

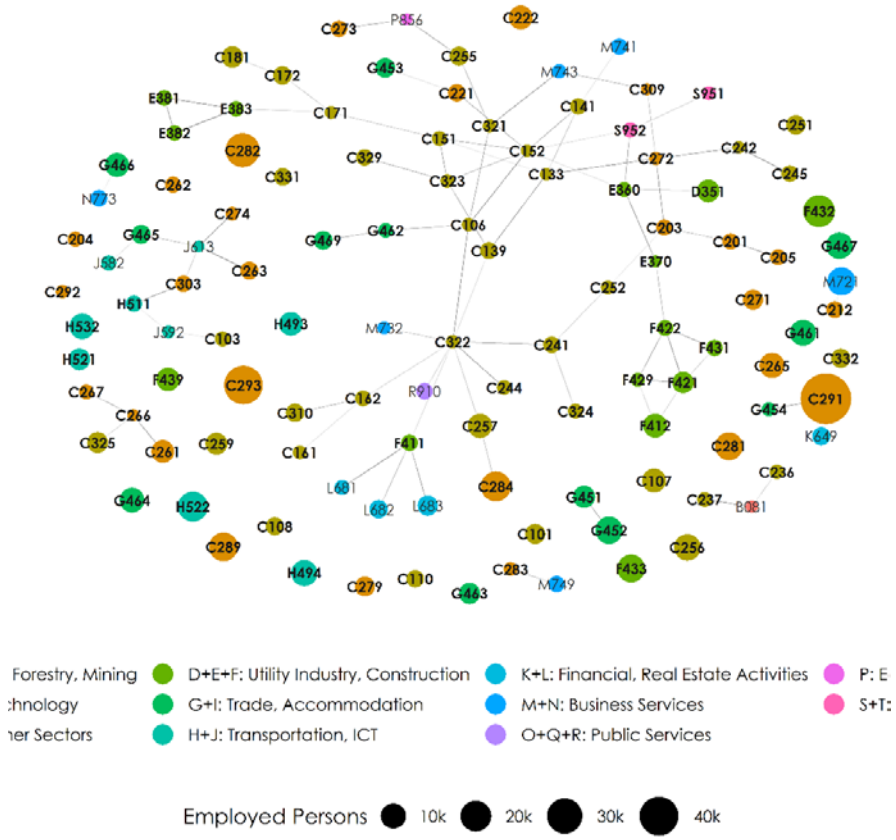
Overall, both the degree of specialisation and the embeddedness in the regional sectoral structure are decisive for an assessment of the development potential of a branch. According to Otto et al. (2014) economic branches in a region can be classified into four different categories, by differentiating, according to the values of their localisation quotient and their embeddedness indicator (Table A1):

1. If the branch under consideration is heavily localized in the region (LQ_{ir} > 1.1) and if this branch is also well embedded in "related" branches (LQ_{ir}^{rel} > 1.1), the branch is large relative to the regional economy and it is likely that it will also strongly profit from localised knowledge transfers across industries in the region. As a consequence, its future development prospects should be favourable, and the branch can be considered to be a "strength" of the regional economy.
2. By contrast, a branch with a low degree of specialisation and embeddedness (LQ_{ir} as well as LQ_{ir}^{rel} < 0.9) is unlikely to profit substantially from localized knowledge transfers but is also small in terms of the regional economy. Despite the fact that such branches may be of importance for the other reasons (e.g., the presence of natural resources or the satisfaction of local demand) such branches have therefore been regarded as a regional "weakness" in previous analysis from a technological development perspective.

3. Branches that are lowly localised (LQ_{ir} < 0.9) but well embedded (LQ_{ir}^{rel} > 1.1) are faced by a favourable regional environment of technologically or cognitively "close" branches (and thus diverse opportunities to use a common knowledge base) but are still relatively small. Such branches could thus offer special "opportunities" to develop new strengths through structural policy initiatives in the future.
4. Finally, branches which are highly localized (LQ_{ir} > 1.1), but only weakly embedded in complementary in the region (LQ_{ir}^{rel}< 0.9), tend to be seen at risk which could be reduced by strengthening complementary branches through structural policy initiatives. This is because they are relatively large but are unlikely to profit substantially from their regional knowledge base.

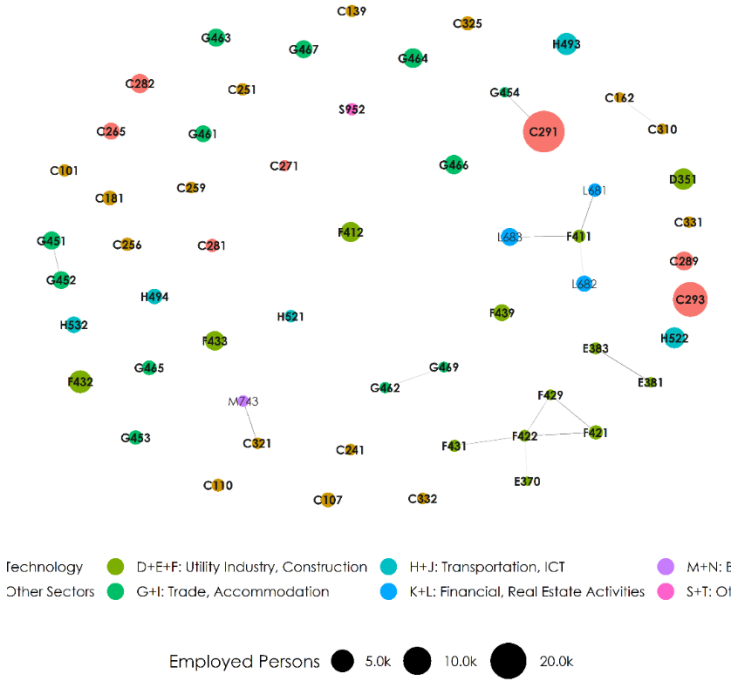
5.2 Network of branches

Figure A1: Network of branches (total Stuttgart metropolitan area).



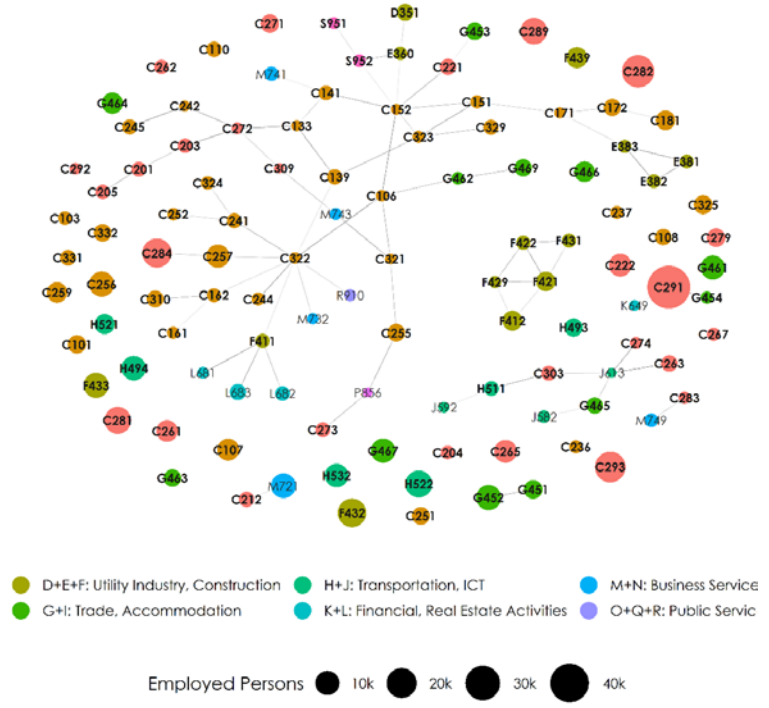
Source: Federal Employment Agency, BA, network structure based on Neffke et al. (2019B), ESPON MISTA (2020) calculations. For illustrative purposes, only NACE 3-digit branch groups marking productive activities (in bold) and non-productive activities with strong links to productive activities with at least 100 employees are displayed.

Figure A2: Network of branches (city of Stuttgart).



Source: Federal Employment Agency, BA, network structure based on Neffke et al. (2019B), ESPON MISTA (2020) calculations. For illustrative purposes, only NACE 3-digit branch groups marking productive activities (in bold) and non-productive activities with strong links to productive activities with at least 100 employees are displayed.

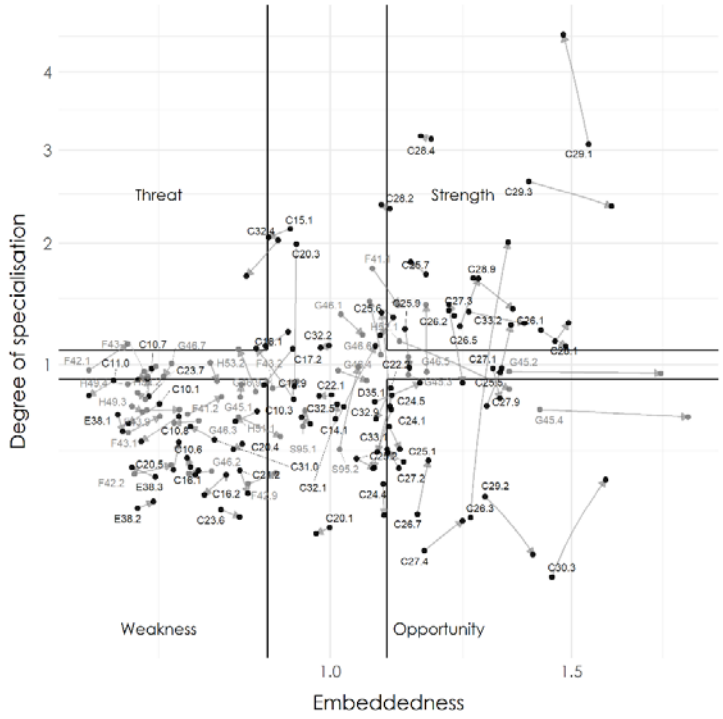
Figure A3: Network of branches (environs).



Source: Federal Employment Agency, BA, network structure based on Neffke et al. (2019B), ESPON MISTA (2020) calculations. For illustrative purposes, only NACE 3-digit branch groups marking productive activities (in bold) and non-productive activities with strong links to productive activities with at least 100 employees are displayed.

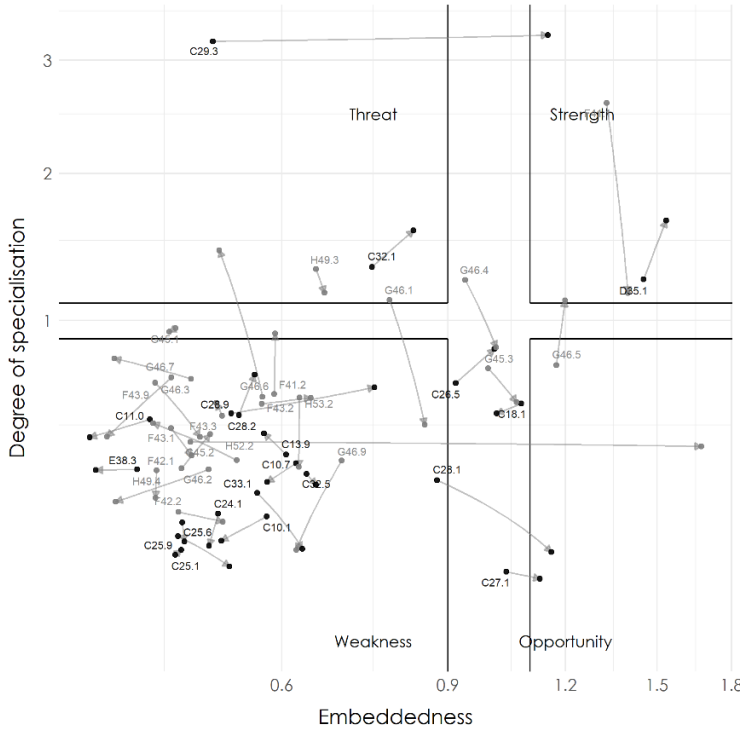
5.3 A dynamic perspective on the SWOT profiles

Figure A4: Dynamic of the SWOT Profile (total Stuttgart metropolitan area).



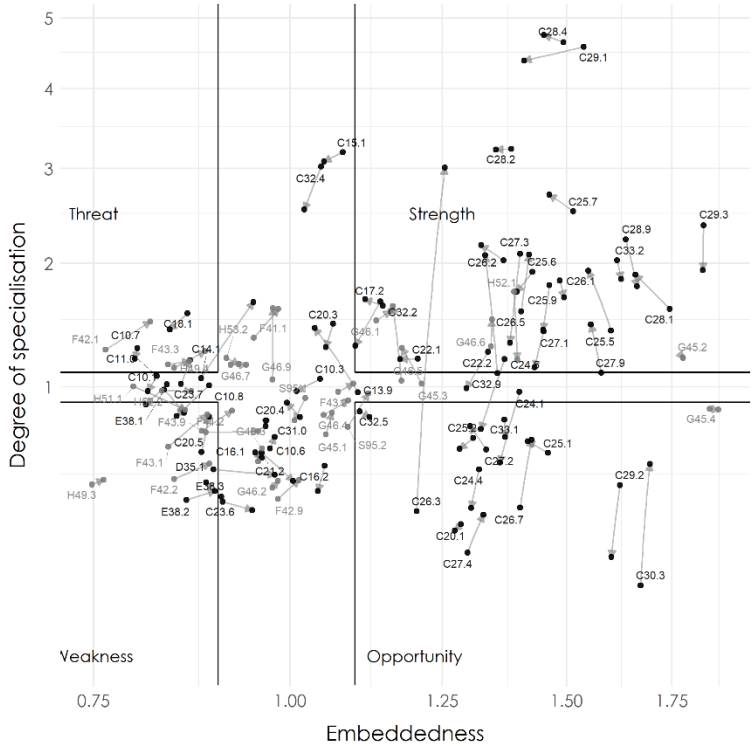
Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

Figure A5: Dynamic of the SWOT Profile (city of Stuttgart).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

Figure A6: Dynamic of the SWOT Profile (environs).



Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. Industry (service) activities in black (grey). For illustrative purposes only branches with at least 100 employees are displayed. For NACE codes and branches see Table A8 in the annex.

5.4 Top 10 Tables for Subregions

Table A1: Top 10 branches in terms of size (2019).

NACE	Name	Empl.	Share in %
Total metropolitan region			
C29.1	Manufacture of motor vehicles	81686	6,38
C29.3	Manufacture of parts and accessories for motor vehicles	39443	3,08
C28.2	Manufacture of other general-purpose machinery	27269	2,13
F43.2	Electrical, plumbing and other construction installation activities	22360	1,75
C28.4	Manufacture of metal forming machinery and machine tools	18493	1,44
H52.2	Support activities for transportation	18322	1,43
C28.9	Manufacture of other special-purpose machinery	16488	1,29
C28.1	Manufacture of general-purpose machinery	14633	1,14
F43.3	Building completion and finishing	14237	1,11
G45.2	Maintenance and repair of motor vehicles	13250	1,03
City of Stuttgart			
C29.1	Manufacture of motor vehicles	28800	6,76
C29.3	Manufacture of parts and accessories for motor vehicles	17948	4,21
F43.2	Electrical, plumbing and other construction installation activities	5143	1,21
H49.3	Other passenger land transport	4457	1,05
D35.1	Electric power generation, transmission and distribution	4175	0,98
H52.2	Support activities for transportation	3778	0,89
F41.2	Construction of residential and non-residential buildings	3255	0,76
G46.4	Wholesale of household goods	3033	0,71
F43.3	Building completion and finishing	2845	0,67
G46.6	Wholesale of other machinery, equipment and supplies	2807	0,66
Environs			
C29.1	Manufacture of motor vehicles	52886	6,19
C28.2	Manufacture of other general-purpose machinery	24540	2,87
C29.3	Manufacture of parts and accessories for motor vehicles	21495	2,52
C28.4	Manufacture of metal forming machinery and machine tools	18493	2,16
F43.2	Electrical, plumbing and other construction installation activities	17217	2,01
H52.2	Support activities for transportation	14544	1,70
C28.1	Manufacture of general-purpose machinery	14176	1,66
C28.9	Manufacture of other special-purpose machinery	13926	1,63
C25.6	Treatment and coating of metals; machining	11758	1,38
F43.3	Building completion and finishing	11392	1,33

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations.

Table A2: Top 10 branches in terms of growth (2012-2019).

NACE	Name	Empl.	Growth p.a. in %
Total metropolitan region			
C30.3	Manufacture of air and spacecraft and related machinery	1395	28,82
C26.3	Manufacture of communication equipment	2296	28,68
H53.2	Other postal and courier activities	10747	20,19
G46.5	Wholesale of information and communication equipment	3134	12,65
C26.7	Manufacture of optical instruments and photographic equipment	672	11,95
G46.6	Wholesale of other machinery, equipment and supplies	8710	10,62
C27.2	Manufacture of batteries and accumulators	227	8,41
S95.2	Repair of personal and household goods	835	8,26
C29.1	Manufacture of motor vehicles	81686	8,22
C32.9	Manufacturing n.e.c.	1464	6,88
City of Stuttgart			
G46.6	Wholesale of other machinery, equipment and supplies	2807	19,30
H53.2	Other postal and courier activities	1394	12,99
G46.5	Wholesale of information and communication equipment	804	12,16
F41.2	Construction of residential and non-residential buildings	3255	7,82
C28.2	Manufacture of other general-purpose machinery	2729	7,37
F42.1	Construction of roads and railways	727	6,89
H52.2	Support activities for transportation	3778	5,62
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	1697	4,67
D35.1	Electric power generation, transmission and distribution	4175	4,23
G46.3	Wholesale of food, beverages and tobacco	2111	3,74
Environs			
C30.3	Manufacture of air and spacecraft and related machinery	1395	28,82
C26.3	Manufacture of communication equipment	2296	28,68
H53.2	Other postal and courier activities	9353	21,64
G46.5	Wholesale of information and communication equipment	2330	12,83
C26.7	Manufacture of optical instruments and photographic equipment	672	11,95
F43.1	Demolition and site preparation	1125	8,42
C27.2	Manufacture of batteries and accumulators	227	8,41
G46.6	Wholesale of other machinery, equipment and supplies	5903	7,84
C32.9	Manufacturing n.e.c.	1464	6,88
C13.9	Manufacture of other textiles	1598	6,68

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees in 2019 are displayed.

Table A3: Top 10 branches in terms of specialisation (location quotient, 2019).

NACE	Name	Empl.	LQ
Total metropolitan region			
C29.1	Manufacture of motor vehicles	81686	4,52
C28.4	Manufacture of metal forming machinery and machine tools	18493	3,17
C28.2	Manufacture of other general-purpose machinery	27269	2,39
C29.3	Manufacture of parts and accessories for motor vehicles	39443	2,37
C15.1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur	620	2,06
C26.3	Manufacture of communication equipment	2296	2,01
C25.7	Manufacture of cutlery, tools and general hardware	8946	1,82
C32.4	Manufacture of games and toys	723	1,70
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	10073	1,67
G46.6	Wholesale of other machinery, equipment and supplies	8710	1,48
City of Stuttgart			
C29.1	Manufacture of motor vehicles	28800	4,79
C29.3	Manufacture of parts and accessories for motor vehicles	17948	3,25
D35.1	Electric power generation, transmission and distribution	4175	1,64
C32.1	Manufacture of jewellery, bijouterie and related articles	175	1,57
G46.6	Wholesale of other machinery, equipment and supplies	2807	1,43
H49.3	Other passenger land transport	4457	1,16
F41.1	Development of building projects	400	1,16
G46.5	Wholesale of information and communication equipment	804	1,12
S95.2	Repair of personal and household goods	292	1,03
G45.1	Sale of motor vehicles	2232	0,94
Environs			
C28.4	Manufacture of metal forming machinery and machine tools	18493	4,75
C29.1	Manufacture of motor vehicles	52886	4,38
C28.2	Manufacture of other general-purpose machinery	24540	3,22
C15.1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur	620	3,08
C26.3	Manufacture of communication equipment	2296	3,01
C25.7	Manufacture of cutlery, tools and general hardware	8857	2,70
C32.4	Manufacture of games and toys	723	2,54
C26.2	Manufacture of computers and peripheral equipment	1179	2,18
C32.3	Manufacture of sports goods	280	2,17
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	8376	2,08

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees are displayed.

Table A4: Top 10 branches in terms of embeddedness (2019).

NACE	Name	Empl.	Embed.
Total metropolitan region			
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	410	1,82
G45.2	Maintenance and repair of motor vehicles	13250	1,74
C29.3	Manufacture of parts and accessories for motor vehicles	39443	1,60
C30.3	Manufacture of air and spacecraft and related machinery	1395	1,59
C28.1	Manufacture of general-purpose machinery	14633	1,49
C26.1	Manufacture of electronic components and boards	6900	1,49
C29.1	Manufacture of motor vehicles	81686	1,48
C29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	211	1,41
C33.2	Installation of industrial machinery and equipment	3361	1,39
C28.9	Manufacture of other special-purpose machinery	16488	1,36
City of Stuttgart			
G45.2	Maintenance and repair of motor vehicles	1956	1,67
C29.1	Manufacture of motor vehicles	28800	1,62
D35.1	Electric power generation, transmission and distribution	4175	1,53
F41.1	Development of building projects	400	1,40
H52.1	Warehousing and storage	283	1,26
G46.5	Wholesale of information and communication equipment	804	1,20
C28.1	Manufacture of general-purpose machinery	457	1,16
C29.3	Manufacture of parts and accessories for motor vehicles	17948	1,15
C27.1	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	128	1,13
G45.3	Sale of motor vehicle parts and accessories	712	1,06
Environs			
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	347	1,87
C29.3	Manufacture of parts and accessories for motor vehicles	21495	1,83
G45.2	Maintenance and repair of motor vehicles	11294	1,78
C30.3	Manufacture of air and spacecraft and related machinery	1395	1,69
C28.9	Manufacture of other special-purpose machinery	13926	1,66
C28.1	Manufacture of general-purpose machinery	14176	1,66
C33.2	Installation of industrial machinery and equipment	3198	1,62
C29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	211	1,60
C27.9	Manufacture of other electrical equipment	3871	1,55
C25.5	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	3117	1,55

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees are displayed.

Table A5: Top Strengths (2019).

NACE	Name	Employment
Total metropolitan region		
C29.1	Manufacture of motor vehicles	81686
C29.3	Manufacture of parts and accessories for motor vehicles	39443
C28.4	Manufacture of metal forming machinery and machine tools	18493
C26.3	Manufacture of communication equipment	2296
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	10073
C25.7	Manufacture of cutlery, tools and general hardware	8946
C28.1	Manufacture of general-purpose machinery	14633
C28.9	Manufacture of other special-purpose machinery	16488
C33.2	Installation of industrial machinery and equipment	3361
C26.2	Manufacture of computers and peripheral equipment	1179
City of Stuttgart		
C29.1	Manufacture of motor vehicles	28800
C29.3	Manufacture of parts and accessories for motor vehicles	17948
D35.1	Electric power generation, transmission and distribution	4175
F41.1	Development of building projects	400
G46.5	Wholesale of information and communication equipment	804
Environs		
C28.4	Manufacture of metal forming machinery and machine tools	18493
C29.1	Manufacture of motor vehicles	52886
C28.2	Manufacture of other general-purpose machinery	24540
C25.7	Manufacture of cutlery, tools and general hardware	8857
C26.3	Manufacture of communication equipment	2296
C29.3	Manufacture of parts and accessories for motor vehicles	21495
C28.1	Manufacture of general-purpose machinery	14176
C33.2	Installation of industrial machinery and equipment	3198
C25.5	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	3117
C28.9	Manufacture of other special-purpose machinery	13926

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees are displayed.

Table A6: Top Opportunities (2019).

NACE	Name	Empl.
Total metropolitan region		
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	410
H52.1	Warehousing and storage	5537
C27.3	Manufacture of wiring and wiring devices	1450
C27.1	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	4004
D35.1	Electric power generation, transmission and distribution	6721
C30.3	Manufacture of air and spacecraft and related machinery	1395
C33.1	Repair of fabricated metal products, machinery and equipment	2009
C27.2	Manufacture of batteries and accumulators	227
C25.1	Manufacture of structural metal products	3570
C26.7	Manufacture of optical instruments and photographic equipment	672
City of Stuttgart		
G45.2	Maintenance and repair of motor vehicles	1956
H52.1	Warehousing and storage	283
C28.1	Manufacture of general-purpose machinery	457
C27.1	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	128
Environs		
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	347
C27.2	Manufacture of batteries and accumulators	227
C24.5	Casting of metals	1463
C26.7	Manufacture of optical instruments and photographic equipment	672
C33.1	Repair of fabricated metal products, machinery and equipment	1839
C25.1	Manufacture of structural metal products	3262
C30.3	Manufacture of air and spacecraft and related machinery	1395
C32.5	Manufacture of medical and dental instruments and supplies	4092
C25.2	Manufacture of tanks, reservoirs and containers of metal	359
C24.1	Manufacture of basic iron and steel and of ferro-alloys	1432

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees are displayed.

Table A7: Top Threats (2019).

NACE	Name	Empl.
Total metropolitan region		
C32.4	Manufacture of games and toys	723
C18.1	Printing and service activities related to printing	5513
C13.9	Manufacture of other textiles	1857
G46.9	Non-specialised wholesale trade	2993
F42.1	Construction of roads and railways	5399
City of Stuttgart		
C32.1	Manufacture of jewellery, bijouterie and related articles	175
H49.3	Other passenger land transport	4457
G46.6	Wholesale of other machinery, equipment and supplies	2807
Environs		
F42.1	Construction of roads and railways	4672
C18.1	Printing and service activities related to printing	4627
H49.4	Freight transport by road and removal services	10580
C23.7	Cutting, shaping and finishing of stone	607
F43.3	Building completion and finishing	11392
C10.7	Manufacture of bakery and farinaceous products	7332

Source: Federal Employment Agency, BA, ESPON MISTA (2020) calculations. For illustrative purposes only branches with at least 100 employees are displayed.

5.5 Summary table on size and SWOT-profiles of all productive activities

Table A.8: NACE 3-dgit branch groups and SWOT profiles

NACE	Name	Total Empl.	City	Envi-rons	Total Reg.
C10.1	Processing and preserving of meat and production of meat products	2134	W	O	
C10.3	Processing and preserving of fruit and vegetables	753	W	S	
C10.4	Manufacture of vegetable and animal oils and fats	205			
C10.5	Manufacture of dairy products	522	W		W
C10.6	Manufacture of grain mill products, starches and starch products	858		S	T
C10.7	Manufacture of bakery and farinaceous products	6968			
C10.8	Manufacture of other food products	3844	W		
C10.9	Manufacture of prepared animal feeds	582		S	W
C11.0	Manufacture of beverages	1773	W	S	W
C13.3	Finishing of textiles		W		
C13.9	Manufacture of other textiles	472	W		W
C14.1	Manufacture of wearing apparel, except fur apparel	689		O	O
C15.2	Manufacture of footwear	137			
C16.2	Manufacture of products of wood, cork, straw and plaiting materials	1883	W		W
C17.1	Manufacture of pulp, paper and paperboard	231	W		W

C17.2	Manufacture of articles of paper and paperboard	2275	W		W
C18.1	Printing and service activities related to printing	3119			
C19.2	Manufacture of refined petroleum products	1236			
C20.1	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	2044			
C20.2	Manufacture of pesticides and other agrochemical products	169			
C20.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	846	W		
C20.4	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	651	W		
C20.5	Manufacture of other chemical products	739	W		
C21.1	Manufacture of basic pharmaceutical products	204			O
C21.2	Manufacture of pharmaceutical preparations	5395	T		
C22.1	Manufacture of rubber products	334	W		W
C22.2	Manufacture of plastics products	4071	W	T	W
C23.1	Manufacture of glass and glass products	207	W		W
C23.3	Manufacture of clay building materials	124			W
C23.4	Manufacture of other porcelain and ceramic products	126	W		W
C23.5	Manufacture of cement, lime and plaster	167		S	
C23.6	Manufacture of articles of concrete, cement and plaster	1677	W	S	W
C23.7	Cutting, shaping and finishing of stone	740	W		W
C23.9	Manufacture of abrasive products and non-metallic mineral products n.e.c.	174	W		W
C24.1	Manufacture of basic iron and steel and of ferro-alloys		W		
C24.3	Manufacture of other products of first processing of steel	284			W
C24.4	Manufacture of basic precious and other non-ferrous metals	570	W		W
C24.5	Casting of metals	666	W		W
C25.1	Manufacture of structural metal products	2847	W		W
C25.4	Manufacture of weapons and ammunition	609		T	T
C25.5	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	507	W	W	W
C25.6	Treatment and coating of metals; machining	1657	W		W
C25.7	Manufacture of cutlery, tools and general hardware	1301	W		W
C25.9	Manufacture of other fabricated metal products	1516	W	W	W
C26.1	Manufacture of electronic components and boards	959	W	W	
C26.2	Manufacture of computers and peripheral equipment	237	W		
C26.3	Manufacture of communication equipment	724	S		S
C26.4	Manufacture of consumer electronics	218	T		
C26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	753	W		
C26.6	Manufacture of irradiation, electromedical and electrotherapeutic equipment	135			O
C26.7	Manufacture of optical instruments and photographic equipment	244	W		
C27.1	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	7091			
C27.3	Manufacture of wiring and wiring devices	713	W	T	W
C27.4	Manufacture of electric lighting equipment	399	W		
C27.5	Manufacture of domestic appliances	146			W

C27.9	Manufacture of other electrical equipment	1174	W		W
C28.1	Manufacture of general-purpose machinery	3292	W	T	W
C28.2	Manufacture of other general-purpose machinery	2513	W		W
C28.3	Manufacture of agricultural and forestry machinery	151			W
C28.4	Manufacture of metal forming machinery and machine tools	131	W		W
C28.9	Manufacture of other special-purpose machinery	4078	W	T	W
C29.1	Manufacture of motor vehicles	808			O
C29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	595	W		W
C29.3	Manufacture of parts and accessories for motor vehicles	2732	W	W	W
C30.1	Building of ships and boats		W		
C30.2	Manufacture of railway locomotives and rolling stock	1048			
C30.3	Manufacture of air and spacecraft and related machinery	1019		S	
C30.4	Manufacture of military fighting vehicles	140			
C31.0	Manufacture of furniture	2710	W		W
C32.1	Manufacture of jewellery, bijouterie and related articles	1015	W		
C32.2	Manufacture of musical instruments	457			
C32.3	Manufacture of sports goods	448	W		W
C32.4	Manufacture of games and toys	1387			T
C32.5	Manufacture of medical and dental instruments and supplies	2455			
C32.9	Manufacturing n.e.c.	417	W		W
C33.1	Repair of fabricated metal products, machinery and equipment	5328	W		T
C33.2	Installation of industrial machinery and equipment	3210	W		
D35.1	Electric power generation, transmission and distribution	4581			
D35.2	Manufacture of gas; distribution of gaseous fuels through mains	2526			
D35.3	Steam and air conditioning supply	1122	W		
E36.0	Water collection, treatment and supply	600			
E37.0	Sewerage	668	W		W
E38.1	Waste collection	3051	W	S	
E38.2	Waste treatment and disposal	924	T	S	W
E38.3	Materials recovery	316	W	S	W
E39.0	Remediation activities and other waste management services	393			
F41.1	Development of building projects	1634	S		
F41.2	Construction of residential and non-residential buildings	21381	W	O	
F42.1	Construction of roads and railways	4257	W	S	W
F42.2	Construction of utility projects	2388	W		W
F42.9	Construction of other civil engineering projects	627	W		T
F43.1	Demolition and site preparation	1510	W	O	
F43.2	Electrical, plumbing and other construction installation activities	25995			
F43.3	Building completion and finishing	16831	W		W
F43.9	Other specialised construction activities	9782	W		W
G45.1	Sale of motor vehicles	10072	W	S	
G45.2	Maintenance and repair of motor vehicles	10285	W	S	

G45.3	Sale of motor vehicle parts and accessories	3308	W	S	W
G45.4	Sale, maintenance and repair of motorcycles and related parts and accessories	584	W	S	
G46.1	Wholesale on a fee or contract basis	7398		S	
G46.2	Wholesale of agricultural raw materials and live animals	3104	W	S	
G46.3	Wholesale of food, beverages and tobacco	8458	W	S	
G46.4	Wholesale of household goods	20637		O	
G46.5	Wholesale of information and communication equipment	4691	O		S
G46.6	Wholesale of other machinery, equipment and supplies	13981	W	S	T
G46.7	Other specialised wholesale	13434	W	S	
G46.9	Non-specialised wholesale trade	2083	W	S	
H49.1	Passenger rail transport, interurban	1532		O	S
H49.2	Freight rail transport	2625	O	O	S
H49.3	Other passenger land transport	18910	T	O	
H49.4	Freight transport by road and removal services	16050	W	S	
H49.5	Transport via pipeline	338		S	S
H50.3	Inland passenger water transport	135	S		
H51.1	Passenger air transport	7394	O		S
H52.1	Warehousing and storage	973	W	S	
H52.2	Support activities for transportation	21571	W	S	
H53.1	Postal activities under universal service obligation	6603		W	
H53.2	Other postal and courier activities	2119		S	
S95.1	Repair of computers and communication equipment	559			S
S95.2	Repair of personal and household goods	1312	T		

Source: ESPON MISTA (2020) calculations*; S… Strength, W… Weakness, O… Opportunity, T… Threat; Empty cell indicates no specific SWOT profile in the region.*

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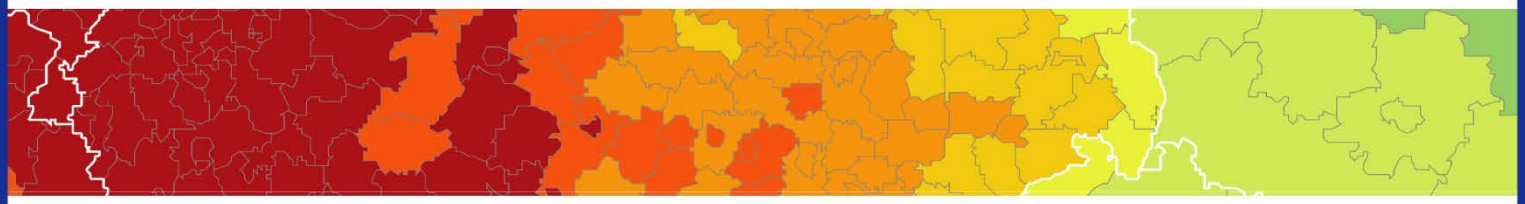

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The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.