Electrifying Times: restructuring and decision-making in an automobile concern in the 21st century – The case of BMW Group

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Abstract

The aim of this paper is to capture the changed location decision-making processes and location factors of the automotive industry, resulting from the current challenges brought by electro mobility. From the Taylorist assembly-line production system in the "Fordism" era to the just-in-time focused manufacturing of the Japanese carmakers during "post-Fordism" and at the turn of the millennium with global production and new technologies in the digital age, location analysis has changed massively over time. The same is to be expected for the fourth revolution in the industry. For this reason, the decision-making process of a major German car manufacturer is analysed in a field study conducted over a two-year period. Based on this, a decision process that takes the new framework conditions into account is modelled. The relevant location factors are then examined in a survey of the relevant departments in the BMW Group. Due to the changed production requirements in the course of the electrification, the uncertainty in the technological change and the unstable political trading conditions, the factors: network suitability, risk exposure, optimal sunk cost usage and sustainability play central roles. Before the latest economic crisis, the industry was focused on exploiting opportunities and expanding the production network. This tendency now seems to be transformed by a volatile technological future and by cost pressure. This means that 'sustainability' is increasingly important in automobile industry decision-making, but in specific ways.

Keywords: automotive industry, location decision, network suitability, restructuring, sustainability, BMW Group

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Introduction

Automobile industries currently face a vast number of challenges (Bailey, D. *et al.* 2010). After decades of large scale plant restructuring including massive investments in Greenfield sites combined with development of strategic alliances and global production networks, they are now confronted by different challenges. These include changing environmental regulations (Whitmarsh, L. and Köhler, J. 2010), environmental reporting using double bottom line and corporate social responsibility (Ormond, J. 2015) and dramatic failures related to them like the diesel scandal (Jung, J.C. 2017). The list of challenges seems endless when counting in e-mobility, new consumption formats like car sharing, leasing and rental markets (Bailey, D. *et al.* 2010) or new public and private infrastructure investments such as loading stations for electric vehicles. Moreover, design and innovation requirements are being transformed by the need for automation in driving and production, e-mobility, new materials enhancing simpler and lighter models as well as greater computing power and digitalization. Additionally, rising protectionism combined with upcoming adversaries in China has dramatically increased competition among automobile manufacturers worldwide (Bailey, D. *et al.* 2010).

In consequence, automobile firms again need to be restructured in terms of their production network and their production strategy. The financial crises at GM and Ford as well as the decline of the American rust belt demonstrate

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the consequences of delayed restructuring and act as warnings for the whole industry (Oxelheim, L. and Wihlborg, C. 2008; Klier, T.H. and Rubenstein, J.M. 2010; Financial Times, 2017). Some of these challenges have been picked up in the economic geography literature, for example, organizing e-mobility and re-planning mobility systems (e.g. Tanner, A.N. 2016; Cranois, A. 2017) but others have not. Notably omissions include emerging new production geographies and restructuring in relation to technological change in business, and this paper aims to address this set of issues. We argue that there have been signs of fundamental change in the decision making frameworks of automobile companies when restructuring their investments and plants.

This research considers the decision making of a German automobile industrial company conducting its regular seven-yearly model planning cycle. This kind of planning affects every plant the new models are supposed to be manufactured at. The focus of this paper's research is on one firm's smallest and oldest production plant which is located in the downtown area of a major German city, Munich. The next product lifecycle of the model assigned to that established plant involves a change to the production of an electric car. So, in addition to the traditional internal combustion engine (ICE) models, there will be a plug-in hybrid electric (PHEV) and an electric vehicle (BEV) Version. These changes to the power train require a much more complex production and, thus, comprehensive restructuring of the established production site close to downtown. Even if the focus is on the BMW Group, generalizing assumptions can be transferred to the whole industry. Schamp, E. (2005), for example, describes four types of automobile manufacturers when differentiating their strategies. The quality-oriented manufacturers such as BMW and Mercedes are strategically very similar. This is also evident from the choice of the locations operated on.

Based on these considerations and the economic framework, this paper aims to explain why the automobile manufacturer decided to upgrade the established downtown site rather than to relocate to a (new) Greenfield site. Our expectation is that the site analysis has changed fundamentally due to new challenges. Previous analyses, which focus on singular site discussions (Schamp, E. 1978) or neglect the time frame (Witlox, F. 1999), are no longer sufficient to explain the location decision-making of large manufacturing corporations. In this context, the case study concerning the restructuring process of the large German car manufacturer was conducted over two years. A wide range of field notes was compiled, covering planning sessions, document analysis and expert discussions. The data was documented at regular intervals and evaluated and clustered through key categories. This was followed by a series of interviews with those involved on the planning. Subsequently, a conjoint analysis of the decisive management functions regarding the process parameters and the actual meaning of sustainability was conducted in order to check the consistency within the group. The intent was to analyse the interaction among rating patterns and to identify key factors for site selection.

This study, thus, allows not only identification of the decision framework used, including its novelty, but also discussion of the implications of this framework and setoff factors for economic geography research on the geographies of automobile restructuring. It turns out that the key factors are shifting: central requirements of recent years are becoming less important. Therefore, in this paper we first present a review of the location analysis in the automobile industry and a brief overview of the strategic situation of the BMW Group. The specific decision-making related to the Munich plant upgrade is analysed. The final discussion focuses on the implications of the revealed decision-making framework and factors for understanding the location decision process. The questions that need to be answered are how a company proceeds in its decision-making process in the changed framework conditions of industrial change and which factors play a key role in this process.

Location analysis in the automobile industry

The automobile industry's changing production geographies have been a prominent focus of economic geography research. Over the years, though, the research focus and findings have shifted, with, generally, a change in focus from location decision making related to individual auto assembly plants (De Souza, A.R. and Stutz, F.P. 1994) to what constitutes the optimal global production network and organization (Dicken, P. 2015). This shift in focus is widely understood as a reaction to changing regimes of accumulation or industrial revolutions. Most recently, economic geographers (Klier, T.H. *et al*. 2010; Fromhold-Eisebith, M. 2018; Iammarino, S. *et al.* 2018; Palmer, J. and Schwanen, T. 2019) are noting signs of a new revolution associated with digitalization, protectionism, e-mobility and environmental regulation.

The changing regimes of the industrial environment and technology have always been accompanied by changing location analyses. In these terms, Alfred Weber's (1929) work set the starting point. Key factors of his cost-minimized location consideration are transport routes and weights. He demonstrated through reference points for the raw materials and places of sales of the products, the optimal sites in space. Many other factors, such as labour costs, agglomeration effects and resource substitution effects, are constantly being accepted and neglected across the entire area. Hoover, E.M. (1937) and Böventer, E. (1962) picked up on Weber's theory and expanded it to include agglomeration effects, which lead to relevant contributions to assessing business connectivity in site selection (Bathelt, H. and Glückler, J. 2012, 154). In the early 1970s, Smith, D.M. (1971) introduced a new perspective on site analysis by relaxing the assumption of companies as profit maximizers. Thus, an optimal location is not defined to an exact point but can be located within a certain space. Smith also primarily considered the costs of site assessment using a spatial cost function with location-dependent costs that include transport costs. In his theory, Smith, D.M. described the different effects of, for example, price increases, subsidies and bad management on location decisions. Considerations like these shifted the focus to new location factors in economic geography.

With the rejection of the explanation of industrial choice by rational action, Pred, A.R. (1967) developed the behavioural approach to location theory. He assumed that the total numbers of location-relevant factors cannot be perceived by decision-makers and therefore cannot be included in assessment. The choice of the optimal location, thus, depends on a matrix of two categories: on the one hand, the amount of available location information is relevant; on the other, decision makers must be able to make use of that kind of information. By combining these two categories, a location is decided. The probability of an optimal choice is greatest with high information availability and processing. Pred's approach also helps to explain the occurrence of wrong site decisions. In summary, traditional site theory, as it was developed at that time, represented initial explanations for location decision with an emphasis on profit maximization, cost orientation and the predetermination of location factors.

During the "Fordist era" the location factors focused on a specific framework of commodity flow and production factors. The distance/cost allocation later shifted from a material-oriented to a customer-oriented view (Kellerman, A. and Paradiso, M. 2007). The result was the formation of a global manufacturing network of large factories. In terms of location decision making, this shift affected both the framework of location factors itself and the balance of the factors within it. Over time, specific organizational needs became increasingly important whereas spatial restrictions lost some relevance (Lloyd, P.E. and Dicken, P. 1990). Holmes, J. (1983) described the Fordism period as the first "of major reorganization". He argued that the spread of production on a global level increased the competition in automobile industry and forced manufacturers to rethink and reorganize their production and work processes.

After industrial changes to "post-Fordist" and into the "information age", location analysis also went through a logic development (Bailey, D. *et al.* 2010). In this era both the importance of particular location factors and the logic of industrial location theory have again been critiqued. Since the value per volume combined with a low weight of the products makes up for a low transport cost share of the sales, the location factor of the transport costs in this time loses importance. Accessibility and speed, however, still play a major role. The trend at that time was towards a location factor catalogue in which the different industries can accurately determine the importance of each factor. Factors such as agglomeration advantages (with customers, competitions, indifferent ones), labour market aspects, state influences, capital markets as well as environmental and living conditions were actively included in assessments (Bathelt, H. and Glückler, J. 2012).

Increasing attention was given to Grabow, B. *et al*.'s (1995) distinction between "hard" and "soft" location factors. The hard factors are the quantitatively measurable cost factors. Hardly quantifiable factors such as living conditions, site image and political climate, on the other hand, are soft location factors and are of significant importance for the decision of a location. Florida, R. (2002) went a step further and changed the overall decision-making approach. Based on the scarcity of resources among highly qualified personnel, he assumed that company decisions are based on the location of the "creative class" and not the other way around. A realistic representation of company decision-making processes provided the approach of a "decision tree". This method was developed from qualitative data collection from practice and was initiated by Rees, J. (1972) (see De Souza, A.R. and Stutz, F.P. 1994). The advantage of this processing is the integration of the time-sphere in addition to the dominant sphere of space via learning and feedback effects. Together, these methods were used to explain the location decisions of the enterprises in this time.

Foci of recent research are the challenges of the upcoming "fourth industrial revolution" in the automobile industry resulting in the end of the stable geographies of production (Fonseca, L.M. 2018). The automobile industry's future is as uncertain as never before (Schade, W. *et al.* 2012). Current technological changes enable a much greater connection between products and their digital environment (Krawczyński, M. *et al.* 2016). Moreover, innovative manufacturing processes and IT solutions have increasingly been applied regardless of industrial branches and have accelerated the overall economic innovation process (Tanner, A.N. 2016). The power of information technology has increased to such a great extent that processing of huge amounts of data in a short time as well as customer-centred production have become possible and highly flexible (Büttner, R. and Müller, E. 2018). This development also enables revolutionary product innovations such as autonomous driving.

Nowadays, even the development of the automobile industry to a mobility service provider is conceivable. This research area requires a great deal of human and financial resources and represents a major challenge for the automotive industry in the next decades (Verband der Automobilindustrie, 2018). Despite improved customer access, proximity to the market of production sites has gained greater importance. Protectionism has increased significantly since the financial crisis of 2008–2010 (Yalcin, E. and Steininger, M. 2018). Sales figures in the triad (USA, EU, and Japan) are stagnating at a high level (Verband der Automobilindustrie, 2018). A major drop in sales due to a lack of local content in production and associated tariffs has become a problem for carmakers. By contrast, large growth markets are developing in the BRICS countries (Brazil, Russia, India, China, South Africa) (Schade, W. *et al.* 2012). For example, China is now the largest car market in the world despite a state-regulated economy (Dicken, P. 2015; Verband der Automobilindustrie, 2018). This development requires a strategic positioning of the original equipment manufacturers (OEMs) within stable free trade agreements in order to provide for the global market volume without any extra investment (Klier, T.H. and Rubenstein, J.M. 2017). Among the biggest challenges accompanying the current "fourth industrial revolution" are climate policies based on the rejection of fossil fuels. In the course of the climate change debate, governments are trying to ensure the transition to ecologically sustainable mobility concepts through increasing regulation of emission standards (Schade, W. *et al.* 2012).

So this advancement of information technologies, the volatility of the sale regions through demand and regulation as well as the emergence of new technologies and greater sustainability orientation require an intelligent factory. Such a factory is able to organize itself in a mutable manner, to produce in an efficient way, and to integrate customers and stakeholders into the manufacturing process. The requirements for such a factory are different from the previously relevant location factors and, thus, also affect the decision-making process (Pfliegl, R. and Keller, H. 2015). The afore-mentioned challenges have barely found their way into economic geographic literature. There is hence a need to work on the combined challenge of global site decisions and environmental conditions in economic geography analysis of the auto industry.

BMW's strategic situation

In this study, the focus is on a German car manufacturer, the BMW Group. Along with Daimler, Audi and Porsche, the Munich-based company competes in the premium segment. Audi and Porsche belong to Volkswagen, which is one of the two largest manufacturers in terms of volume in the world. German car production has highly depended on exports and this trend has increased in recent years. With a 77.5 per cent export rate in 2017, a new record was achieved. BMW's largest sales markets are the EU internal markets, the USA and China (Verband der Automobilindustrie, 2018).

After decades of success producing and selling powerful, fossil-fuel powered, quality vehicles, the BMW Group is now confronted by a competitive situation that reflects the challenges of the entire automotive industry. Global trade regulations have put massive pressure on the company as they not only boost import tariffs on vehicles but also prices for cross-border trade in components. Even stable trade relations, such as those between Europe and the United Kingdom, are now under threat, in this case from Brexit. Great Britain has played a major role in BMW's internal combustion engine supplier structure. In order to reduce customs costs for finished vehicles, BMW has positioned its production of certain derivatives in associated main markets. For years, the US has been the largest sport utility vehicle (SUV) market, thus, these models are produced locally, mainly in Spartanburg. Currently the plant produces large SUVs for markets worldwide. Smaller models are manufactured in rising large markets, and notably in China. China is indeed a special challenge (BMW Group 2018). Its state-protected economy only allows production in cooperation with a Chinese partner. Supplying markets outside the country is subject to high tariffs, which can add up to 40 per cent depending on engine performance (Germany Trade & Invest, 2017). Apart from a few derivatives, the Chinese factories in Dadong and Tiexi produce almost exclusively for China's local market. Exports from China to the world are currently barely noticeable.

Adapting to dynamic markets therefore requires regular investment in new regions. Small-scale manufacturing in India, Brazil and Russia, for example, facilitates BMW's access to the potential growth markets of the BRICS countries. Both the construction of plant in new locations and upgrades of the existing product network present a financial burden. In particular, the conversion to the production of electric vehicles in the same line of conventional powertrains requires great investment. In order to ensure market flexibility despite capital bound in new locations, upgrades and electric vehicles, BMW, like its competitors, organizes its production in smaller sub-networks within its established production system. Thus, the production volume can be shifted globally among plants and so extensions can be ensured without interrupting the market supply.

The central production system of the BMW Group comprises five sub-networks. Whereas Regensburg (Germany) and Oxford (UK) form a sub-network for small vehicles, Munich (headquarters, Germany) and San Luis Potosi (Mexico) constitute a network for the compact models. Dingolfing (Germany) and Goodwood (UK) manufacture luxury-class vehicles. Spartanburg (USA) supports Rosslyn (South Africa) in the production of SUVs. The only plant which is currently not part of a sub-network is Leipzig (Germany), because the factory has a diverse product portfolio and is currently still the only factory, albeit with a different production logic, for e-vehicle production. The new plant in Debrecen, which is under construction, primarily serves the purpose of increasing the flexibility of the network and solving dependencies (see Molnár, E. *et al.* 2020). For example, SUV models could be manufactured in Europe instead of just in the US. But there is also the option of building a competence factory for electric models there. The Chinese plants are considered separately because of their characteristics as a joint venture. Munich, Hams Hall (UK), Steyr (Austria) and Shenyang (China) are sites of BMW engine production and form their own supply network (BMW Group 2018) *(Figure 1).*

From 2008 to 2018 production units increased in all plants with the exception of Munich. Munich's decline in production units in 2018, however, is a cyclical effect and is followed by a high-volume year 2019, which is marked by the production of the new 3-Series. Striking are the increases in units in the US and in China (no plant in 2008). The German locations also produce more units then they did in 2008. Oxford and Rosslyn have remained at a constant production (unit) level. With the launch of the Mexico plant in 2019, the network of the 3-Series will be expanded and Munich will have spare capacity for an electrified vehicle in 2021.

In addition to the expenditure on plant restructuring, there is currently a great need for research on battery technology and autonomous driving. Massive spending on R & D is needed to help shape the future industry

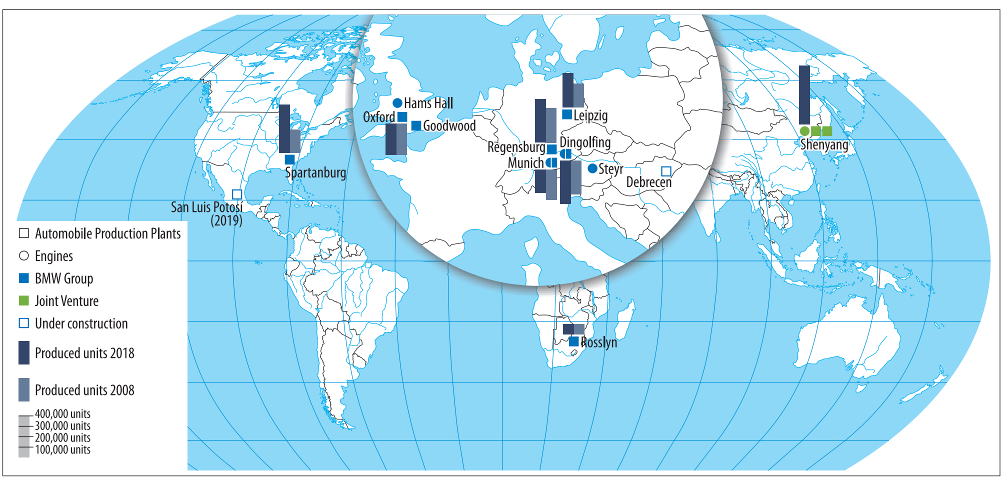

Fig. 1. BMW production network and produced cars, 2008–2018. *Source*: BMW Group, 2018.

standard and to avoid losing competencies. Cooperation can significantly reduce expenses, with know-how being available to all partners. BMW has decided to take this step in autonomous driving by cooperating with Daimler (Hägler, M. 2019). Investments in research and in implementation of e-mobility are necessary because of the EU regulatory framework. Due to a sustainability concept that is gaining importance at the moment, the new vehicle fleets are subject to strict CO_2 emission limits. As a premium manufacturer with many large luxury-class vehicles and high engine performance, balancing carbon emissions with electric vehicles is one of BMW's many key competitive requirements. That is why a fast but efficient integration of BEV and PHEV into the plants of the production network is necessary, and requires major investments in plant infrastructure. Since the traditional production process of a conventionally-powered vehicle differs from that of an electrified vehicle, the production sections must be redesigned and rebuilt to be suitable for both production platforms. Such a split-line strategy with all types of drive significantly increases the flexibility of a plant, but requires massive expenditure and severe interventions in the existing network (BMW Group, 2018).

Munich plays a special role in this network. This site houses the corporate headquarters and the Vehicle, Technology and Component Development Research and Innovation Centre. The campus for autonomous driving is located in close proximity on the outskirts of Munich. With the BMW World, the BMW Museum and the BMW Classic, Munich is also the centre of the lived brand history and perception. Within these capacities, the BMW plant Munich also fulfils its function as a production facility with an annual output of over 200,000 units of midsize vehicles. It is the oldest and smallest plant in the production network. Located in the district of Milbertshofen, the plant is close to downtown and surrounded by densely populated residential units. Therefore, the site entails a variety of peculiar requirements but also offers some advantages (BMW Group, 2019).

In terms of infrastructure, the plant is integrated in a cooperation network of various partners to reduce negative effects of the mentioned site-specific factors. With the Traffic Concept 2030+, the city of Munich is planning to satisfy requirements that will sustainably improve the traffic situation in the North of Munich. Such a project would ensure the supply capability of the plant. Therefore, the plant participates with its expertise in the goal setting. In the context of plant supply, cooperation with logistics service providers is also an option. With partners like Deutsche Bahn / Schenker and Scherm, joint supply centres are founded and operated. Parts can be stored and precommitted via these centres. The Just in Sequence delivery at the plant can then be planned more reliably over a smaller distance between supply centre and plant. In addition, these partnerships enable new supply concepts such as transporting the parts via an e-truck. This truck has limited ranges, but is CO_2 neutral and can reduce the risk of increased emissions legislation in downtown Munich. Other partnerships in this regard include supplying the plant with energy or providing a digital infrastructure.

Within the production network, Munich is the lead plant regarding the middle class models and forms a sub-network with the plant in San Luis Potosi, Mexico. Should there be an increasing demand for a specific derivative for example within the NAFTA region, the production volume within the sub-network can swiftly and flexibly be exchanged from Munich to Mexico. Since 2015 the Munich plant has undergone a process of continuous restructuring characterized by the vehicle life cycle, technological change, and sustainability and efficiency upgrades. Initiated by the new model of the 3-Series, reconstruction work in Munich factory halls started and saw the construction of a more efficient and sustainable paint shop among others (Schulenburg, C. and Hemmerle, A. 2015). With the launch of the i4-model, an all-electronic mid-range executive vehicle, further restructuring is necessary (BMW Group 2019).

The BMW Group has created opportunities to deal with the challenges of the automotive industry. With the implementation of a shared platform for all types of engines, the BMW Group can exploit economies of scale despite niche production. By using and implementing small subnetworks across the globe, it is possible to react flexibly to different market changes. Despite the global nature of the production network, three of the four lead plants (Munich, Regensburg, Dingolfing) are concentrated within a radius of 100 kilometres and can exchange information concerning the core tasks of the subnetworks in no time. This results in a mix of global activity and geographical proximity. By focusing on sustainability in production, the company is also trying to prepare for further future challenges (BMW Group 2018).

Analysis of Munich plant's upgrade decision

The construction or reorganization of a production site is always a long-term decision that binds large sums of capital. In addition, a site must meet the requirements of many different functions. Logistics must ensure optimal supply and sufficient space to supply the production line. The availability of skilled workers over a longer period of time is in the interest of the Human Resources Department. The assembly and production of the painted body relies on a large amount of contiguous and, at best, ground level, surfaces. Due to legal regulations, it is the task of the facility management to ensure compliance with fire safety and other safety regulations.

For these reasons, interdisciplinary teams are formed for all location decisions, which are to work out and evaluate an optimal cross-departmental solution. These teams are guided by the strategic control of the production system. Important parts of the project are the planners of the core technologies, logistics, body shop, paint shop and assembly. For existing sites, other affected technologies are involved. In Munich this includes engine construction, seat production and material analysis. In addition, special functions such as facility management, human resources, IT, corporate strategy and sustainability as well as the internal structure planners participate.

Basically, a location decision is based on a strategic and technical framework. In the automotive industry this often combines aspects and interactions among the manufactured product and the related life cycle as well as the overall volume development of the vehicles. Depending on the plant, further site-specific challenges may arise. For Munich, these are the structural shell of the plant and the urbanity of the location. The product life cycle of the old 3 Series ended in 2018/19. The successor model has already been integrated into the structure. From 2021 on, a fully electric vehicle is to be integrated into the factory, requiring large investment. In addition, the plant faces the challenge of having some assembly halls from the early days of production at the site and having conformity risks that entail greater redevelopment efforts. The last difficulty is the urban situation. With an increase in traffic, the supply continues to be burdened, which makes an alternative logistics concept necessary. This bundle of difficulties justifies the range of decision-making latitude, from maintaining the status quo to phasing out the plant in Munich that marked the Munich plant upgrade decision process. Field study of the more than two year-long decision-making process of the Munich location revealed a framework used for the location decisions process at BMW Group *(Figure 2)*.

The existing production network always represents the starting point. The need for site intervention in this production system can be triggered by either internal or external factors. These stress factors have a fundamental effect on the production network in total. The external parameters include the production volume. This must, sensibly distributed over the network, be produced in the sum of the factories. If the network or one of its sub-instruments is fully occupied, the system must be intervened. New markets constitute a second external factor. In

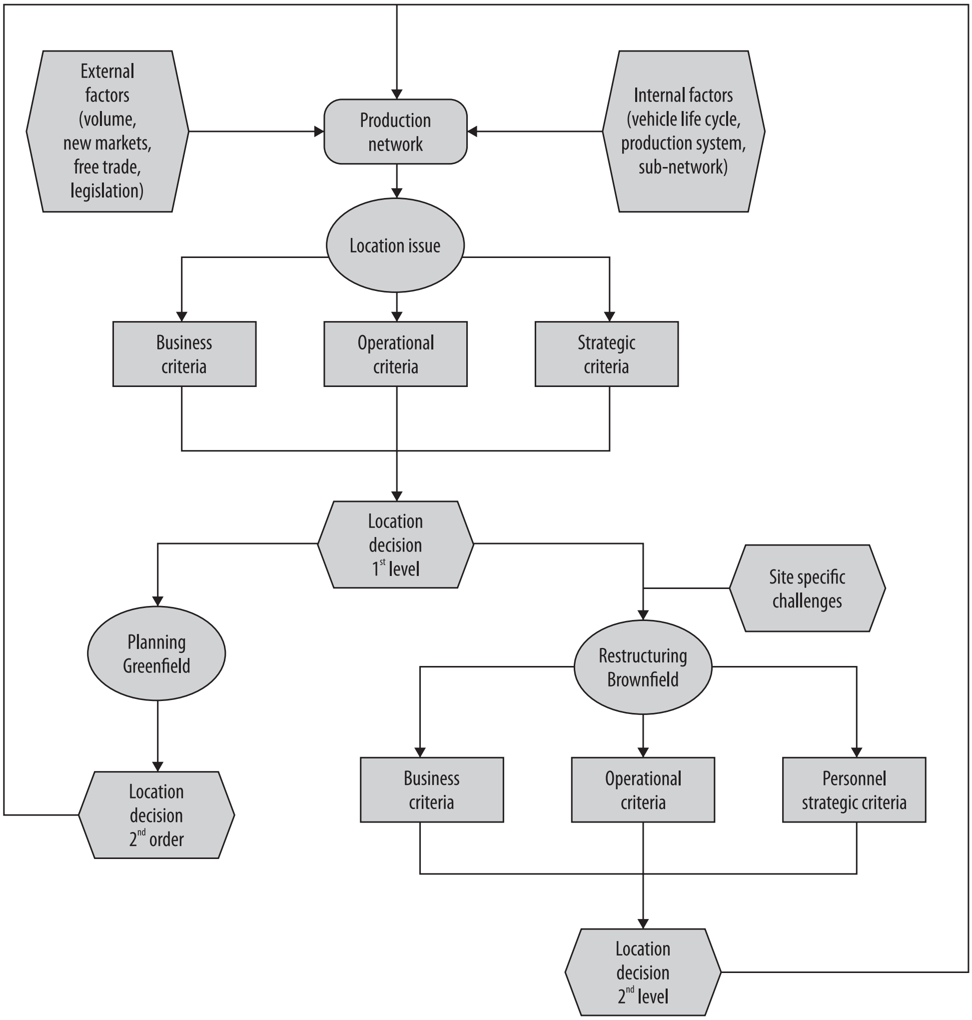

Fig. 2. Decision making framework in location matters of the BMW Group. *Source*: Edited by the author.

the case of strong growth in a single market, such as China, BMW Group's presence in the country should be strived for, or an existing small-scale production should be expanded in its capacity and be more integrated into the network. Free trade agreements allow easier and cheaper trade between the countries involved. The emergence or cessation of such regulations will result in changed framework conditions for action in the network (Klier, T.H. and Rubenstein, J.M. 2017). The last external factor, legislation, can involve many things. From the increased taxation of corporate profits and regulations, for example CO_2 limits, to subsidies and tax advantages, a change in activity in the state can have positive as well as negative effects. Internal factors include the end of a vehicle's life cycle, which is always linked to investment decisions in the production network. The plant in which the model is manufactured has to be adapted and modernized in its structures.

Production system refers to the clear increase of the hourly output by structural extensions. These are necessary if this increase can no longer be achieved through efficiency improvements. In many plants, space reserves have been created for this purpose. The factor sub-network describes the organization within the large overall network. If the logic is changed, the sites have to be rebuilt for other vehicle classes or drive types.

These factors act directly on the production network and must be recognized and evaluated there. If a need for action is derived on the basis of the changed environment, then this results in a location issue. This issue is discussed, evaluated and decided in the central control of the production network. This evaluation includes business, operational and strategic criteria. In the business analysis, scenarios are weighed, for example, against their investment, planning, material, production and transport costs. With the assessment of complexities in start-up and operation, the criticality of the decision, personnel policy issues as well as flexibilities and responsiveness, the operational criteria provide another form of comparability. The strategic criteria focus on risk assessments in the network. Dependencies on individual sites play a significant role in the course of regulatory measures. This criterion aims at robustness to changes in a volatile environment, such as volume or technological change to e-mobility. The result of the evaluation leads to an initial location decision. This is achieved without much involvement of the individual sites. The overall optimum of the production system should therefore be in the foreground.

This first-level location decision is one of the key findings of the field study and has not yet been taken up in the economic geographic literature. This approach guarantees the network suitability of the decision, which enables a flexible response to customer needs, improves the Group's cost position and creates a balanced risk position. Following this site decision, in the case of a network extension in the Greenfield, the planning units will be commissioned with the site search and the optimal plant structure. In the case of a Brownfield restructuring, the plant departments will be integrated into the valuation process of the existing site and an optimal conversion based on the given decision-making state that will be sought.

It is noticeable that the original analysis approaches of site theory are less important in the current model. Transport costs as a function of weight and distance are virtually absent from the evaluation. The understanding of space changes from a transport and distance-oriented approach to an assessment of the location in spatial units. These spatial units are shaped by political actors. They do not have to exist constantly or retain their meaning over longer periods of time. So the time frame, which was later included in the analysis (for example, De Souza, A.R. and Stutz, F.P. 1994), also plays an important role in this model. Several determinants, such as a changed network and altered demand developments or life cycles, integrate the time frame into the model. However, a fairly new consideration in the evaluation is the peculiarity of the decision maker per se. The existing production network influences the decision both spatially and temporally. In order to position the company's locations in the space units, the existing structure must be assumed. If a decision is postponed to a later point in time, the network might have changed by then due to the decisions made in the meantime. This kind of altered framework will be explained in more detail on the basis of the location decision of the Munich plant.

The field study conducted at the Munich plant focuses on the restructuring of the Brownfield. In this type of network intervention, various location-specific challenges play a significant role. For Munich, these challenges are mainly about the plant's urban surrounding, its difficult supply situation, its spatially limited factory premises and its established structures. Nevertheless, the plant's proximity to the research and development departments, the availability of many university graduates and high-skilled workers as well as the perception as a regional player have a positive effect on the Munich location. All these aspects must be taken into account to allow a productive discussion about the restructuring of the Brownfield. The assessment of the site discussion is made in greater detail by a large number of affected site functions and central offices. The logic here is comparatively similar to the first location decision, but neglects the connection to the network. This connection has already been ensured via the network suitability and its associated premises. At this stage, assessment of the business criteria focuses strongly on the structural investment and the running costs of production. The strategic criteria target personnel strategy issues in particular. Here, a potential shift in the future employment structure must be kept in mind. Further interesting points of the analysis can be deduced from the operational criteria. While the proportion of qualitative evidence is very high, the evaluating functions enjoy a wide range of interpretation within the assessment. For this reason, improvements in production value flow, flexibility, quality and employee orientation and better adaptation to site-specific challenges can be assessed in a comparative analysis. Based on the sum of these three evaluation clusters, a site-specific decision was reached to implement a specific type of restructuring for the singular factory. This choice, by analogy with a decision for a Greenfield plant, implies a second-level location decision. Thus, the production network is either extended (Greenfield) or renewed/restructured (Brownfield). This second decision provides a conclusion and a new starting point for future location decisions.

Following this logic, two site decisions were also made for the Munich plant taking both internal and external factors into consideration. The upper middle class vehicles built in Munich have a large market worldwide. Both the US and Europe as well as Asia, which shows strong growth in this segment, require high production volumes. Due to the facts that the processes of site search and construction in the Greenfield would take too much time and that compensation for the required volume in the network is impossible, Munich is already a preferential choice at this time. In addition, the launch of e-mobility requires a new type of vehicle architecture in the plants. In order to make maximum use of the existing structures, to install technological transformations in a leading plant and to distribute the produced volumes optimally to sales markets, Munich was chosen as a Brownfield restructuring project. This first location decision attests a network suitability and a balanced risk position for future product and market changes to the Munich plant. Furthermore, the investments that had been made a few years earlier to launch the successor model of the 3 series continued to be used beneficially (Schulenburg, C. and Hemmerle, A. 2015).

The specific challenges which the Munich plant brings with itself at the second decision stage have already been explained. Of further interest now are the evaluation criteria which were taken into account in the business, operational and personnel strategy analyses. Personnel Strategic Assessment reviews possible implementation of future site scenarios in terms of staffing and residual costs. Due to the presence of many different technologies, especially the engine construction at the factory site, both perspectives, business and operational, have one thing in common: uncertainty. Since potential modifications in the plant's structure will affect other technologies in the future, or even possibly displace them, costs for compensation must also be assessed. The transition to e-mobility, for example, results in an evaluation uncertainty. If change is stronger, a scenario of greater displacement of old technologies may be more cost-effective than a weaker one. This would affect almost all categories of business valuation, such as investment or running costs. An alternative perspective is provided by the operational criteria. The parties involved can include their production-relevant framework conditions in a qualitative assessment and, thus, increase comparability to other scenarios. Relevant aspects of sustainability, such as neighbourhood acceptance or development minimization can also be added to the equation.

Overall, the location decision from the case study regarding the Munich plant is based on a few key criteria. First and foremost, network usability plays a significant role. The location is well integrated in the established system taking the leadership role of a sub-network with well-performing supplier and personnel structures. This key suitability factor has already been discussed in the first location decision. Network suitability represents a change in the value of the location, since in previous decisions the topic of network expansion had clearly been more important than its basic suitability. Since a complementary network ensures a balanced risk position in this first decision, a closer look must be taken on the second factor. The established structure of the plant also fulfils the factor of risk exposure. With rather stable political conditions and a consistent sales market in the regional economic area, the Munich plant holds a relatively secure position. This fact is important in both types of location decisions and manifests itself in different ways. This kind of risk centering also represents a change in the analysis of the locations. In previous years, location decisions were opportunity-oriented. With the uncertain future of the industry, the key driver of risk appetite has also changed. In addition, the BMW Group aims to optimize the use of existing structures. To some extent this indicates an escalating commitment to the concept of sunk costs. The need for security seems to correlate with an increased orientation towards existing structures. In this context, 'sustainability' has become more prominent in decision-making and represents a special case. In the underlying assessment, some topics are taken up directly by the valuating departments, whereas others are not explicitly mentioned. However, the following discussions point to a stronger position of sustainability in location decisions than is currently the case in the model. Further, it is becoming apparent that the assessment of sustainability is geared towards new indicators which make a further perspective on location decision necessary.

Changes in location factors and location decision

How do these findings affect the location research of economic geography? At least since the last economic crisis 2008–2010, the framework conditions in the choice of location have changed massively. This concerns the technological capabilities of the industry as well as their considered location factors. The competitive pressure within the industry, especially in the automotive industry, is also a major cost burden and an uncertain factor for future development. Against this background, the risk appetite of the actors is changing from an aggressive investment culture to the passive optimization of proven structures and partnerships (Klier, T.H. and Rubenstein, J.M. 2012; Häntsch, M. and Huchzermeier, A. 2016). The large research needs of automotive technology, such as battery technology and autonomous driving, are preferably developed in cross-competition cooperation in order to spread the risk and the immense costs (Eriksson, R.H. 2011; Hägler, M. 2019). The change to e-mobility increases the pressure even further (Nieuwenhuis, P. and Wells, P. 2015). A conversion of the existing works to a changed and diverse product architecture is necessary. In addition, a worldwide charging infrastructure must be set up. This infrastructure is also to be implemented in Europe in a joint venture of European automobile manufacturers (Mayr, S. 2018). The questions to be discussed are the following: How does this need for security in the currently challenging situation affect decision-making about locations? And how does the approach of location decision-making change in comparison to the existing scientific relevance of economic geography?

The location decision analysis has changed in four key criteria. The exposure to risk is one of them. The need for security in terms of costs, benefits and future prospects has significantly increased since the turn of the millennium (Klier, T.H. and Rubenstein, J.M. 2012). The financial difficulties of large car manufacturers in the wake of the economic crisis are also due to an unbalanced risk position (Klier, T.H. and Rubenstein, J.M. 2010). The location factor of the network suitability is closely related to this. The production network is the basis for any global action of a manufacturing company. This network can be used to enter new markets, to serve existing markets in a customer-centred manner, to avoid trade barriers as best as possible and to reduce dependencies on individual sites. In the manufacturing industry, the expansion of production into the world through globalization has been a major driver in site planning for many years. For many automobile companies, this process of expansion has meanwhile been completed: global production networks have already been set up. Additions usually only take place when new, large sales markets are emerging. China is the best example in this regard. Globalization as a driver of the choice of location therefore loses importance (Krawczyński, M. *et al.* 2016). The focus shifts to an optimal organization of the existing global production network. Flexibility and adaptability are the new framework conditions of this network.

Based on the above mentioned production network, another location factor is derived. It is an optimal use of existing structures and investments made in the past. This sunk cost phenomenon is not new in the field of economic geography research, as the management of sunk costs has long been recognized as an important part of the operational restructuring process. Of particular importance when considering the location decisions from an existing production network are the accumulated and the exit sunk costs (Clark, G. and Wrigley, N. 1995). These costs are largely relevant to the location. The initial investments made result in configurations of production due to a particular geography and/or history. These start-up investments can be very different for each company in the business. If an enterprise wants to shift the basis over a changed production orientation, the initial investments are often hardly recoverable (Clark, G. 1994). This special position of sunk costs is also recognizable in the decision-making process of the industry today. In addition, the change to electro-mobility requires a changed production environment and, associated with that, a difficult use of the differently centred investments of the past. For this reason, sunk costs develop in the current consideration to a key factor of the location choice.

The last location factor of particular importance is sustainability or, better, a sustainable alignment of the network and the individual plant locations. This factor changed a lot in recent years. In the evaluation departments, economic aspects still dominate. However, social and ecological characteristics are increasingly being integrated into the evaluation. This has two main reasons. First, there is an imbalance in the assessment of sustainability between the clerks and the key management. The focus on social and ecological criteria is receiving much more attention in management and, despite the lack of a monetary assessment, is of greater interest than it is at the operational level. Second, the transformation to electro-mobility is largely driven by sustainability considerations. The decarbonisation of the automobile industry is the central content of politics and public perception. This industrial restructuring process will take time due to external factors and the associated large financial outlay (Seto, K.C. *et al*. 2016). But, in the name of 'sustainability' a transition to low carbon mobility is underway in the auto industry. However, despite the BMW Group Chief Executive Officer's certainty that electro-mobility is the future, the transition involves risks and therefore careful transition steps associated with this model cycle.

Relevant for the economic geography is the change in the consideration of all described location factors. The expansion of the network to realize all the opportunities offered, combined with a neglect of socially relevant aspects, is no longer the status quo of the industrial decision-making process. The process at the BMW plant in Munich shows that reinforced structures and their location factors can gain in importance in the difficult framework conditions in the industrial environment. This means attention to what the advantages of old or existing factory locations are. First and foremost, the site is part of the production network. Thus, the network and its sub-organizations around this plant co-developed. A high degree of suitability is, thus, ensured. In addition, suppliers and cooperation partners have set up the site in terms of either space or organization. There is a solid structure that can respond more quickly and more effectively to potential risks. Moreover, the internal connections, supply networks, cooperation partnerships and research institutions still play important roles in the site analysis of existing plants. These spill-over effects lead to innovation and to advantages in development costs, especially in what is technically a very volatile time (Tanner, A.N. 2016).

In this context, the Munich plant is of course an old factory. It is important to mention that network, cooperation and spillovers play a particularly important role in this plant due to its geography and history. The above-mentioned urban situation not only entails higher costs and challenges, but also has many positive effects. In addition to the corporate headquarters, the research and development centre is in the immediate vicinity. Furthermore, three of the four subnetworks are led by Bavarian plants. This enables a physical exchange with the other regional plant locations. Munich is also home to many large industrial groups that tend to work together more closely in the face of new technological challenges. Collaborations with renowned universities are also possible at this location. Tanner, A.N. (2016) describes how new technologies in metropolitan areas increasingly occur and are further developed. Due to the increasing significance of the new key factors in site analysis, old factory locations are becoming more important. Existing investments and cooperation are maintained and tend to be further deepened and optimized. In this technologically and financially uncertain time, it is important to avoid risks and still provide a sustainable structure. To secure the company's success, a corporation must position itself best in a globalized world. The resulting production network forms the basis for long-term success. If an existing, old location has proven its worth, its suitability and the contribution to the company's success are secured until the next analysis. A secure base serves as a starting point for the great tasks of the coming years. The change to electro-mobility is the beginning of a major decarbonisation of the automotive industry and other manufacturing industries (Seto, K.C. *et al.* 2016). This requires the development of sustainable vehicle concepts and production structures. The relevance of 'sustainability' is growing, driven both by the state and by companies. Precisely what this 'sustainability' looks like in detail deserves further attention but is beyond the scope of this paper.

However, in general this research finds evidence that BMW Group is thinking about 'sustainability' by rethinking its sunk costs and risk profile, reacting to societal pressure for decarbonisation and paying attention to social issues of work force retention and restructuring. These findings confirm the idea that a 'fourth revolution' is occurring in the automotive industry. As described, this revolution is caused by three driving factors. On the one hand, there is the progressive individualization of the product range in ever new niches. On the other hand, states and organizations are putting great regulatory pressure on the industry. The last factor is the advancing digitalization, which enables significantly leaner production by combining high automation with individual demand. The automotive industry decides differently today than ten years ago. The analysis reported in this paper reveals those key parameters that were integrated into location decision-making and the framework within which they had effect. These were the decisions and framework used lately. Regulations and protectionism are further important drivers that can influence site analysis in the future. Exactly how the factors and technologies identified will be integrated into the industry and its production has yet to be seen.

The last remaining question is the extent to which this paper's findings can be generalized. Are the results of the case study of just one automobile company applicable to the whole industry? As discussed, the manner in which location decisions are made depends on several parameters such as production network, type of production, size and historical decisions. These influencing factors allow conclusions for the general validity. All major automotive groups, such as VW, Mercedes or General Motors, have a production network that spans around the globe. This structural feature is common to almost all OEMs. The decision history and the type of production, on the other hand, generally allow for selective differentiation in the process. Type 2 OEMs, such as BMW or Mercedes, specialize in product quality and individuality. As opposed to that, VW is an economies of scale producer and therefore operates on a different strategy (Schamp, E. 2005). Nevertheless, the first step of every decision is to aim for structures that are optimal within the company's network. Optimal for a company in this context means to guarantee sustainable company success in connection with the existing structures and networks, and not to take negligent risks. This applies to both a mass producer and a quality leader. In conclusion, it can be said that the data, although they stem from one particular company, do speak for a change relevant to the industry. This can also be seen in large investments in new plants and plant restructuring visible industry-wide (Häussler, U. 2020). The form of these investments can of course differ. For example, a mass producer may build a completely separate plant for electric vehicles and opt against the path of plant integration. Due to the larger number of production units, the company would still optimize its production networks, which would be a justifiable option. Research in another company would further support this thesis.

Conclusions

In addition to the network suitability, sunk costs and risk exposure, the topic of sustainability is revealed as particularly important in this location analysis. In the first three, a contrarian change in the direction is evident. Network suitability replaces network expansion, optimizing investments supplant capital stock expansion and avoiding unnecessary risks trump an expansive opportunity orientation. Sustainability, however, is a further development. While economic trends have clearly dominated over the past few years, social and environmental factors are becoming increasingly important. A detailed analysis of the changed perception of sustainability is to be considered in further studies, but is already to be regarded as a key factor in the industrial context. With the advent of electromobility, a key technology is now turning into a sustainability-oriented product. This orientation is new in the automobile manufacturing industries and argues for a global trend beside what we have come to know as the economics of plant restructuring. This research reveals that as decarbonisation, digitalization and protectionism grip the automobile industry, location decision-making is already taking on new frameworks, a changed repertoire of factors, and an orientation toward risk averse notions of 'sustainability'.

REFERENCES

Bailey, D., De Ruyter, A., Michie, J. and Tyler, P. 2010. Global restructuring and the automobile industry. *Cambridge Journal of Regions, Economy and Society* 3. (3): 311–318.

Bathelt, H. and Glückner, J. 2012. *Wirtschaftsgeographie*. Stuttgart, Eugen Ulmer Verlag.

BMW Group 2018. *Geschäftsbericht 2018 – Meilensteine zukünftiger Mobilität*. Available at https://www.bmwgroup.com/content/dam/bmw-group-websites/bmwgroupcom/ir/dow nloads /de/2019/gb/BMW-GB18_de_Finanzbericht_190315_ONLINE.pdf (17. 11. 2018.)

BMW Group 2019. *BMW Group Werk München*. Available at https://www.bmwgroup-werke.com/muenchen/de.html (02. 05. 2019.)

Böventer, E. 1962. *Theorie des räumlichen Gleichgewichts*. Tübingen, Mohr Siebeck Verlag.

Büttner, R. and Müller, E. 2018. Changeability of manufacturing companies in the context of digitalization. *Procedia Manufacturing* 17. 539–546.

Clark, G. 1994. Strategy and structure: corporate restructuring and the scope and characteristics of sunk costs. *Environment and Planning A, Economy and Space* 26. (1): 9–32.

Clark, G. and Wrigley, N. 1995. Sunk costs: A framework for economic geography. *The Royal Geographical Society* 20. (2): 204–223.

Cranois, A. 2017. *From Automobility to E-mobility: Moving Conservatisms?* Paris, Université Paris-Est.

De Souza, A.R. and Stutz, F.P. 1994. *World Economy, The Resources, Location, Trade and Development.* San Diego–San Marcos, Pearson Verlag.

Dicken, P. 2015. *Global Shift: Mapping the Changing Contours of the World Economy*. Los Angeles–London–New Delhi–Singapore–Washington D. C., Sage.

Eriksson, R.H. 2011. Localized spillover and knowledge flows: How does proximity influence the performance of plants? *Economic Geography* 87. (2): 127–152.

Financial Times 2017. Last exit for Detroit. *Financial Times* 11. 20.

Florida, R. 2002. *The Rise of the Creative Class*. New York, Basic Books.

Fonseca, L.M. 2018. Industry 4.0 and the digital society: concepts, dimensions and envisioned benefits. *Proceedings of the International Conference on Business Excellence* 12. (1): 386–397.

Fromhold-Eisebith, M. 2018. Research achievements in transition: German scholars' contribution to economic geographies of knowledge, innovation and new technologies. *Zeitschrift für Wirtschaftsgeographie* 62. (2): 152–162.

Germany Trade & Invest 2017. *Merkblatt über gewerbliche Wareneinfuhren – VR China.* Bonn, Gesellschaft für Außenwirtschaft und Standortmarketing mbH. Available at https://www.gtai.de/GTAI/Navigation/DE/Trade/Recht-Zoll/Zoll/merkblaetter,t=merkblatt - ueber-gewerbliche-wareneinfuhren--vr-china-2017,did=1762928.html (19. 08. 2018.)

Grabow, B., Henckel, D. and Hollbach-Grömig, B. 1995. *Weiche Standortfaktoren.* Stuttgart, Kohlhammer Verlag.

Hägler, M. 2019. BMW und Daimler entwickeln gemeinsam autonome Autos. *Süddeutsche Zeitung* 28. Februar 2019. Available at https://www.sueddeutsche.de/wirtschaft/bmw-daimler-autonomes-fahren-1.4348666 (12. 04. 2019.)

Häntsch, M. and Huchzermeier, A. 2016. Transparency of risk for global and complex network decisions in the automotive industry. *International Journal Production Economics* 175. 81–95.

Häussler, U. 2020. Autohersteller investieren aktuell in Lade- und Batterieprojekte. *Elektronik automotive* 20. 01. 2020. Available at https://www.elektroniknet.de/elektronik-automotive/elektromobilitaet/autohersteller-investieren-aktuell-in-lade-und-batterieprojek te-172749.html (13. 02. 2020.)

Holmes, J. 1983. Industrial reorganization, capital restructuring and locational change: An analysis of the Canadian automobile industry in the 1960s. *Economic Geography* 59. (3): 251–271.

Hoover, E.M. 1937. *Location Theory and the Shoe and Leather Industries*. Cambridge, MA, Harvard University Press.

Iammarino, S., McCann, P. and Ortega-Argiles, R. 2018. International business, cities and competitiveness: recent trends and future challenges. *Competitiveness Review: An International Business Journal* 28. (3): 236–251.

Jung, J.C. 2017. Volkswagen's diesel emissions scandal. *Thunderbird International Business Review* 59. (1): 127–137.

Kellerman, A. and Paradiso, M. 2007. Geographical location in the information age: from destiny to opportunity? *GeoJournal* 70. (2–3): 195–211.

Klier, T.H. and Rubenstein, J.M. 2010. The changing geography of North American motor vehicle production. *Cambridge Journal of Regions, Economy and Society* 3. (3): 335–347.

Klier, T.H. and Rubenstein, J.M. 2012. Detroit back from the brink? Auto industry crisis and restructuring, 2008-11. *Economic Perspectives* 36. (2): 35–54.

Klier, T.H. and Rubenstein, J.M. 2017. Mexico's growing role in the auto industry under NAFTA: Who makes what and what goes where. *Economic Perspectives* 41. (6): 1–29.

Klier, T.H., Lavelle, M. and Rubenstein, J.M. 2010. After the perfect storm: What next for the auto industry? *Chicago Fed Letter* 277a.

Krawczyński, M., Czyżewski, P. and Bocian, K. 2016. Reindustrialization: A challenge to the economy in the first quarter of the twenty-first century. *Foundations of Management* 8. 107–122.

Lloyd, P.E. and Dicken, P. 1990. *Location in Space: Theoretical Perspectives in Economic Geography*. New York, Harper Collins.

Mayr, S. 2018. Infrastruktur für E-Autos – Energieschub an der Autobahn. *Süddeutsche Zeitung* 20. April 2018. Available at https://www.sueddeutsche.de/auto/infrastruktur-fuer-e-autos-energieschub-an-der-autobahn-1.3951178 (19. 04. 2019.)

Molnár, E., Kozma, G, Mészáros, M. and Kiss, É. 2020. Upgrading and the geography of the Hungarian automotive industry in the context of the fourth industrial revolution. *Hungarian Geographical Bulletin* 69. (2): 137–155.

Niewenhuis, P. and Wells, P. 2015. *The Global Automotive Industry*. Hoboken, John Wiley & Sons.

Ormond, J. 2015. New regimes of responsibilization: Practicing product carbon foot printing in the new carbon economy. *Economic Geography* 91. (4): 425–448.

Oxelheim, L. and Wihlborg, C. 2008. Corporate distress and restructuring with macroeconomic fluctuations: The cases of GM and Ford. *IFN Working Papers Series* 780. 1–36.

Palmer, J. and Schwanen, T. 2019. Clearing the air after dieselgate: Time for European regulators to experiment with participatory governance. *The Geographical Journal* 185. (2): 237–242.

Pfliegl, R. and Keller, H. 2015. Mobility Governance – Digitalisierung des Verkehrs im Kontext von Industrie 4.0 und der Verantwortung der Gesellschaft zur Nachhaltigkeit der Mobilität. *Elektrotechnik & Informationstechnik* 7. 374–379.

Pred, A.R. 1967. *Behaviour and Location: Foundations for a Geographic and Dynamic Location Theory.* Part 1. Lund, Sweden, University of Lund.

Schade, W., Zanker, C., Kühn, A., Jäger, A., Hettesheimer, T. and Schmall, T. 2012. *Zukunft der Automobilindustrie* 152. Berlin, TAB.

Schamp, E.W. 1978. Unternehmensinterne Entscheidungsprozesse zur Standortwahl in Übersee am Beispiel eines Deutschen Chemischen Unternehmens. *Geographische Zeitschrift* 66. 38–60.

Schamp, E.W. 2005. Die Automobilindustrie auf dem Weg nach Europa. *Geographische Rundschau* 57. 12–19.

Schulenburg, C. and Hemmerle, A. 2015. *Das BMW Group Stammwerk München*. München, Hirmer.

Seto, K.C., Davis, S.J., Mitchell, R.B., Strokes, E.C., Unruh, G. and Ürge-Vorsatz, D. 2016. Carbon lock-types, causes, and policy implications. *Annual Review of Environment and Resources* 41. 425–452.

Smith, D.M. 1971. *Industrial Location: An Economic Geographical Analysis*. New York, Wiley.

Tanner, A.N. 2016. The emergence of new technology-based industries: the case of fuel cells and its technological relatedness to regional knowledge bases. *Journal of Economic Geography* 16. 611–635.

Verband der Automobilindustrie 2018. *Jahresbericht 2018 – Die Automobilindustrie in Daten und Fakten.* Berlin, VDA.

Weber, A. 1929. *Alfred's Weber Theory of the Location of Industries*. Chicago, C.J. Friedrichs.

Whitmarsh, L. and Köhler, J. 2010. Climate change and cars in the EU: the roles of auto firms, consumers, and policy in responding to global environmental change. *Cambridge Journal of Regions, Economy and Society* 3. (3): 427–441.

Witlox, F. 1999. Towards a relational view on industrial location theory. *Tijdschrift voor Economische en Sociale Geografie* 99. (2): 135–146.

Yalcin, E. and Steininger, M. 2018. Weltweite ökonomische Folgen einer zunehmend protektionistischen US-Handelspolitik. *IFO Schnelldienst* 4. 30–38.