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Digitalization and Evolving IT Sourcing Strategies in the German Automotive Industry

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Abstract – **Digitalization and major changes in core business products and processes are now sweeping through the global automotive industry, and many automotive companies are confronted with the challenge of formulating and implementing a company-wide digital transformation strategy. Digitalization is associated with significant and extremely rapid change, and, in some cases, even the replacement of established business models. This transformation is part of what is often termed Industry 4.0 and, in large companies, where the provision of information technology (IT) has hitherto been outsourced, the introduction of these new technologies may be the catalyst for a major re-think of IT sourcing strategy. This may entail bringing previously outsourced activities back in-house – a process known as backsourcing - to regain ownership and control, in order to be more flexible and respond more effectively to rapidly changing demands. This study reviews the extant literature on the motivation for backsourcing, and then examines the potential impact of digitalization on IT sourcing in the German automotive industry. A conceptual framework for subsequent research is put forward, using a knowledge-based view of the firm. In addition, following initial feedback from an online survey, an initial model for analyzing change in IT sourcing strategy is proposed. The model is being developed through more in-depth interviews to provide operational guidance for IT management and strategists in the German automotive industry.**

Keywords – IT sourcing strategy; backsourcing; digitalization; digital transformation; German automotive industry; conceptual framework; operational model.

I. INTRODUCTION

The backsourcing process in the German automotive industry has been the focus of recent research [1], as companies continually assess their IT sourcing strategy in the light of the implications of digitalization and other industry trends [2]. Over the past two decades, many different forms of IT outsourcing have emerged, all associated with expectations that the company can better concentrate on its core business, focus on innovation, reduce costs and increase the effectiveness of IT services [3]. Now, however, this assumption is being challenged in the German automotive industry, as changes in the external technology environment - digitalization and new automation technologies – are demanding a reassessment of IT sourcing options.

When IT outsourcing agreements expire, or the activity is reviewed, the decision has to be made as to whether to continue the agreement, to switch to another vendor, or to bring management and control of the hitherto outsourced activity back in-house – thereby backsourcing the IT provision [4] [5]. The German automotive industry is the most affected of all industries by digitalization in the German economy [6], and the aim of this paper is to assess current understanding of IT backsourcing and determine what impact digitalization may have in the German automotive industry regarding current and future IT sourcing strategies. The study explores a relatively unknown field, and will contribute to both research and practice, providing new knowledge for researchers and operational guidance for practitioners.

This article has six sections. Following this Introduction, Section II looks at the main concepts under study, briefly discusses relevant background issues and sets out three main research questions. Section III then outlines the research methodology, which is based on a systematic literature review, but which is now being complemented by an online survey and interview analysis with industry experts. Section IV analyses the existing literature to address the three research questions and makes an initial attempt to establish a conceptual framework and provisional operational model. Section V then reports on the preliminary findings from the online survey. Finally, Section VI provides a summary of the ground covered in the paper and makes some concluding comments on the significance of evolving IT sourcing strategies in an industry sector undergoing unprecedented change.

II. BACKGROUND AND RESEARCH QUESTIONS

The term sourcing is a generic term that combines several different sub-concepts, models or strategies besides the two fundamental directions of insourcing and outsourcing. Theoretical and empirical studies to explain insourcing and outsourcing decisions also refer to the terminology of vertical integration. Vertical integration is generally defined as the degree to which a firm intends to source services externally or carry out the activity in-house. This leads to make-or-buy decisions which reflect the strategic intent and purposeful design of in-house service competencies and depth [7] [8]. A large body of research provides an overview of what can be

the subject of a make-or-buy decision and the criteria that should be taken into account (Figure 1).
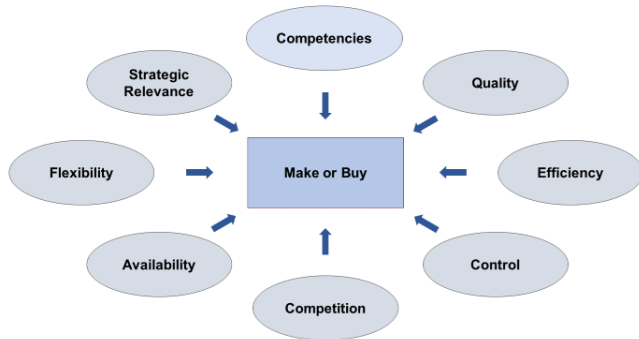

Figure 1. IT sourcing and criteria for make-or-buy decisions

Many different forms of IT outsourcing have emerged in recent decades, which can be combined in many ways and lead to a high degree of complexity, there being many possible dimensions to the outsourcing process (Figure 2).

Whilst backsourcing involves *bringing* previously outsourced activities back in-house, insourcing is sometimes used as a general term for *performing* activities in-house. Terms, such as backshoring, reshoring, onshoring or relocating, are sometimes used synonymously with backsourcing. However, Nujen et al. [9] underlined that these terms imply a change in location, and backsourcing is the only term that indicates a change in ownership. A distinction can also be made between total and selective sourcing. Lacity and Hirschheim [10] defined total outsourcing as being when more than 80% of IT budgets are outsourced to an external provider. Similarly, total insourcing occurs when more than 80% of the IT budget remains within the company. Finally, selective sourcing suggests an allocation of between 20% and 80% of the IT budget to a particular sourcing strategy, and selective outsourcing has been the most popular and the most successful outsourcing strategy [11]. This study applies the same definitions to backsourcing, which may involve just a single IT service - such as a datacenter or a bundle of applications - or complete backsourcing, where a company rebuilds the previously outsourced IT organization.

There is some overlap in the literature between the terms "digitization", "digitalization" and "digital transformation". Digitization is a more technical interpretation and refers to the conversion of information from an analog to a digital storage medium [12]. It also equates to the transfer of tasks to the computer, which were previously performed by humans. Thus, digitization also refers to a special form of automation. The focus is on digital technologies, for which the acronym "SMACIT" (social, mobile, analytics, cloud, and Internet of Things) is sometimes used [13]. This has been widened by some authors to encompass Big Data, artificial intelligence, digital twin, 3-D-Printing, augmented and virtual reality, and
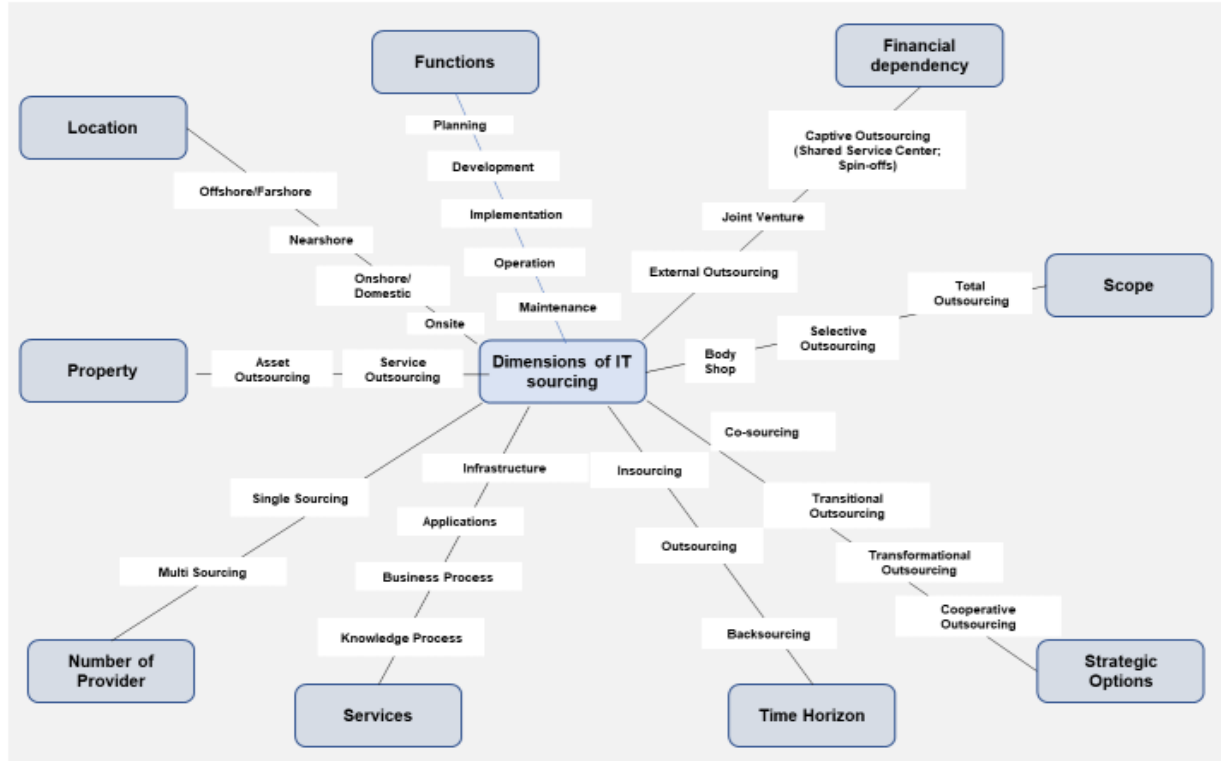

Figure 2. The potential dimensions of IT sourcing. Based on Krcmar [7] and Von Jouanne-Diedrich, Zarnekow and Brenner [8].

robotics. Many of the technologies mentioned are not new or revolutionary on their own. Rather, their innovative potential stems from their significantly enhanced efficiencies, their intensive networking possibilities and their increasingly widespread use [14].

The term digitalization is more broadly defined and is intended to express the fact that digitalization now affects all economic and social areas [12]. Riedl et al. [15] define digitalization as "the process of introducing digital technologies, which essentially deal with changes caused by information technologies". Koch, Ahlemann and Urbach [16] define four conditions for this. First, the technologies used do not have to be new - rather the newness is created in the context of business and value creation models. Second, digitalization is data-driven, and is based on an increased generation, processing and analysis of often new types of data. Third, digitalization means that the character of the value added or the business model changes significantly as a result. Fourth, there needs to be an association with a clear strategic dimension, as companies expect competitive advantages from it.

Digital transformation is a result of digitalization and refers to how the deployment of digital technologies can lead to new, disruptive business and value creation models [17]. For Singh and Hess [18], this requires a company-wide digital transformation strategy to guide a company through the transformation process. However, there is no uniform definition of this term to date. Vial [19] reviewed 282 digital transformation related academic publications and found 23 different definitions. Based on the existing definitions, he developed a conceptual definition of digital transformation as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" [19].

Industry 4.0 can be viewed as part of digitalization, encompassing the entry of complex digital technologies and architectures into manufacturing processes. A generally accepted definition has not yet been established in the literature, but the definition of Roth [20] is used in the context of this research. "Industry 4.0 comprises the networking of all human and machine actors along the entire value chain as well as the digitalization and real-time evaluation of all relevant information with the aim of making processes and value creation more transparent and efficient in order to optimize customer benefits with intelligent processes and services." Industry 4.0 is also sometimes called the "fourth industrial revolution" or Industrial Internet of Things (IIoT), where the focus is on the strong integration of Internet-based information and communication technology (cyber-physical systems) into industrial processes [20].

Industry 4.0 has its roots in the concept of the Smart Factory and this is viewed as the starting point and main purpose of Industry 4.0 [21]. People, machines and products to be manufactured are connected in a network. The aim of this network is to achieve the overall optimization of quality, lead-time and utilization of resources. It is considered a decisive innovation that all data are available in real time,

providing a permanently up-to-date, virtual image of reality, which allows complex manufacturing processes to be better controlled [21]. The Smart Factory represents an adaptable system in which flexible production lines automatically adjust their processes to different types of products and changing conditions [22].

In recent years, digitalization has become one of the most important topics in social, scientific and economic life [12]. Digital technologies are regarded as major technical changes or breakthroughs and the associated digital transformation is seen as a driver for significant and extremely rapid change, in some cases even leading to the replacement of established business models [23]. The term "transformation" reflects the variety and complexity of the measures that may need to be taken when companies are confronted with these new and disruptive technologies [18]. Some companies may see this as requiring a company-wide digital transformation strategy, which can encompass all business areas as well as products, processes and organizational structures.

If pre-existing IT strategy is aligned with the business, IT can be seen as an enabler for digital transformation [24]. Companies may review their IT sourcing strategies and governance models and consider alternatives for existing outsourcing arrangements [25]. This in turn may lead to a move towards IT backsourcing. Many companies have already established innovation labs, digital factories or technology accelerators in recent years, in order to keep up with the increased demands of digitalization [26]. Volkswagen, for example, strengthened its IT department with 1,000 new IT employees from various disciplines [27]. At Daimler, too, there are signs of a part move away from the IT sourcing strategy that has been pursued for years, aimed at increasing its own contribution to IT from 25% to 35% [28].

The significance of digitalization as a factor in the backsourcing of IT provisions has received little attention in the scientific literature so far. In contrast to insourcing and outsourcing, IT backsourcing generally lacks scientific studies [29]. The literature that does exist deals mainly with the reasons and decision-making processes for IT backsourcing in relation to contract problems that have led to failure [30]. Internal or external organizational changes are only explained using individual examples of high profile / large-scale events, which have received press attention but cannot support generalization [31].

The German automotive industry consists of the Original Equipment Manufacturers (OEMs) and a three-tier supplier network. The industry is facing serious external organizational changes, which are leading to four megatrends in the automotive industry: Connectivity, Autonomous Driving, Shared & Services, Electric [32], for which the acronym C.A.S.E. is often used.

Each of the C.A.S.E. elements has the power to radically change the industry and undermine existing business models. The challenge is to combine them in a way that delivers a comprehensive and seamless package to the customer. Digitalization and Industry 4.0, and the associated connection of the physical with the digital world, as well as the networking of the entire value chain, are the drivers of this change [33] (Figure 3).
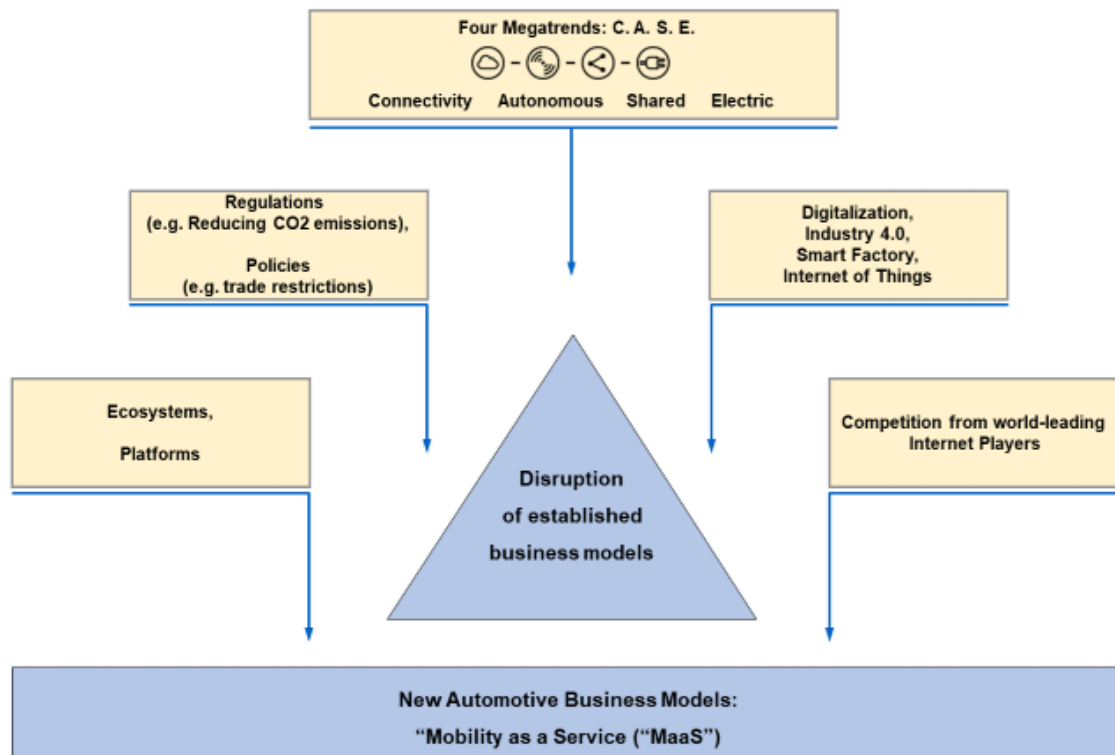
Figure 3. External environmental changes in the German automotive industry. Based on Automobil-Produktion [32] and Daimler Annual Report [33]

Digitalization and digital transformation affect all areas of a company. The aim of the study is to analyze to what extent digitalization has influenced the German automotive industry's move towards IT backsourcing, and provide new insights concerning decision-making relating to overall IT sourcing strategy. The current study addresses three Research Questions (RQs):

RQ 1: What does the extant literature reveal regarding current thinking on the rationale for IT backsourcing?

RQ 2: To what extent has digitalization influenced the German automotive industry's strategy regarding IT backsourcing and what are its potential benefits?

RQ 3: How can an operational model be developed to aid practitioners in the German automotive industry in the reassessment of their IT sourcing strategy?

This article presents initial findings from the study that are now being pursued through in-depth interviews with industry practitioners. In general, current evidence for IT backsourcing, as presented in the existing literature, brings only partial answers to the research questions of this study.

III. RESEARCH METHODOLOGY

To date, a systematic literature review has been undertaken. The search for existing and relevant literature was carried out in three stages. As the selection of search terms (keywords) has a significant impact on the search results [34],

an initial exploratory search was undertaken in April 2019 in order to ascertain key terminologies and concepts used in the literature. A combination of keywords was used in the search string when identifying relevant literature.

A second systematic search was carried out in May 2019 using complex combinations of keywords, and a third search was undertaken in July/August 2019, after reformulating the research questions. Keyword searches were conducted in the Science Direct, IEEExplore, Business Source Complete (EBSCO), AIS Electronic Library and Google Scholar databases, restricting the publication dates to be within the year 2008 and after, because the topic of digitalization was not a current issue before 2008.

A practical screening was performed [35], and after deleting duplications and separating all non-relevant ones, 22 publications were selected. Backward and forward searches based on references and authors were performed to uncover seminal publications on the subject of IT backsourcing [36]. The backward search showed no further results. The forward search resulted in five more articles from Sage journals, SpringerLink, Emerald insight and Researchgate. Of the 27 articles in total, 13 are peer reviewed. Practice-oriented publications such as the frequently published magazines MIT-Technology report, CIO magazine or reports from the Association of German Automobile Manufacturers (VDA) as well as from international IT consulting and supplier organizations were also reviewed.

The research project is now being extended to encompass an online survey and exploratory interviews with senior management in the German automotive industry, and with other industry practitioners and consultants as the primary source for data collection. This will allow interaction with decision-makers in a complex and dynamic situation, taking account of many context-relevant factors that support an assessment of the "situation as a whole". Data collection and analysis is based on the selection of a single case study, taking the German automotive industry as whole as the main unit of analysis and the different companies in this industry as embedded sub-units of analysis. The case study entails a double-phase research design, beginning with an online survey to identify important themes, followed by the main stage of data collection with in-depth semi-structured interviews. The purposive sampling for both the survey and the interviews is representative of the German automotive industry, including IT executives and practitioners from 6 German OEM's and 22 German first-tier suppliers which belong to the Top 100 world-wide automotive supplier of the year 2019. The first responses from the survey and first interviews with industry experts have confirmed the practicability of these methods for data generation. The early results from the survey are reported in section V below.

IV. FINDINGS FROM THE LITERATURE REVIEW

RQ1: What does the current literature reveal regarding current thinking on the rational for IT backsourcing?

The reasons for individual backsourcing decisions are a focus in both the academic and practitioner literature. The practitioner literature highlights cost savings, quality improvements, and increase in control and flexibility as the three most important reasons [37]. The academic literature looks at a broader picture and distinguishes between the three important categories: contract problems, internal organizational changes and external environmental changes, to which individual reasons are assigned [2]. Contract problems emerges as the main reason for backsourcing until now (Table I).

As regards contract problems, one of the main motivators for backsourcing is dissatisfaction with the quality of services provided by the vendor. Moe et al. [38] state a lack of communication between client and vendor, the inability to provide the necessary knowledge and skilled resources, a high turnover of employees on the vendor side and cultural problems such as different understandings of responsiveness and punctuality. Gorla and Lau [39] have analyzed how negative experiences in outsourcing affect future outsourcing decisions. They conclude that competence and coordination problems with the vendor have a stronger influence on backsourcing and future outsourcing decisions than unexpected costs. According to Kotlarsky and Bognar [40] low service quality is typically linked to poor responsiveness or a lack of professionalism on the vendor's side. The relationship between client and vendor, as well as trust, also plays a significant role in either changing vendors or taking backsourcing into account [41]. The gap between expected and actual cost reductions through outsourcing is another important driver for backsourcing. As Kotlarsky and Bognar

[40] point out, cost savings through outsourcing tend to be overestimated and hidden costs such as transition costs, rising wages in the outsourcing destination country or staff turnover are not sufficiently taken into account. Another critical factor is losing control over the vendor's activities or over certain functions [8]. This can be risky if security or intellectual capital is involved, or if it turns out that outsourced systems have a strategic value.

Kotlarsky and Bognar [40] stated that a knowledge mismatch is one reason for loss of control if the vendor knows more about the systems than the client does, or the vendor only barely understands the client's business. Another possible reason for backsourcing is when the IT outsourcing company fails to adopt the latest technologies, thereby not delivering best value to the customer [42]. Losing control also leads to limited flexibility for the client compared to in-house operations [43]. Benaroch et al. [44] contend that in times of increased demand uncertainty, there is a tendency among clients towards backsourcing or insourcing decisions, as opposed to vendors' view that these situations would be motivators for outsourcing. They also claim that companies would prefer the flexibility of contracts in increased demand uncertainty, e.g., the possibility to pay a lump sum as a penalty to ease backsourcing. However, without the flexibility built into the original outsourcing contract, the probability of backsourcing is limited.

The most recent studies show, however, that contract problems and the resulting operational difficulties are no longer major drivers of backsourcing. Könning, Westner and Strahringer [31] analyzed over 1,000 sourcing deals in Austria, Switzerland and Germany between 2006 and 2017 and show that the companies are able to manage a large number of IT vendors. They also mention that companies use international sourcing consultancies (e.g., ISG, Accenture, BCG, Deloitte, KPMH, PwC) to design tenders and contracts, support the transition process, the provision of global delivery models and advise on the processes for the constant monitoring of the various vendors and services. A review of the German automotive industry shows that, on the one hand, the depth of service in the in-house provision of IT services is generally between 20% and 30% of the overall IT budget [28], while at the same time companies have employed thousands of IT employees worldwide [45]. These IT organizations have also developed and implemented comprehensive process models to minimize contractual and operational risks in outsourcing [46]. However, Solli-Saether and Gottschalk [47] refer to the Sourcing Circle and the stages-of-growth model to determine whether a formerly in-house function has a higher degree of maturity when it comes back after years of outsourcing. They argue that the outsourcing phase is not a waste of time, "it is not a return to the beginning, but something that has been altered" [47].

The literature on internal organizational factors for IT backsourcing focuses on the discussion of strategic reorientation in the company, the intensive debate about the value of IT and internal power-political behaviour, which are more subjective and therefore more difficult to assess [48]. In this context, the role of IT and the sourcing strategy of IT are repeatedly reassessed. According to Butler [48], the proper

alignment between business and IT strategies requires the re-positioning of the IT function from a commodity to a key strategic asset, and this may lead to appropriate backsourcing decisions. He also points out that not all IT functions are core business or non-core business, but the challenge is to categorize IT functions as either commodity or strategic in order to adjust the IT sourcing strategy. Qu, Oh and Pinsonneault [49] also emphasize that companies should make more efforts to assess the strategic value of IT, rather than considering IT as a non-core activity. Benaroch et al. [50] add that strategic considerations play an important role in transaction- and information-intensive processes with volatile demand and that backsourcing increases the capabilities for innovation and competitive advantages.

Thakur-Wernz [51] combined the two theoretical lenses - Transaction Cost Economics (TCE) and Resource Based View (RBV) - and concluded that companies decide backsourcing for two reasons: short-run total costs and internal capabilities. She contradicts earlier research, which assumes that costs and capabilities play a complementary role and are intertwined, especially in the long run. Based on a backsourcing topology, however, Thakur Wernz [51] claims that costs and capabilities are independent of each other, especially in the short-term. The reason for this assumption is that companies would not be in a position to change or expand their capabilities at short notice. She concludes that companies are less likely to undertake backsourcing when the total short-term costs of backsourcing are higher, and more likely to go for backsourcing when internal reintegration capabilities are higher.

Oshri et al. [52] stated that dissatisfaction with an outsourcing agreement is an even stronger driver for backsourcing decisions than cost considerations. They used the behavioral theory as a lens, which is based on realistic assumptions about human cognition and relationships. The theory suggests that decision making in companies is characterized by the limited rationality and organizational politics of decision makers. The assumption is that problem-driven managers tend to make irrational decisions rather than based on a systematic assessment of long-term opportunities and risks. The transition from outsourcing and especially from offshoring to backsourcing means a radical change of strategy with significant economic consequences. Those responsible would do well to first consider a detailed feasibility study.

Qu et al. [49] postulate, from the knowledge-based view, that IT backsourcing would create value and competitive advantage. Best practice processes require the integration of IT and business knowledge and this interaction increases the alignment between IT and business objectives. Shared knowledge and smooth coordination between IT and business is not a commodity, which can be bought on the market. This in-house knowledge only evolves over many years and is part of the corporate culture.

External environmental changes such as economic cycles with volatile demand, financial crises, changes in the structure of the industry that redefine the overall business strategy of the company are identified by some authors as the catalyst for backsourcing [52]-[54]. Regarding mergers and acquisitions, several authors cited the example of how JP Morgan Chase

terminated its large-scale outsourcing contracts after the merger with Bank One or Bank of Scotland merged with or Halifax Building Society because the mergers gave rise to new internal capabilities to provide in-house IT services more effectively. In addition, changes on the vendor side are triggers for backsourcing, when the vendor redefines its business strategies or its organizational structure, which is often the result of mergers and acquisitions between vendors. German companies have been affected by the wave of concentration on the vendor side, which can also be assumed as a reason for backsourcing.

TABLE I. SUMMARY OF REASONS FOR IT BACKSOURCING BASED ON LITERATURE REVIEW

Contract Problems: Outsourcing agreement did not meet expectations
- Higher than expected costs   - Poor service quality   - Poor transition planning   - Loss of control over the core business   - Loss of flexibility   - No benefits from outsourcing   - Disagreement with vendor   - Loss of know-how   - Incompetence of the vendor (e.g., missing innovations on the vendor side hinders the client's business success)
Internal Organizational Changes
- New or changed executive management   - Structural changes in the company (e.g., new business line, new corporate entity)   - New business strategies   - Recognition of IT as business enabler   - New/changed importance of outsourced activities   - Changes in IT strategy due to mergers and acquisitions   - Power and politics
External Environmental Changes
- Changes in the environment of the company   - Economic cycles   - Bandwagon effect   - Changes in vendor organization   - Technology changes ("break-through" technologies)

Thakur-Wernz [51] refers to the bandwagon effect mentioned by Lacity and Hirschheim [10]. Outsourcing was widespread, many companies did it and therefore more companies followed suit. There was significant increased risk that the outsourcing decision was not adequately researched and assessed, and backsourcing is the correction of outsourcing failures. Ironically, the bandwagon effect could now also happen with backsourcing. Finally, and most significantly for this study, Wong [43] and Von Bary [55] state that new and disruptive technologies, lead to a

repositioning of the value of IT and trigger backsourcing decisions.

RQ2: To what extent has digitalization influenced the German automotive industry's strategy regarding IT backsourcing and what are its potential benefits?

Germany is the second largest outsourcing market in the western world [56] but is under-represented in the academic literature, although online sources provide evidence of a number of failures in large outsourcing deals in German industry. In addition, digital technologies are regarded as major technological changes, and the associated digital transformation is seen as potentially leading in some cases to the replacement of established business models. The German automotive industry as a manufacturing industry and the most important German industrial sector is particularly affected by these changes. New digital business models are becoming the starting point for the future competitiveness of the German automotive industry on the world market [57]. According to Veltri et al. [2] and others, external environmental changes are seen as motivators for IT backsourcing because the core competencies of a company need to be redefined. These dependencies and effects have not yet been specifically investigated by researchers using the example of an entire industry in Germany.

Researchers have applied various theories, such as TCE, RBV or Knowledge-Based View (KBV), to explain and demonstrate the benefits of IT backsourcing. However, there is some debate as to whether these theories are useful in evaluating IT backsourcing decisions, and in providing practical guidance. According to Wernerfelt [58] and Barney [59], the RBV considers an organization from the inside and the central thesis of the RBV is that companies generate sustainable competitive advantage by introducing strategies that exploit their internal strengths. However, in the KBV concept, it is argued that competitive advantages are achieved not only on the basis of physical or financial resources, but also through knowledge-based capabilities [60]. Teece, Pisano and Shuen [61] published the theory of Dynamic Capabilities (DC) in 1997, which extends the internal view to the market and defined the DC as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (p. 516).

According to Teece, Pisano and Shuen [61] markets can be divided into moderate and highly dynamic markets. Moderate dynamic markets are characterized by continuous changes. These are relatively easy to predict. Moderate markets are transparent and stable. Resources, organizations and processes are generally based on existing skills, knowledge and abilities. Highly dynamic markets, on the other hand, are characterized by rapid changes, have unstable structures and the resources of a company are based less on existing skills than on situation-specific knowledge, skills and abilities that can be quickly developed and newly created. The static approach of the RBV is not suitable for this field of operation [62]. The RBV would only apply to firms in predictable environments.

Since the German automotive industry is in a highly dynamic market because of the digital transformation, the theories applied to answer the question of whether IT backsourcing contributes to a sustainable competitive advantage or not should be extended to include the DC approach. A review of the existing literature shows that there is no analysis and evaluation with the DC theory on IT backsourcing.

Previous research on IT backsourcing has concerned IT technology and IT systems in general. In the context of the strategic alignment between business and IT, there is a need to examine which outsourced IT functions, technologies or applications are brought back in-house, particularly against the background of digital transformation, in order to achieve sustainable competitive advantage. There is clearly a link to the core production process as many manufacturing companies have outsourced parts of their production, especially to offshore locations such as China. It is to be expected that digitalization and Industry 4.0 will lead to backsourcing of production to some extent [63]. The new technologies provide opportunities for production to be more flexibly and cost-effectively re-located in the home country for two reasons: firstly, because the cost advantages that originally resulted in offshoring can be neutralized, and secondly, the application of Industry 4.0 technologies can then increase flexibility in the production process. This would also have implications on outsourced IT services for manufacturing processes. Backsourcing does not necessarily mean that the affected functions and capacities are locally returned to the headquarters of the mother organization. The German automotive industry has worldwide access to resources and know-how and has the opportunity to network resources and knowledge with modern forms of agile cooperation [27].

RQ3: How can an operational model be developed to aid practitioners in the German automotive industry in the reassessment of their IT sourcing strategy?

The existing literature partly shows in individual case studies the challenges of knowledge transfer during outsourcing, and provides overviews of the requirements for knowledge re-integration during backsourcing or switching vendors. An overall framework that offers guidance to practitioners involved in backsourcing in the German automotive industry is missing.

The proposed conceptual framework (Figure 4) represents the theoretical basis for answering the research questions in this study. It uses the theory of dynamic capabilities to investigate the value of IT backsourcing. The concept of dynamic capabilities can be divided into the ability to identify and shape opportunities and threats, the ability to seize opportunities and the ability to maintain competitiveness by improving, combining, protecting and reconfiguring the assets of the business [64]. Sensing, seizing, reconfiguring and transforming are the main components of dynamic capabilities. This theory is combined with the knowledge-based view of the firm, since it is assumed that digital transformation requires significant change in the knowledge-base of the company to increase its innovative capacity [65]. However, in combining these theoretical perspectives, three main dimensions of change relating to the new digital technologies, the change in processes relating to IT
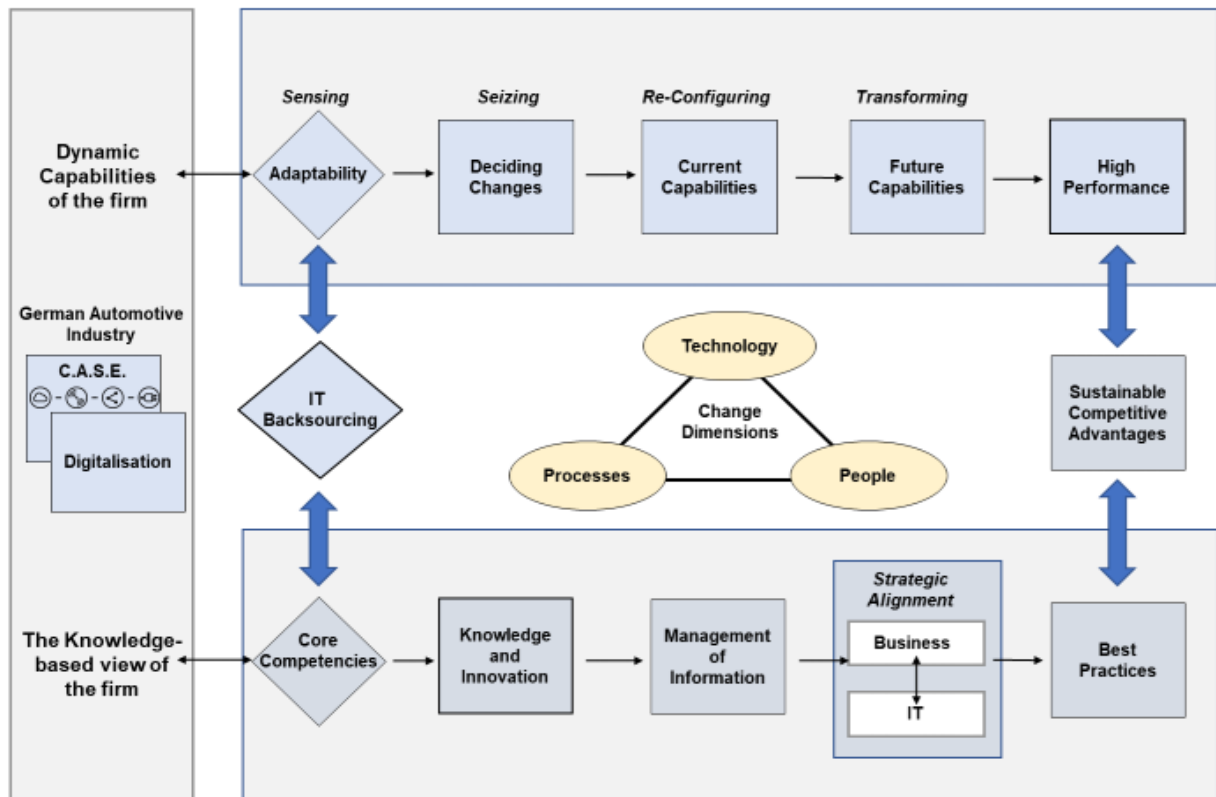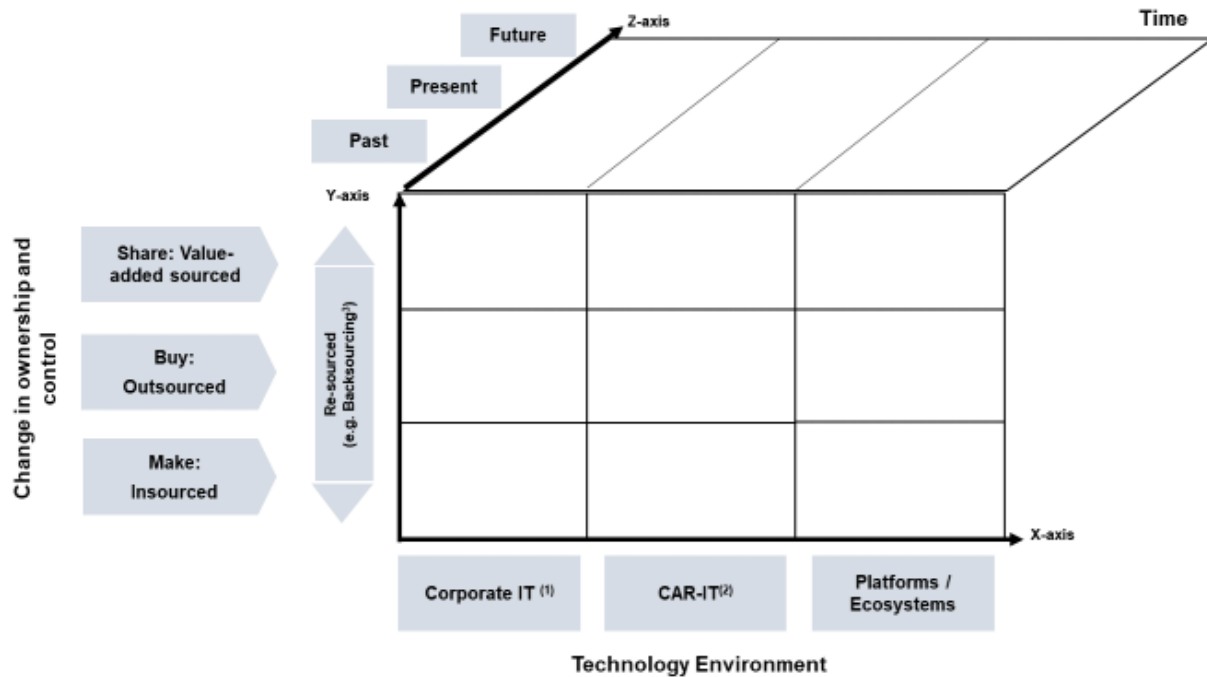
Figure 4. Theoretical conceptual framework

backsourcing, and the necessary enhancement of people skills and capabilities, will be used to identify critical success factors (CSFs) to achieve competitive advantage from the adoption of appropriate IT sourcing strategies. This aligns with other studies of change and innovation relating to the introduction of new technologies into organizations [66]. IT backsourcing may thus be viewed as a strategic decision of a company to respond to the rapidly changing external environment and provide a source of sustainable competitive advantage. This is especially the case when this enables important innovation, increases flexibility to respond very effectively to new business requirements, introduces emerging technologies to achieve new capabilities and facilitates the rapid placement of new digital business models, products or services in the marketplace.

The knowledge-based view has received a great deal of interest in the literature because it recognizes the fundamental economic changes that have resulted from the accumulation and availability of knowledge over the last two decades [67]. The transition from production to service in most developed economies is based on the manipulation of information and not on the use of physical products [68]. Knowledge has become one of the most important assets for creating a sustainable competitive advantage [69], and this trend becomes even more pronounced with digitalization. A central element of digitalization and of Industry 4.0 is the generation of huge amounts of data with cyber-physical systems and the

storage and linking with technologies such as Big Data. However, data itself are of little value. The data from many different sources are only transformed into valuable information through comprehensive analysis and correlations. What matters is the management and the intelligent exploitation of this information to evolve new business models and processes.

The conceptual framework and underlying philosophy of the study is therefore based on the authors' belief that the digital transformation of a company is an eminently knowledge-based issue. The theory of the knowledge-based view of the firm assumes that a company exists because it has advantages in the market through the generation of knowledge and innovations [70]. In addition to the dynamic capabilities, in responding to changes in the external environment, knowledge is also a key resource for achieving sustainable competitive advantage.

Based upon the conceptual framework, research findings to date indicate that an operational model (Figure 5) may be of value in supporting practitioners in German automotive companies in adjusting their IT sourcing strategy. Based on the preliminary findings from the first expert interviews, this model involves a three-way classification of sourcing status: insourced, outsourced, or value-added sourced. In this context, backsourcing is viewed as a process that changes the status of all or part of the IT provision from being outsourced to being insourced. Value-added sourcing reflects the fact that

(1) Also termed Company Business Information System, Backend-IT, Mainstream Business Systems
(2) Also termed In-Automotive IT, Connected Car, Onboard-IT
(3) Backsourcing is defined as bringing previously outsourced IT activities back in-house

Figure 5. Provisional operational model

the classic make-or-buy decision is now becoming a make-or-buy-or share decision. Joint ventures constitute an alternative to external and internal sourcing of the IT provision to provide mutual benefit from complementary competencies [71].

Significantly, this model encompasses *all* IT technology environments in the automotive industry, including not just standard "Corporate IT" (mainstream business systems), but also "Car-IT" and digital "Platforms and Ecosystems" [72]. These sourcing classifications will be applied and analysed in past, present and future scenarios to understand how and why IT sourcing strategies are evolving. In addition to developing CSFs for the realignment of IT sourcing, the resultant model will provide operational guidance for managing this transition, and be of value to IT and company strategists in the German automotive industry, and in other car manufacturers undergoing parallel changes.

Interview findings will help determine to what extent digitization and the C.A.S.E. trends are encouraging backsourcing and changes in overall IT sourcing strategy. Any such correlations and conclusions will also take account of other influencing entrepreneurial factors. In this context, "digital entrepreneurship" [73] emerges as a significant new competence in making IT sourcing decisions. The impact of digitalization and the complexity of the C.A.S.E. change agenda will require high investment in new competencies and knowledge to develop sustainable competitive advantages in the long term. Digitalization leads to extremely rapid change, in some cases even the replacement of established business

models, and the German automotive industry will have to demonstrate appropriate capabilities to change and adapt. The industry must have the dynamic capabilities to react flexibly to the accelerating changes in the external environment the internal capabilities, in terms of resources and knowledge, to drive and support the necessary innovation. This can provide the basis for the development of company-wide digital transformation strategies, encompassing possible re-positioning in the marketplace, reworking of sourcing agreements, and implementation of necessary change in terms of technologies, processes and people competencies.

V. INITIAL REPORT ON SURVEY RESULTS

Preliminary results come from the online survey, drawing on the findings from the extant literature discussed above, and incorporating the experience of practitioners from the German automotive industry to identify key issues and trends. The survey comprises twenty-four statements and a five-point Likert scale (ranging from Strongly Agree to Strongly Disagree), statements being clustered into three main areas of IT sourcing related business activity. The first cluster concerns digital transformation strategy, which provides the business and management framework for decision-making and action in the different technology environments. Secondly, there are statements regarding digital entrepreneurship, which provide the culture and mindset for organizational changes. The third cluster of

statements focuses on the justification of IT backsourcing and evolving IT sourcing strategies. The initial report on survey results helps develop responses to RQ2 and RQ3. RQ1 is, in the main, addressed by the findings from the literature review.

Survey respondents from the German automotive industry confirm that the so-called "megatrends" (C.A.S.E.) and Industry 4.0 have been triggered by the emergence of digital technologies. These technologies are partly considered revolutionary and disruptive and partly only evolutionary. The evolutionary perception is more prevalent among companies that have had the financial resources to constantly invest in state-of-the-art IT technologies. The companies surveyed also indicate that a digital transformation strategy has been developed, but that its execution requires more than the traditionally existing IT strengths of the companies. There is a generally agreed view that, amongst the digital technologies, artificial intelligence combined with self-learning algorithms are gaining industrial relevance and constitute an increasingly significant competitive factor. The survey also indicates that the shortage of skilled experts has been the biggest hurdle for digitalization and has led to a "battle for talent".

The survey results also emphasize that the deployment of digital technologies must be supported by digital entrepreneurship. Some companies argue that digitalization is not necessarily a new phenomenon, but rather an organizational challenge alongside the mainstream economic and strategic questions. Digital entrepreneurship requires investment in cultural change, enabling the company to be more agile, more experimental, risk-taking to an acceptable degree, supportive of continuous learning, and adaptive and tolerant of new forms of collaboration. This provides a sound basis to generate value from technology. Additionally, the advent of digital technologies and associated transformation strategies is leading to a significant redefinition of core competencies in IT that where lost in the past due to the high degree of outsourcing. There is consensus that a clear strategic goal is to have the key IT capabilities and related resources for digital technology deployment in-house in the long run. Thus, IT sourcing management must take on new roles and competencies as changes in the sourcing strategy are driven by the search for highly specialized talent and the closing of digital skill gaps. Digital technologies have made IT sourcing a much more complex and multi-layered process. Significantly, companies claim that IT sourcing strategies are a proven source of sustained competitive advantage, but they also report a lack of validation to prove success.

The majority of respondents took the view that the introduction of digital technologies leads to a higher degree of vertical integration and thus an increased provision of IT services in-house. Digitalization encourages bringing IT services back in-house in order to strengthen core competencies, become more agile and respond more effectively to rapidly changing demands. However, these first survey results show different perceptions about further outsourcing. There is some agreement that due to the trend towards standardization of IT infrastructure components and services, an almost complete outsourcing of IT infrastructure services is expected in the future. This is in line with the agreement that cloud sourcing will become the digital backbone for standardized infrastructure. The responses partly underline a trend that further outsourcing of commodities (e.g., infrastructure) will create flexibility to focus resources on strategically important technology areas, such as software engineering. This initial analysis of survey responses has highlighted a number of key perspectives, which will be developed and tested through the further collection and analysis of data within the case study.

VI. CONCLUSIONS AND FUTURE WORK

Many companies in the automotive sector are currently under pressure to review their IT sourcing strategies to reflect the anticipated implications of digital transformation, industry 4.0 and the megatrends that are sweeping through the industry - changes in Connectivity, Autonomous Driving, Shared and Electric. This is part cause/part effect of the moves towards sustainability in the automotive industry and in society in general [74]. In this context, the literature review indicated that there are three main motivations for IT backsourcing - unsolvable contractual problems, internal organizational changes and external environmental changes, and digitalization is a significant component of the last-named category. Digitalization has the potential for new, disruptive business and value models, and requires companies to shape their digital transformation process, within which an evolving IT sourcing strategy will play a significant part.

Future work will use the conceptual framework and provisional operational model to identify critical success factors and key actions for the successful adoption of new IT sourcing strategies. IT backsourcing will undoubtedly play its part, arguably creating better conditions for the interaction between IT and business, and for sharing and integrating IT and business knowledge, which can underpin the adoption of best practice [49]. The protection of mission-critical knowledge, intellectual property and security issues are taking on a new significance in the context of digitalization and supplier partnerships involved in value-added sourcing.

The contribution of this research to theory has several aspects. First, it will provide an informed view on whether digitalization is encouraging IT backsourcing – currently a gap in the extant literature. Second, it will explore and explain how companies in the German automotive industry justify decisions for IT backsourcing within the framework of a company-wide digital transformation strategy. This will allow key issues regarding IT backsourcing to surface - for example, the need to develop dynamic capabilities and redefine core competencies in order to achieve sustainable competitive advantages in the so-called digital age. Research results will also establish the methods used by companies to forge a strategic link between digitalization and IT backsourcing and to determine the resulting value.

In terms of contribution to practice, the project aims to provide decision makers in the German automotive industry with operational guidance to assess the different options for IT sourcing as part of a digital transformation strategy. The

study will provide illustrative examples of the practices, procedures and organizational change needed for new IT sourcing strategies. It will provide an insight into how the German automotive industry is being forced to fundamentally reinvent itself to survive. The traditional core competencies of the industry revolve around car-production, and the industry is still heavily invested (including labour) in end-of-life business models, technologies and products. Value is generated exclusively through physical materiality. In the future, software will account for a large share of automotive value creation. Car manufacturers will need to develop their own operating systems for networking their vehicles. Additionally, the world-leading internet platform players are currently all pushing into the automotive and mobility area for new data-driven business models. As an alternative to pure insourcing and outsourcing, the industry needs gap-closing sourcing concepts with IT tech players, such as alliances, where mission critical resources and competencies are shared in a partnership. Thus, especially for Car IT and the creation of shared platforms and ecosystems, the traditional make-or-buy will become a make-or-buy-or-share decision for IT sourcing. The operational model developed through this research will support automotive industry practitioners in developing new strategies to navigate this rapidly evolving technology and business landscape.

<div align="center">REFERENCES</div>

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