UNIVERSITY OF TWENTE.

Faculty of Behavioural, Management and Social Sciences
Department of Technology Management and Supply

Master Thesis
Master of Science (M.Sc.) Business Administration
Purchasing & Supply Management

Make, buy or ally? Comparing practical software sourcing decision factors with transaction cost economics, resource-based and knowledge-based view: a case study in the automobile industry

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Number of pages: 54
Number of words: 22517

Braunschweig, 20th March 2020

Abstract

Several theories that determine the boundaries of the firm exist. Amongst those are the theory of transaction cost economics, the resource-based view and the knowledge-based view, which all contain a framework that gives recommendations about preferred sourcing models. Those proposed optimal sourcing models of each theory deviate from one another and uncertainty about whether those theories are applicable for any good or service, exist. To test whether the factors influencing the sourcing decision mentioned in the theories and their resulting sourcing recommendations are also suitable for the procurement of software, the present qualitative research study has been conducted. An automotive company, sourcing amongst others embedded software, was used as a case company to determine the applicability of TCE, RBV and KBV in the field of software sourcing. The frameworks of the three theories were combined into one research model to detect the similarities and differences between the theoretical research model and the practical sourcing recommendations. After combining the theoretical frameworks, a world café in the purchasing department and seven stakeholder interviews were executed, leading to a total of nine detected factors that influence the software sourcing decision in practice. The degree of software standardization, availability of internal and external resources, time-to-market pressure, unique selling point, business strategy, total cost, supplier risk and governmental issues were found to influence the sourcing model decision of software in the case company. Six of those identified factors are not included in the theoretical view, indicating that the theoretical factors influencing the sourcing decision are not complete and only partially applicable to the process of software sourcing. The results show that combining TCE, RBV and KBV into one framework lead to a more powerful practical approach while simultaneously demonstrating that the theoretical framework needs adjustment to fit the sourcing environment of software.

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List of abbreviations

KBV	Knowledge-based view
RBV	Resource-based view
TCE	Transaction cost economics
ITO	Information Technology Outsourcing
OEM	Original Equipment Manufacturer
IP	Intellectual property
USP	Unique selling point

1. Sourcing model recommendations of influential organizational theories are distinct from one another

The organizational creation of a new product initiates a strategic decision-making process in the purchasing department of a company. Each component of the new product needs to be acquired in some way. Eventually, the new product contains materials and technologies or needs services that have not been sourced before. In any case, for every component of new products, a sourcing decision has to be made. Sourcing can be done internally by vertical integration, by outsourcing through buying at the market or alliances can be created, combining the first two options (Handfield, Monczka, Giunipero, & Patterson, 2011, p. 223). Making this sourcing decision can be influenced by many factors like internal, external and component factors. Does the company have the internal resources to produce a certain component itself? Are capable suppliers accessible and interested in doing business? Or do the component characteristics require a special sourcing process? The goal of the organization is to decide on the sourcing model that brings the greatest benefits to the company compared to the other sourcing options.

Detecting this superior sourcing model has been on the agenda of organizations and organizational economic scholars for decades (Cousins, Lamming, Lawson, & Squire, 2008, p. 28). Amongst others, three theories namely transaction cost economics (TCE), resource-based view (RBV) and knowledge-based view (KBV), developed, intending to indicate the optimal sourcing model, depending on certain criteria (Tiwana & Bush, 2007, p. 260). TCE uses a transaction as the basic unit of analysis (Williamson, 1981, p. 548). When a good or a service moves across boundaries a transaction appears and costs are created. According to the theory a transaction can have three dimensions: asset specificity, frequency and uncertainty (Williamson, 1981, p. 555). Williamson (2008, p. 9) states that in general sourcing through markets or hybrid forms is more advantageous and creates less transaction costs than insourcing. Only exception, transactions that are uncertain, frequent and highly specific, for those vertical integration should be considered. RBV on the other hand takes a different approach, stating that vertical integration can bring competitive advantages for strategic assets (Crook, Combs, Ketchen Jr, & Aguinis, 2013, p. 68). Barney (1991, pp. 105) argues that creating firm resources that are rare, valuable and imperfectly imitable and non-substitutable can create sustained competitive advantage and that organizations cannot expect to purchase those advantages by outsourcing. The third theory, KBV, extends the RBV. While from the RBV point of view any internal resource, like in-house knowledge of

technology, machinery, procedures, capital or the brand name can be the key for competitive advantage and thus the reason for insourcing, the KBV accredits knowledge as the key resources of success (Grant, 1996, p. 110; Tiwana & Bush, 2007, p. 269). If required knowledge is not existent and cannot be created within the company, knowledge trading has to take place through strategic alliances or outsourcing arrangements (Grant, 1996, p. 119).

It becomes obvious that those mentioned theories take different approaches and come to different conclusions about the preferred sourcing model. They suggest different sourcing models to be the preferred ones in certain situations. And although empirical studies have been conducted to test all three theories, the outcomes of those studies are mixed and a consensus is not reached yet (David & Han, 2004, pp. 44-48; Parmigiani & Rivera-Santos, 2011, p. 1113). David (2004, p. 52) for example discovered by reviewing 308 empirical tests of TCE that less than half of the studies (47%) statistically support TCE and 10% of the tests found statistically significant results supporting the opposite of the theory. Similar results were created by other empirical test reviews (Carter & Hodgson, 2006, p. 473; Lacity, Willcocks, & Khan, 2011, p. 151). Those findings support the statement that TCE, RBV and KBV, like most theories, are not yet fully developed. Those theories need continuous reformulations, polishing and expansions due to new empirical and theoretical findings (Geyskens, Steenkamp, & Kumar, 2006, p. 519).

And while there is no full consensus of the practicability of the theories and the answer to the optimal sourcing model in general, there is also uncertainty on the applicability of those theories. Assuming that customer needs, depending on the industry, can radically and frequently change, companies are forced to enter new business areas in which they have less production and sourcing knowledge. New processes and strategies for the new business area have to be defined. The question of whether the theories TCE and RBV and general sourcing decision influencing characteristics are still fully valid and applicable in a new business environment can be of high importance. Especially in those new situations, sourcing decisions can be comparably difficult to adjust, making it valuable and practical to determine if TCE, RBV and KBV can be used to determine optimal sourcing decisions in any setting. One example, and the example that is used in the remaining of this paper, is the embedded software sourcing process for OEM's in the automobile industry. Automakers are perceiving a switch in the importance of technology. While for the longest time automakers competed based on mechanical technology, experts state that software-based technologies will determine future successes and differentiation (Calem, 2019; CTA, 2019). While

automakers perfectioned the production of a car, creating core competences and immense knowledge and know-how in the area of mechanical technologies, creating and building software-based technologies has not been part of an automakers core business (Calem, 2019). This shift of the importance of software in the industry forces the firms to modify their core competences. Modifying or adding new core competences to the business could be demanding and a lack of structure and know-how might make insourcing inaccessible despite the theoretical advice. Next to the assumption that the changing business model in the automobile industry is impeding the sourcing decision, sourcing software in general, compared to sourcing non-IT products, is a comparably new field in purchasing. Software represents a service and differs from other products by being a more knowledge-intensive and not machine-intensive product (Curado & Bontis, 2006, p. 367). The production of software needs less investment in expensive machines and production facilities but more investment in human capital. Human capital might comparably be harder to manage and easier to lose as employees are not property of the firm. Employees that are leaving the company take their knowledge with them and if the knowledge is not inherent in the organization, tacit knowledge is leaving the organization. Modern information technology outsourcing research (ITO) argues that IT sourcing phenomena are too complex to be captured by TCE, requiring new and adapted theories fitting the needs of ITO (Lacity et al., 2011, p. 139). Theories are broad and generalized and the three mentioned theories do not differentiate between sourcing different products, components or commodities. Are those theories applicable for any type of product or do optimal sourcing models depend on the product that has to be sourced? As software differs from other assets and sourcing software in the automobile industry states a new core business, a unique context is given and the question of whether the sourcing recommendations of TCE, RBV and KBV are applicable should be assessed.

The goal of this research therefore is to determine the similarities and differences between the theories and practice in terms of what characteristics influence the software sourcing decision to check if the theoretical models fit the new core business software sourcing process or if the theories eventually need to be broadened or adjusted. This goal leads to the following research question: *What are the similarities and differences between the theoretical sourcing recommendations of TCE, RBV, KBV and the practical results based on factors influencing the embedded software sourcing decision in the automobile industry?*

In order to answer this research question, the frameworks of TCE, RBV and KBV and their application for sourcing decisions were reviewed and summarized. Based on that review a research model and propositions were stated. To compare the theoretical findings with practical ones a qualitative research approach was used. In collaboration with an international successful automobile producer, a world café and case studies in the embedded software purchasing department were conducted to determine influencing factors in practice. To be more precise, three carried out software sourcing cases were analyzed. One sourcing case in which the software was sourced in-house, one in which it was outsourced and one in which a form of strategic alliance took place. Those case studies shall point out which influential factors lead to the used sourcing decision. Furthermore, by looking at the present performance of the three cases, it can be examined if those sourcing decisions were productive or suboptimal and if best practices can be drawn from those perceived performance measures for future cases. After collecting sourcing decision influencing factors in theory and in practice the degree to which those are aligned was analyzed and theoretical and practical implications were drawn.

By answering the research questions, this research can add value to the existing theoretical and empirical status by not just comparing the sourcing model recommendations of TCE, RBV and KBV but it can add or adjust those theories by including a software sourcing view. The need of extending and combining those theories has been emphasized by several researchers (e.g. Crook, 2013, p. 72; Carter & Hodgson, 2006, pp. 473-474). Furthermore, the outcomes of this research can investigate the claim that ITO needs its own make-or-buy theories as the nature of IT goods is too complex for using TCE or RBV (Lacity et al., 2011, p. 151). Additionally, the applicability on a company's shifted, new core business of the theories will be tested. This execution will potentially deepen and extend the empirical evidence of TCE, RBV and KBV by checking if those theories are also applicable in a setting of embedded software sourcing and shifting core businesses. Crook et al. (2013, p. 72) states that further literature has to be developed, investigating in which settings TCE works and in which it does not and how it can be integrated with other theories to create a more complex solution for managers in praxis. Moreover, it is argued that other factors, despite the ones in the TCE framework, that influence the sourcing decision have to be determined to extend the TCE view (Crook et al., 2013, p. 72). Building on this demand, this qualitative research can give new insights and push towards more quantitative research investigation in this field by combining TCE, RBV and KBV and investigating further

practical sourcing decision influencers. This could lead to a more consistent strategic sourcing model decision advice, helping organizations improving their purchasing processes. From a practical point of view the results of this research are relevant for the analyzed company to improve their sourcing decision process for software but it can be also be relevant for other automakers in a similar situation, gaining insights into best practices or lessons learned. This paper is contributing to the practical knowledge about how to source a core competence that is new to the company by delivering evaluated sourcing cases.

In the following, definitions and explanations of the main concepts like sourcing models and sourcing decision influencers will be given to create a common understanding. Furthermore, detailed information about the history, the framework and empirical findings of all three theories are listed. Those are then combined into a model, representing the theoretical characteristics influencing sourcing decisions. After giving information about the methodology of this research the results and findings of the case studies will be given, answering the research question and providing an adjusted model of sourcing decision influencers. Lastly, a discussion, practical implications and limitations of the research will end this paper.

2. Theoretical Framework: TCE, RBV and KBV are popular theories, intending to determine the boundaries of the firm

Determining the boundaries of firms and choosing between in- and outsourcing is a fundamental interest of the theory of the firm (Afuah, 2001, p. 1211). Decades ago, a set of theories, exploring what determines the boundaries of firms, have been developed and plenty of research followed, accumulating empirical evidence for those theories. Three of those theories were TCE, RBV and KBV. All three theories share the intention to give guidelines to the question of which transactions should be brought in-house and which should be sources through the market, and thus determining the boundary of the firm. Since this research aims to identify practicability and gaps between well-known theories in this area and the sourcing of embedded software in the automobile manufacturer industry, those theories seemed most applicable. TCE is one of the most established theories, answering the fundamental question of how complex contractual relationships should be governed (Ketokivi & Mahoney, 2017, p. 1), making it the first valuable and used theory for the conduction of this research. RBV focuses on internal resources and their impact on the sourcing decision and sustainable competitive advantage (Miller, 2019, p. 1). KBV as an extension assumes that knowledge is the essential resource for creating value (Grant, 1996,

p. 112) and having this focus seems important for this research, considering that the creation and development of software notably requires human capital and knowledge.

In the following the history of those theories, their framework and empirical evidence is gathered, summarized, compared and classified. Beforehand the three sourcing options, namely, insourcing, outsourcing and alliances are introduced.

2.1. Sourcing Models: Increased complexity in choosing sourcing model due to changing business environment

Defining the firm boundary by choosing to rely on internal capabilities or preferring to source a component at the market is an important and challenging task. While for some products the sourcing decision might be simple, it can be a complex and strategic business decision that is influenced by many factors (Handfield et al., 2011, pp. 173, 223). The complexity of this decision gained importance and intensified in the past due to increased competitive pressure, globalization, rapid technological change and dispersed knowledge (Holcomb & Hitt, 2007, p. 464; Venkatesan, 1992, p. 107). To define the firm boundary a strategic decision between make, buy or ally needs to be made. For better understanding of the options, the definitions, characteristics, advantages and disadvantages of insourcing, outsourcing and alliances are summarized hereafter.

2.1.1. Insourcing – keeps control and strategic know-how within the firm.

The decision to perform a certain activity within the firm is labeled with different terms in literature. Insourcing, make, hierarchy governance or vertical integration describe the internalization (e.g. (David & Han, 2004; Grant, 1996; Venkatesan, 1992; Williamson, 1979). Insourcing defines the purchasing decision to produce a component or assemble a product inside the facilities of the firm (Handfield et al., 2011, p. 223). Organizing a transaction internally brings the advantage of maintaining the control and the information flow within the firm. Valuable skills can be built and kept in the organization, preventing the firm from becoming "hollow". Less dependency and shorter transportation and communication are also advantageous. Furthermore, establishing activities within the firm can be beneficial for filling idle capacity and jobs can be preserved (Venkatesan, 1992, p. 100). On the other hand sourcing internally means committing resources, which eventually limits flexibility and it can be difficult for the company to reverse the decision (Holcomb & Hitt, 2007, p. 464). Market or technological changes can make invested resources and gained know-how of insourced processes obsolete, leaving companies stuck with their investment.

2.1.2 Outsourcing – provides access to world-class capabilities and increases flexibility.

Next to the technical term of outsourcing, literature also uses terms like buy or market governance to characterize the decision of a firm to source certain activities from external suppliers (e.g. (David & Han, 2004; Grant, 1996; Parmigiani & Rivera-Santos, 2011; Venkatesan, 1992; Williamson, 1979). Outsourcing can be defined as "the organizing arrangement that emerges when firms rely on intermediate markets to provide specialized capabilities that supplement existing capabilities deployed along a firm's value chain" (Holcomb & Hitt, 2007, p. 466). Sourcing non-core activities at the market can reduce expenses which then can be used to put a focus on the core activities of a firm. Outsourcing can reduce bureaucratic complexity and increase flexibility (Holcomb & Hitt, 2007, p. 469). Environmental uncertainty, that result from future volume and technology instability, as well as the risks that come along with insourcing can be reduced (Holcomb & Hitt, 2007, p. 469). Also, outsourcing provides the firm with access to worldwide high-class capabilities that could not easily be obtained and imitated internally (Holcomb & Hitt, 2007, p. 470). On the contrary, outsourcing a transaction leads to a loss of control. An outsourcing firm has to deal with greater dependency on the market and might need to face the lost of capabilities (Holcomb & Hitt, 2007, pp. 467-468).

2.1.3 Hybrid arrangements – can boost reputation, innovation and resource access.

Hybrid arrangements as well, appear under different terms in literature. Interorganizational relationships, relational and hybrid governance, partnerships or alliances (e.g. (David & Han, 2004; Grant, 1996; Holcomb & Hitt, 2007; Parmigiani & Rivera-Santos, 2011; Venkatesan, 1992; Williamson, 1979). Hybrid arrangements are defined as cooperative relationships between a firm and one or several other firms, intending to share and trade resources, with the ultimate goal to improve all involved firms' performance (Parmigiani & Rivera-Santos, 2011, p. 1109). The involved firms aim to choose a suitable governance structure, then gain access to complementary resources and afterwards coordinate the incentives between the involved parties (Parmigiani & Rivera-Santos, 2011, p. 1114). This common goal requires and creates mutual dependency, joint operations, trust, correlated expectations and fairness (Geyskens et al., 2006, p. 522). Hybrid arrangements can be created through different governance structures, including strategic alliances, licensing, franchising, joint ventures, networks, trade associations, co-branding, buyer-supplier agreements and consortia (Parmigiani & Rivera-Santos, 2011, p. 1109). Parmigiani and Rivera-Santos (2011, p. 1109)

however also argue, that not the chosen form of the hybrid arrangement is the significant feature, but the intention of the interorganizational relationship. The intention of the relationship to explore, exploit or balance the two is argued to be more significant than the type of collaboration. Hybrid arrangements are seen as the right choice of sourcing when potential issues with insourcing or outsourcing the transaction are expected. Specific investments, complementary assets and incentives alignments can be reasons to choose hybrid arrangements. Furthermore, benefiting from powerful allies, improving the firm's reputation, associating with distant organizations and getting access to new resources like social capital knowledge, innovative ideas or opportunities are the advantages and reasons of choosing hybrid arrangements for sourcing a transaction (Parmigiani & Rivera-Santos, 2011, p. 1114). It is even argued by van Wijk, Jansen, and Lyles (2008, p. 830) that sourcing through hybrid arrangements to acquire knowledge has become essential for a firms success. On the other hand, in hybrid arrangements different organizational cultures of the partners can create barriers and communication problems. Different management styles, uneven efforts and contrasting agendas can also have a negative influence on the project and the relationship (Robbins & Barnwell, 2006, p. 405). Table 1 summarizes the advantages and disadvantages of the previous mentioned sourcing models. As Hybrid governance models come in various variations, their classification in the table depends very much on the type of hybrid arrangement. Whether the factors states an advantages or a disadvantage of the hybrid model depends on the type and is therefore marked with this "/" sign.

Table 1: Advantages and Disadvantages of the sourcing models

	Insourcing	**Outsourcing**	**Hybrid**
Control	higher (+)	lower (-)	/
Information flow	quicker (+)	slower (-)	/
Building & keeping skills	yes (+)	no (-)	yes (+)
Dependency	lower (+)	higher (-)	higher (-)
Transportation time	short (+)	eventually longer (-)	eventually longer (-)
Commitment of resources	yes (-)	no (+)	yes (-)
Flexibility	lower (-)	higher (+)	/
Risk	keeping (-)	passing (+)	/
Access to worldwide capabilities	no (-)	yes (+)	yes (+)
Acquire knowledge	yes (+)	no (-)	yes (+)
Bureaucratic complexity	increases (-)	decreases (+)	/
Filling idle capacity	yes (+)	no (-)	/
Investment cost	higher (-)	lower (+)	/
Benefiting from powerful allies	no (-)	no (-)	yes (+)

After creating better understanding of the concepts, advantages and disadvantages of market, hybrid and hierarchical governance the main theories used in this research are introduced and their recommendations towards these governance models are stated.

2.2. TCE: The theory roots back to R. Coase article of 1937

The roots of the transaction cost economics theory go back to 1937, when the British economist Ronald Harry Coase published his article "Nature of the firm". The Nobel laureate introduced the concept of transaction costs to define the nature and the boundary of a firm. While common theory of the time proposed that sourcing at the market is always advantageous since the market is efficient, Coase suggested that other costs than just the price of the good have to be considered when sourcing from the market. Transaction cost that emerge by sourcing at the market would increase the overall cost. By vertically integrating the needed resources certain transaction costs could be saved (Coase, 1937, p. 5). It is furthermore argued that a firm can only take advantage of those saved transaction costs to a certain degree. As firms get lager the cost of internalizing additional transactions will rise and a firm will reach a point where the costs of insourcing equal the cost of sourcing at the market (Coase, 1937, p. 6). Coase argues that those increasing costs for every additional insourced transaction give a natural limit to the size of a firm.

Around forty years later the American economist Oliver Eaton Williamson, student of Ronald Coase, focused on the concept of transaction costs and how they determine the boundary of a firm. By publishing his book "Markets and Hierarchies" in 1975 he began to form "one of the leading perspectives in the study of management and organizations" (David & Han, 2004, p. 39). He published several articles over the decades of his career, creating a framework and shaping the transaction cost economics theory. Williamson was awarded with the Nobel Memorial Prize in Economics for his work in the field of the boundaries of firms in 2009 (NobelPrize.org., 2019).

2.2.1. TCE framework: with few dimensional exceptions TCE assumes market governance to be more efficient than hybrid or hierarchy governance.

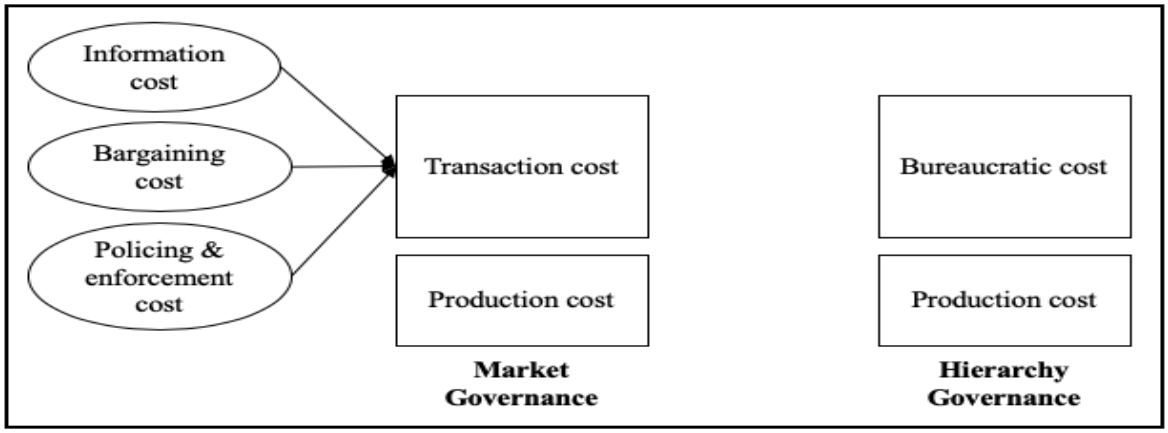
The framework TCE is based on two assumptions, bounded rationality and opportunistic behavior (Parmigiani & Rivera-Santos, 2011, p. 1113). The concept of bounded rationality, introduced by Herbert A. Simon, states that a decision maker is restricted in his aim to make a decision by having incomplete information about all possible options and their consequences. Additionally, the decision maker has only restricted capacity to evaluate all options and a limited amount of time is available to make a decision. Bounded rationality

assumes cognitive limitations and that no two individuals can possess the exact same knowledge (Conner & Prahalad, 1996, p. 482; Kahneman, 2003, pp. 1452-1454). Not being capable of fully processing all available information in an organization leads to satisfactory instead of optimized outcome, called "satisficing" (Robbins & Barnwell, 2006, p. 52; Simon, 1956, p. 129). Those bounds on rationality make it basically impossible to set up perfect contracts that cover all scenarios and details. Having legal gaps in a contract can trigger opportunistic behavior. This is the second assumption of TCE. The inability of writing complete contracts creates room for opportunistic behavior of the seller (Grossman & Hart, 1986, p. 692). Opportunism assumes that employees are driven by self-interest. Achieving an objective by lying, cheating, stealing, passing false information or misleading the other party is considered opportunistic behavior. TCE does not argue that all people act opportunistically, however, it states that it is very difficult, especially considering bounded rationality and uncertainty, to distinguish ex ante between people who will act opportunistically and those who will not (Cousins et al., 2008, pp. 30, 31).

Determining if a transaction is best implemented outside the firm, inside the firm or with a hybrid collaboration model is the essential objective of the TCE framework (Geyskens et al., 2006, p. 520). A transaction itself is seen as the basic unit of analysis in TCE and recognizing transaction cost is significant for studying organizations (Williamson, 1981, p. 548). According to Williamson (1981, p.552) a transaction appears when "a good or service is transferred across a technological separable interface". Therefore, a transaction and with-it transaction cost occur by sourcing from the market. Transaction costs have different origins. First, transaction cost can result from all actions undertaken to search and gather information. Costs caused from these actions are called information cost and include checking the market availability and comparing prices. Second, all actions connected to negotiate terms and conditions and fixing those in an acceptable contract are called bargaining cost and are a type of transaction cost. At last, policing and enforcement cost contain all actions that are undertaken to ensure that the other party holds up to the contract and actions that have to be taken in case the other party does not adhere to the contract (Cousins et al., 2008, p. 31; Dahlman, 1979, pp. 147-148). The existence of transaction cost might argue in favor of hierarchy sourcing, however, a trade-off between transaction cost and differences in in-house and market production cost impedes the sourcing decision. For general transactions the market can take advantage of economies of scale due to gathering of demands. This results in lower production costs at the market compared to higher

production costs in-house due to lower production volume (Williamson, 1981, p. 558). Additionally, bureaucratic costs occur when a transaction is organized internally. An overview of different cost factors influencing the sourcing recommendation of TCE can be found below in Figure 1. Combining those costs, TCE states that it is generally advised to insource only as a last resort. Market or hybrid sourcing shall be preferred (Williamson, 2008, p. 9). This general sourcing suggestion is limited, and certain transactions portray exceptions to this statement, as will be presented in more detail shortly.

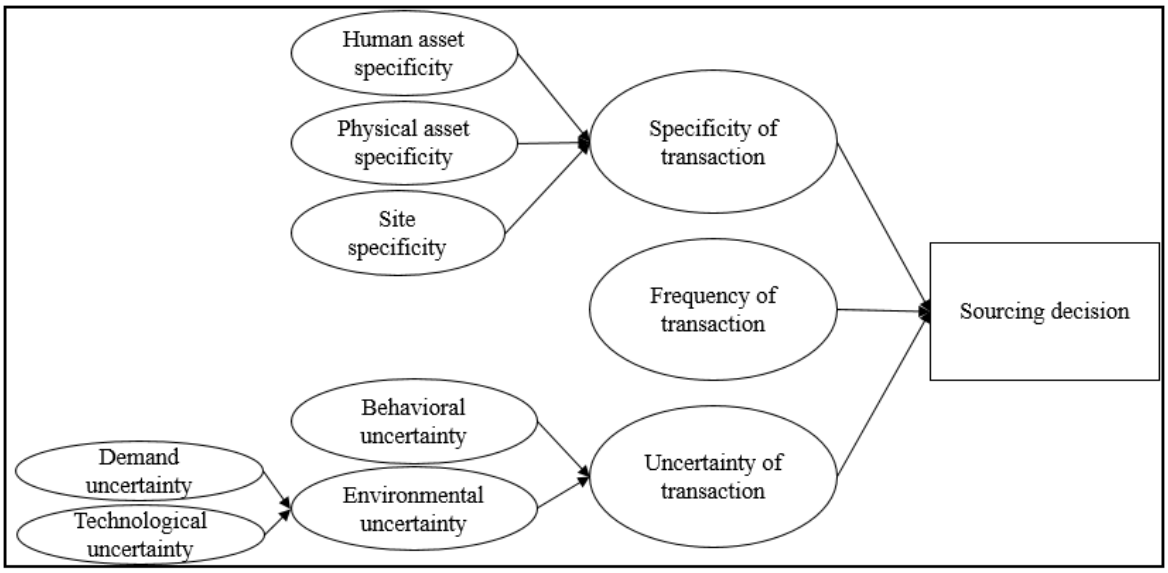
Figure 1: Cost factors highlighted of TCE for market and hierarchy governance.



While some easy and smooth handled transactions create smaller transaction cost, other transactions generate higher transaction cost for example due to conflicts and misunderstandings that lead to delayed or wrong deliveries or even breakdowns (Williamson, 1981, p. 552). This discrepancy is rooted in the heterogeneity and diversity of transactions. Every transaction differs from others and thus also creates a different amount of transaction cost and every transaction carries a varying risk of opportunism. Three critical dimensions were created in the TCE framework to characterize transactions. This enables the grouping of similar transactions and giving sourcing recommendations for those groups. The three dimensions are asset specificity, transaction frequency and uncertainty and are explained in more detail in the following. A crucial dimension is the one of asset specificity which describes a transaction that requires high investments to create specialized assets. Williamson (1981, p. 555) distinguishes between site specificity, physical asset specificity and human asset specificity If transaction-specific, also called nonmarketable, expenses occur, the seller and the buyer are “locked in” the transaction (Williamson, 1979, p. 240; 1981, p. 555) . Assets that are not buyer-specific can be sold by the supplier to other buyers in the market. Also, a buyer can source non-specific assets from other suppliers in the market. If however, buyer and seller carry out transaction specific investments in specialized

physical- and human-capital, both parties lock themselves in an exchange relation. In those cases, neither entity has many alternatives. Suppliers will struggle to find other buyers that are in need of the specific asset and also the buyer cannot turn to alternative sources, considering that the full value of the investment cannot be transferred to other suppliers (Williamson, 1981, p. 555). This makes specialized assets risky (Cousins et al., 2008, p. 32). The bond between both parties can create trust, nevertheless it can also create the opposite. Sourcing marketable assets, the market competition can restrain opportunistic behavior to a certain degree, since suppliers have to stay competitive. But for nonmarketable assets there is less competition that could limit opportunism (Geyskens et al., 2006, p. 520). The other two dimensions of the TCE framework gained much less attention from Williamson. The second dimension of a transaction is uncertainty. Uncertainty can be grouped in two great causes. Firstly, behavioral uncertainty, which expresses the incapability to predict the behavior of the other party (Cousins et al., 2008, p. 32). High behavioral uncertainty can increase the disability of a company to assess a supplier's activities and thus expand transaction costs due to increased chances of unobserved opportunistic behavior (Crook et al., 2013, p. 66). Secondly, environmental uncertainty, which is sub-categorized into technological uncertainty and demand uncertainty, describes the inability to predict future demand or the future technological development (Cousins et al., 2008, p. 32). It is argued that those uncertainties increase transaction cost because unforeseen events limit the ability to determine a contract specifically for those uncertain events or behaviors. Furthermore, behavioral or environmental uncertainties can increase the coordination cost and create possibilities for opportunistic behavior (Crook et al., 2013, p. 66). Uncertainties are difficult to predict and can create information asymmetries that generate options for opportunistic behavior of the supplier (Teo & Yu, 2005, p. 453). The last dimension, transaction frequency, only gains little attention in the framework (Geyskens et al., 2006, p. 521). It describes the frequency that a transaction recurs, which can be one-time, occasionally or recurrent (Williamson, 1979, p. 246). As the frequency of a transaction increases, the bargaining cost and policing and enforcement cost for sourcing the transaction also increase (Crook et al., 2013, p. 66). By internally integrating frequent transactions the transaction costs can be lowered (Crook et al., 2013, p. 66). A visualization of the dimensions, which can be seen as sourcing decision influencers are given in Figure 2.

Figure 2: TCE sourcing decision influencers



As mentioned earlier, the general assumption of TCE is that market sourcing is more beneficial than hierarchy governance. This assumption is justified by the competitive pressure in the market and the internal bureaucratic cost that should make the market the more efficient sourcing option. But TCE is making some exceptions to this guideline. Combinations of the three dimensions, asset specificity, transaction frequency and uncertainty, can highly increase transaction cost, leading to a market failure and the recommendation to source the transaction internally (Geyskens et al., 2006, p. 521). Asset specificity is the crucial dimension here. Williamson (1979, p.254) argues in his TCE framework, that non-specific assets are always sourced more efficient over the market. The frequency of the transaction and the uncertainty have no influence on the sourcing suggestion if the assets are non-specific (Williamson, 1979, p. 254). As asset specificity increases, so do transaction cost and the threat of opportunism. Moving away from market governance will increase the bureaucratic cost, however, those will be offset by higher transaction cost and opportunism. Facing a medium level of asset specificity, a form of hybrid governance is suggested. A high level of asset specificity should lead to hierarchical governance (Williamson, 1991, p. 284). Although it might seem that the dimensions of frequency and uncertainty are not important, they do encourage and strengthen the suggested sourcing option of an asset specific transaction. For transactions with asset specificity, high frequency pushes the transaction even further away from the market and into hierarchy because the transaction has to be checked frequently, requiring constant monitoring efforts at the market (David & Han, 2004, p. 41). The same is valid for asset specific transactions with high uncertainties. High uncertainties strengthens the argument to source the

transaction internally as uncertainties further increase coordination cost and the chances of opportunistic behavior (David & Han, 2004, p. 41).

2.2.2. TCE was empirically tested on a large scale, producing moderate support for the theory.

Since the development of the TCE framework many scholars tried to find empirical evidence for the theory, leaving us today with a broad and mixed empirical foundation (Geyskens et al., 2006, p. 531; Parmigiani & Rivera-Santos, 2011, p. 1113). The overall empirical support for the framework is diverse. While some research produced significant support (e.g. Crook et al., 2013; Geyskens et al., 2006), others discovered no significant results or even significant results arguing for the opposite of the framework. The review study of David and Han (2004) examined 308 studies which tested to core of TCE. They conclude that of those 308 studies, 47% were significantly supporting the core ideas of TCE, 43% produced no significant results and 10% reached significant results arguing against the core of TCE.

One inconsistency between the theory and the empirical findings is the impact of uncertainty on the governance model and the relationship between uncertainty and asset specificity. In theory, uncertainty and asset specificity are connected and uncertainty only plays an influential role in the presence of asset specificity (Williamson, 1979, p. 254). On the contrary a number of authors argued that technological uncertainty should be treated differently than other types of uncertainty (Afuah, 2001, p. 1211; Geyskens et al., 2006, p. 532). Williamson argues that asset specific and uncertain transactions should be sourced internally. Sourcing internally requires giving up a certain amount of flexibility compared to sourcing at the market. Rapid changes in technology makes capabilities obsolete. When transactions with high technological uncertainty are sourced internally, the firm is less flexible in responding to quick technological changes and the firm might be stuck with obsolete technology. It is therefore suggested that highly technological uncertain transactions should, despite the TCE framework, not be sourced internally (Balakrishnan & Wernerfelt, 1986, p. 358) . This is backed up by empirical findings (David & Han, 2004; Geyskens et al., 2006). The review of David and Han (2004, p. 47) summarizes that only nine out of 37 empirical studies indicated that high uncertainty makes firms choose insourcing over outsourcing. Almost the same amount, six, showed that in the same situation firms choose outsourcing over insourcing, so the opposite. The outcome of this empirical study review makes the question of whether high uncertain transactions should be sourced internally or externally remain. However, it illustrates that Williamsons claim for sourcing

uncertain transactions internally still lacks empirical evidence. Geyskens et al. (2006, p. 532) also achieved reversed results compared to the theory, stating in their results that "in the face of technological uncertainty, market governance is preferred over hierarchical governance." Additionally, the review of David and Han (2004, p. 42) emphasizes that too little research explicitly investigated the interaction effect between uncertainty and asset specificity and those that did, produced mixed results. It was furthermore declared that the superior importance in choosing the governance model, that is given to asset specificity in the theory, compared to the other two dimensions could not be supported empirically (Geyskens et al., 2006, p. 532).

A second discrepancy between theory and empirical findings can be seen in the importance of hybrid governance. Most studies of TCE focused on the classical make-or-buy decision, not including the hybrid option, which is used in Williamsons framework (David & Han, 2004, p. 46). A study that did include hybrid arrangements found that hybrid governance has a greater effect on performance than hierarchical governance. It furthermore argues that hybrid sourcing can be most advantageous when facing high uncertainty compared to either market or hierarchy sourcing (Geyskens et al., 2006, p. 533).

Looking at the broad picture, two general critiques on TCE are published in the literature. First, TCE assumes that the needed capabilities of the transactions that should be sourced internally are already existing in the firm or can be equally easy developed in every firm. However, several other business theories and views assume that firm capabilities are heterogeneous and not equally accessible for every firm (J. Barney, 1991). This would mean that a TCE approach argues for insourcing the asset specific transaction, but a firm might not be able to realize this form of governance because it cannot acquire or develop the needed capabilities (Madhok, 1996). Second, the framework of TCE is basing the governance choice on the model that has the lowest transaction cost, thus it is a theory of cost minimization. Scholars criticize that the focus should not just be on minimizing the cost of a transaction but also to maximize the value.

Mixed significant results and points of criticism on the framework indicate that TCE comes not without imperfection. As mentioned earlier theories are and have to develop over time to adapt to new and changing environments and new empirical evidence supports this change of theories (Geyskens et al., 2006, p. 519). Concluding, despite the mixed empirical findings, TCE remains an influential theory in determining the boundary of the firm. The theory delivers characteristics that influence the decision of how to source a good or a

service. Looking from a general perspective at the recommended governance structures indicated in the frameworks, the following ranking emerges:

1. Market governance
2. Hybrid governance
3. Hierarchy governance.

After summarizing the TCE framework, its empirical evidence and its applicability in the sourcing decision domain, the same will be done for the RBV and its extension the KBV.

2.3. RBV: The theories first roots were initiated by Penrose in 1959 and got significantly shaped by Barney in the 90's

The roots of the resource-based theory date back to the fifties, when the British economist Edith Penrose published her second book "The Theory of the Growth of the Firm" in 1959. Dr. Penrose perceived a lack of knowledge concerning explanations about how firms grow. Determined to extend the existing theory she wrote her book, creating not only a theory of the process of firm growth but connected to that also a theory of effective management of firm resources and diversification (Kor & Mahoney, 2004, p. 184). Creating causal links between capabilities, resources and competitive advantages, Penrose generated concepts that later influenced the modern theory of RBV (Kor & Mahoney, 2004, p. 184). Twenty-five years later the Danish economist Birger Wernerfelt published his famous article "A Resource-based View of the Firm", focusing research on firm resources, which hardly got any attention since Penrose book publishing (Wernerfelt, 1984, p. 171). His paper states that firms should not only be evaluated from a product point of view but also from the resource side. Wernerfelt developed economic tools to investigate a firm's resource position and to put the focus on the strategic options that arise from a resource-based view. He called the tools resource position barrier and resource-product matrices, leaning on entry barriers and growth-share matrices for product analysis, intending to discover the relationship between profitability, resources and resource position management over time (Wernerfelt, 1984, p. 171). It wasn't until a decade later that the American scholar of strategic management Jay Barney published his article "Firm resources and sustained competitive advantage", crucially forming RBV towards todays theory. Strategic management at that time tried to explain why some firms outperform others. And while famous concepts like Porter's five forces or SWOT analysis were widely used to answer that question, the main focus was set on investigating the relationship between the external environment, opportunities and threats, and gaining competitive advantage (J. Barney, 1991, p. 100).

Barney created a resource-based view of competitive advantage, linking firms' internal characteristics to performance (J. Barney, 1991, p. 101).

2.3.1. RBV framework states that resources creating sustained competitive advantages cannot be purchased on the market.

The RBV is based on two assumptions, namely the heterogeneity and immobility of resources (J. Barney, 1991, p. 101). The heterogeneity assumes that resources within an industry are not identical and that the strategic resources that a firm control may be different from one another (J. Barney, 1991, p. 101). The immobility of resources assumes that those heterogeneous resources are not perfectly mobile and may not be transferable to other firms, making the heterogeneity long lasting (J. Barney, 1991, p. 101). Barney (1991) argues, that without this assumption no firm in an industry could gain a sustained competitive advantage. Would all resources in an industry be available to all companies, any strategy of one company could be copied and implemented by any other, allowing them to reach the same efficiency and effectiveness, making sustained competitive advantages non-existent (J. Barney, 1991, p.104). To support his argument he offers two examples of why sustained competitive advantage cannot exist in a resource homogeneous and mobile environment. First-mover advantages are a sign of the presence of the two assumptions. If resources would be homogenous all firms in the industry would have the detecting of an opportunity resource and all firms would implement the strategy parallel since they all became aware of the opportunity at the same time. This parallel strategy implementation of firms would prevent a first-mover advantage (J. Barney, 1991, p.104). Additionally, the existing of entry barriers indicates that certain firms used resources to implement strategies that are not available to firms outside the barrier, indicating heterogeneity and immobility of resources (J. Barney, 1991, p. 101).

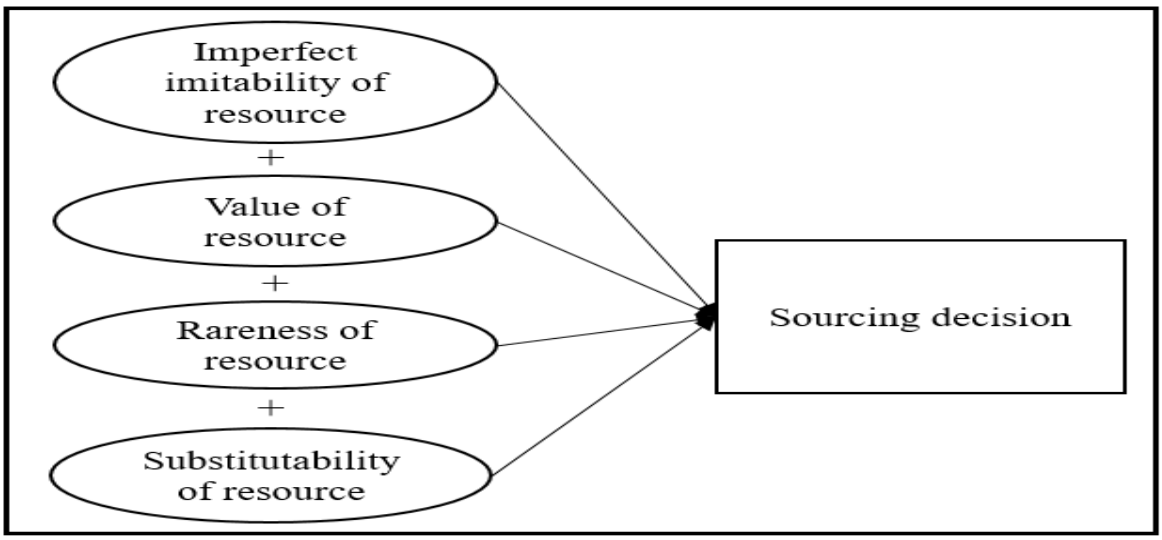
The key concepts and the focus of RBV are firm resources and sustained competitive advantage. The former can be defined as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (J. Barney, 1991, p. 101). Firm resources can be divided into three categories. Firstly, physical capital resources, which include for example a company's equipment, locations and access to raw materials. Secondly, human capital resources contain experience, intelligence and relationships of the individuals in the firm. And thirdly, organizational capital resources include a company's formality, planning, controlling and coordinating systems (J. Barney,

1991, p. 101). The RBV illustrates a firm as a bundle of resources which can create value and the focus of the framework is to determine which of those firm resources, and under which conditions, are a source of sustained competitive advantage (J. Barney, 1991, p.102; Miller, 2019, p.1). Sustained competitive advantage, the second key concept of the RBV framework can be defined as the implementation of a value creating strategy that is not implemented by and cannot be imitated or duplicated by competitors (J. Barney, 1991, p.102).

The framework empathizes that not all firm resources have the potential to become a source of sustained competitive advantage. Four attributes have to be fulfilled to generate a potential resource of sustained competitive advantage (J. Barney, 1991, p.105). The resource has to be valuable, rare, imperfectly imitable and non-substitutable. Resources are considered valuable when they empower the implementation of strategies that improve effectiveness and efficiency or exploit opportunities or neutralizes threats in the firm's environment (J. Barney, 1991, p.106). If a resource is valuable but not rare other competitors can make use of the resource, becoming more efficient as well and leaving no room for a competitive advantage. A resource is recognized as rare when the number of competitors that possess the same resources is less than the number of companies needed to generate perfect competition dynamics (J. Barney, 1991, p.107). Valuable and rare resources can only lead to sustained competitive advantage if the resource cannot be obtained by competitors, if they are imperfectly imitable. A resource can be imperfectly imitable for three reasons. Firstly, it can be imperfectly imitable because of the unique historical conditions. Historical circumstances like the firms founding, management takeover and the path a firm followed through history shaped and influences the firm performance and resources making them imperfectly imitable for all other firms which followed their own unique historical path (J. Barney, 1991, p.108). Secondly, causal ambiguity can create imperfectly imitable resources. If the link between a resource and its resulting sustained competitive advantage is not understood it is difficult for competitors to duplicate the success resource since they cannot identify and connect the resource to the success (J. Barney, 1991, p.109). Thirdly, imperfect imitable resources can be created through social complexity. Complex social phenomena, reputation, culture or interpersonal relationships make resources unique and prevent competitors from duplicating a resource (J. Barney, 1991, p.110). The fourth attribute that enables a resource to be used as a sustained competitive advantage is the substitutability. To achieve the competitive advantage there cannot be strategically equivalent substitutes to the

resource. Substitutable similar or very different resources can lead to the same strategic outcome, making it important that the firm's resource is not substitutable (J. Barney, 1991, p.111). With this framework and the requirements for sustained competitive advantage enabling resources, also called VRIN or VRIS, firm resources can be evaluated. Asking the question of whether a certain resource is valuable, rare, imperfectly imitable and non-substitutable, resources can be classified into sources of sustained competitive advantages and no sources of competitive advantage (J. Barney, 1991, p.115). The RBV furthermore implies and Barney (1991) states, that sustained competitive advantage cannot be purchased on the open market. Instead those advantages have to be detected and supported within the firm by screening and classifying the existing resources (J. Barney, 1991, p.117). The requirements for a resource to be a resource of sustained competitive advantage are summarized in Figure 3.

Figure 3: VRIN model of RBV



The importance of the RBV for the sourcing model decision is two-sided. Firstly, the capabilities of making a strategic and profiting decision of the purchaser himself, can be a source of sustained competitive advantage (J. B. Barney, 2012, p.3). Secondly, classifying internal resources according to the VRIN model can help detect sources of competitive advantage, which then should be promoted internally. In that sense vertically integrating strategic assets can bring sustained competitive advantage (Crook et al., 2013, p.68). Having the RBV in mind, outsourcing or strategic alliances are conducted when internal structures are lacking VRIN resources. New resources can be acquired in four ways. Through internal development, external procurement, strategic partnerships or full acquisition (Parmigiani & Rivera-Santos, 2011, p.1114). Those four sources of strategic resources can be acquired with

different speed and at different cost (Cousins et al., 2008, pp. 30, 31). Strategic partnerships usually provide quicker access to new resources than the internal development of tacit knowledge and imperfectly tradable resources and it can also be cheaper than acquiring a whole firm (Parmigiani & Rivera-Santos, 2011, p.1114). On the other hand, as argued earlier, strategic partnerships bring the risk of potential leaking of internal knowledge to others (Parmigiani & Rivera-Santos, 2011, p.1114). Cost and time for developing the needed resources internally can be high for several reasons: path dependence of long-learning processes, social complexity of the needed resource or causal ambiguity between the link of the resource and its development process (Cousins et al., 2008, pp. 30, 31). If the cost for internal development are considered too high, the next closest alternative would be to acquire a firm with the needed resources. Here, costs and risks have to be evaluated. Knock-on effects (value of the acquired firm and its resources can rise and fall post-merger), technology tie-ins and unwanted baggage (desired resource is hard to separate from the firm as a whole) should be considered when deciding to acquire a firm. Buying from external suppliers or partnerships are valid alternatives. (Cousins et al., 2008, pp. 30, 31).

Regardless of the acquiring method of a VRIN resource, once it is inside the firm, it can be used to create sustained competitive advantage, suggesting that goods or services that are seen as a source of competitive advantage should be sourced in-house in the long run (Parmigiani & Rivera-Santos, 2011, p.1114). Furthermore, the RBV can be seen as an assistant in differentiating between resources that are creating: (a) core competences, those should be sourced hierarchically, (b) complementary competences, those should be sourced in a hybrid form, and (c) non-core competences, which should be sourced on the market (Espino-Rodriguez & Padron-Robaina, 2006, pp. 53, 63).

2.3.2. RBV achieves overall moderate empirical support.

Empirical research of the past three decades tried to deliver proof for the RBV (Armstrong & Shimizu, 2007, p960; Kraaijenbrink, Spender, & Groen, 2010, p. 354; Newbert, 2007, p. 121). The RBV basically demonstrates and prognosticates the benefits of a certain resource (independent variable) on performance outcomes (dependent variable) through sustainable competitive advantage creation (Armstrong & Shimizu, 2007, p. 963). To confirm this view, the relationship between resources, sustained competitive advantage and above-industry performance has to be tested, with the intention to clarify if and which resources are contributing to higher performance (Armstrong & Shimizu, 2007, p. 978). While empirical research in this area is growing (Armstrong & Shimizu, 2007, p. 960), the outcomes of those

analyses only deliver overall modest support for the RBV (Newbert, 2007, p. 121). A systematic review of the empirical RBV literature from Newbert (2007) states that the final sample size of 55 entails 53% empirically RBV supporting studies (Newbert, 2007, p. 136). The review not only followed a similar methodology as the one from David and Han (2004), reviewing empirical TCE studies, but also discovered a similar percentage of support for the reviewed theory (Newbert, 2007, p. 136). As reasons for the modest overall support found in the review, the choice of the independent variable, the theoretical approach used and the need to further theoretically develop the RBV, are named (Newbert, 2007, p. 122). Another RBV review of 125 empirical studies by Armstrong (2007) also indicates that attempts to proof RBV are facing significant empirical challenges which have to be overcome by further theoretical improvements (Armstrong & Shimizu, 2007, p. 960). One empirical challenge is the measurement of intangible and inimitable resources, which are by definition difficult to observe (Armstrong & Shimizu, 2007, p. 966). Another challenge is the focus on sustained competitive advantage. Firstly because, the length and the degree of "sustained" is not defined in the theory and might change over time or across industries (Armstrong & Shimizu, 2007, p. 969). Secondly, only limited firms obviously achieved a long-term superior position under competitive pressure, giving limited data for empirical research (Armstrong & Shimizu, 2007, p. 967).

Looking at the broad picture, three generally summarized critiques are stated concerning and threatening the core of RBV (Kraaijenbrink et al., 2010, p. 350). The first critique concerns the VRIN model. It is argued that the possession of a VRIN resource itself is neither sufficient nor necessary to create a sustained competitive advantage. Only by creating bundles of synergistic combinations of resources and actually utilizing these resources, sustained competitive advantage can be gained (Kraaijenbrink et al., 2010, p. 356). The second criticizing statement presents the RBV as a tautology, not realizing the criteria for a standard theory, making the RBV not testable (Kraaijenbrink et al., 2010, p. 356; Priem & Butler, 2001, p. 27). The tautology accusation stems from core definitions. The used definition of a resource is arguably all-inclusive, making potentially everything in a company a resource, not differentiation for example between resources and capabilities (Kraaijenbrink et al., 2010, p. 358; Priem & Butler, 2001, p. 32). Arguments for a tautology also stem from the definition "of competitive advantage as the condition of implementing a rare value-creating strategy while theorizing that the resources that create competitive advantage are those that are valuable and rare" (Miller, 2019, p. 8).

2.3.3 KBV, one major extension of RBV, considers knowledge as the essential source of value needed for production.

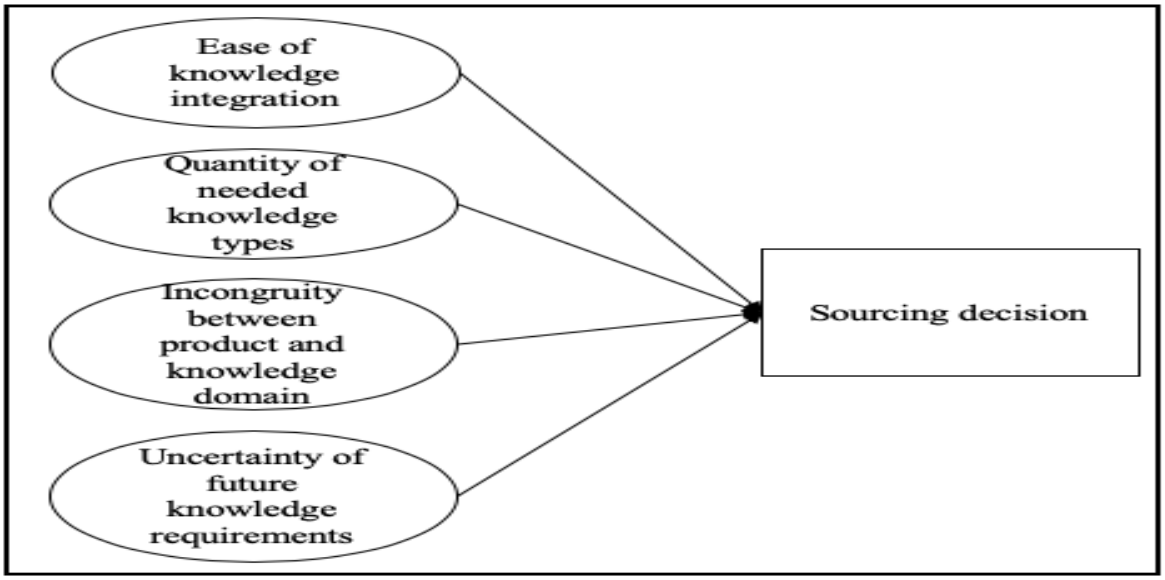
Next to dynamic capabilities and the relational view, the KBV can be seen in literature as one of three major extensions of the RBV (Miller, 2019, p. 1). Greatly shaped by Grant in 1996, KBV recognizes knowledge as the most crucial resource of the firm and the major determinant of sustained competitive advantage (Grant, 1996, p. 109; Miller, 2019, p. 1). It is stated that knowledge-based resources are at least partially tacit, socially complex and difficult to imitate, meeting the VRIN criteria and making heterogeneous knowledge bases a main factor for superior performance and sustained competitive advantage (Miller, 2019, p. 5). As the basic unit of analysis, knowledge can be classified into different dimensions. Literature uses diverse concepts to differentiate knowledge itself, its usage, its management or its purpose like tacit vs. explicit or knowledge generation vs. knowledge application (Grant & Baden-Fuller, 2004, p. 64).

The fundamental assumption of the KBV is that the essential source of value and the crucial providence for production is knowledge (Grant, 1996, p. 112). Furthermore, it is assumed that different types of knowledge alter in their transferability. While explicit knowledge can be transferred easily through articulation and communication between individuals or companies, tacit knowledge can only be transferred slowly and at high cost (Grant & Baden-Fuller, 2004, p. 66). The next assumption states that knowledge is created by individuals and that those individuals need to specialize in order to efficiently create and store knowledge (Grant & Baden-Fuller, 2004, p. 66). Additionally, it is assumed that many types of knowledge are used to produce a single good or service (Grant & Baden-Fuller, 2004, p. 66). Lastly, knowledge has to be contingent on economies of scale and scope. Usually the cost of creating knowledge increases the cost of replicating it, making knowledge subject to economies of scale (Grant & Baden-Fuller, 2004, p. 66).

Combining these assumptions, it can be stated that the production of a good requires several particular types of specialized knowledge, from which each is contingent on economies of scale and scope. The efficient use of the different specialized knowledge resources is then dependent on two factors. The ability to utilize the knowledge to a maximum and the ability to integrate the different knowledge resources (Grant & Baden-Fuller, 2004, p. 67). To optimize efficiency the KBV states propositions for both factors about the preferred governance model for knowledge resources. At first, the recommendation for the highest efficiency of knowledge integration. This efficiency is

dependent on the costs of connecting all the types of knowledge needed for a product. Integrating all the knowledge needed can be done internally in two ways, through direction and routines. Directions are created by converting "sophisticated specialized knowledge into directives, rules, and operating procedures that can be imposed through authority-based relationships" (Grant & Baden-Fuller, 2004, p. 67). Routines are "complex patterns of coordination that permit different specialists to integrate their knowledge into the production of goods and services while preserving the efficiencies of knowledge specialization" (Grant & Baden-Fuller, 2004, p. 68). Over the market, this integration of knowledge is more difficult since routines and directions cannot be used. Instead a common language, time, effort and investments are needed to integrate knowledge from the market within the firm (Grant & Baden-Fuller, 2004, p. 68). Alliances are seen superior to market sourcing but inferior to hierarchy in terms of integrating knowledge. However, alliances can be the preferred sourcing choice if the range and the diversity of the needed knowledge resources is increasing. Then the marginal cost of knowledge integration within the firm can exceed the knowledge integration cost emerging through alliances between firms (Grant & Baden-Fuller, 2004, p. 69). Secondly, the recommendation for the highest efficiency of knowledge utilization. Knowledge is a resource that rather upvalues than devalues with increased use (Grant & Baden-Fuller, 2004, p. 70). If a firm is producing several products and each product requires different types of knowledge, then there will arise the problem of under-utilized knowledge resources (Grant & Baden-Fuller, 2004, p. 72). Strategic alliance can be the solution to this under-utilization, and it is stated that the greater the discrepancy between the product and the knowledge domain, the greater is the advantage delivered by hybrid sourcing over hierarchy sourcing. Collaborative arrangements can give "access and integrate knowledge that can be more efficiently provided by other firms" and they can "more fully utilize the firm's own knowledge" (Grant & Baden-Fuller, 2004, p. 72). Additionally, strategic alliances can be most beneficial if future knowledge requirements are uncertain and acquiring that knowledge is risky and takes time. Risk can be spread and a smaller investment in the new knowledge creation has to be made (Grant & Baden-Fuller, 2004, p. 75). Concluding, KBV states that hierarchical governance is the superior form of sourcing knowledge, however certain situations preferably require strategic alliances. A visualization of the dimensions, which can be seen as sourcing decision influencers mentioned by the KBV are given in Figure 4.

Figure 4: TCE sourcing decision influencers



Summarizing, moderate empirically supporting results and points of criticism on the framework indicate that RBV, and along with it, KBV, do not come without imperfection. As mentioned earlier, to increase significant empirical support for the RBV, the theories have to be further developed and adjusted (Newbert, 2007, p. 122). Both theories deliver characteristics that influence the decision of how to source a good or a service. Looking from a general perspective at the recommended governance structures indicated in the frameworks, the following ranking for both, RBV and KBV, emerges:

1. Hierarchy governance
2. Hybrid governance
3. Market governance.

2.4. Combining the theories, an integrative research model can be created, including several factors influencing the sourcing decision

After reviewing the frameworks and the applicability of TCE, RBV and KBV to the sourcing decision process separately, their essence has to be compared and contrasted. A similarity can be seen in the mentioned factors influencing the sourcing decision. To be more precise, between the VRIN resources of the RBV and asset specificity of the TCE. Crook (2013, p. 68) argues that specific assets, by definition are valuable, which is one requirement for a VRIN resource. He then concludes that a VRIN resource always represents a specific asset but not necessarily vice versa and that therefore specific assets that are also a VRIN resource have a greater influence on the insourcing decision than assets that are just specific, not fulfilling all VRIN requirements (Crook et al., 2013, p. 68). Evidence for differences

between the theories are stated in literature as well. While all theories are determined to state a framework that pictures the boundaries the firm, they do so from opposite views. TCE takes on a market failure approach, arguing with the negative consequences of outsourcing specific assets (Crook et al., 2013, p. 68; Espino-Rodriguez & Padron-Robaina, 2006, p. 55). RBV, and its extension KBV, take on an organizational advantage approach, focusing on the positive effects of not outsourcing core competences (Crook et al., 2013, p. 68; Espino-Rodriguez & Padron-Robaina, 2006, p. 55). TCE, taking a market failures approach (Crook et al., 2013, p. 68), has been criticized to only focus on cost minimization, not paying attention to value maximize (Cousins et al., 2008, p. 33). Additionally, TCE does not take into account the firms need to focus on core competences or considers strategic positioning of resources (Espino-Rodriguez & Padron-Robaina, 2006, p. 55). Combining TCE, RBV and KBV, by using all mentioned factors influencing the sourcing decision in one model, this critique of TCE could be offset by the value maximizing-, organizational advantages approach of RBV and KBV (Crook et al., 2013, p. 68).

This research will combine all theories in one research model for several reasons. The first reason has just been named previously, that by combining TCE with the RBV, an approach of cost minimization and value maximization can be created. Furthermore, it has been argued that TCE has to be expanded with other viewpoints to explain sourcing decisions (Crook et al., 2013, p. 63), stating a good argument for combining the factors influencing the sourcing decision of TCE, RBV and KBV. Considering that this research focuses on sourcing software, the argument that sourcing IT is more complex and cannot be covered by a single decision-making theory (Schneider & Sunyaev, 2016, p. 2), also indicates the usefulness of combining the theories. Therefore, contrasting and combining the different theoretical views leads to the following Table 2, summarizing all sourcing decision influencing factors and how they affect the recommended governance model.

From Table 2 the integrative research model, with a multiple theoretical perspective, is derived (Figure 5). The research model, the sourcing decision influencer table and the previous literature review lead to three propositions.

Proposition 1: If a Software has high asset specificity, high overall uncertainty, is sourced frequently, fulfills the VRIN characteristics and/or is considered a core competence, it is most beneficial to source the embedded software with a hierarchy governance model.

Proposition 2: If a Software has medium asset specificity, only meets some VRIN characteristics, is a complementary-competence, the quantity of needed knowledge types is

high, the efficiency of knowledge integration low, the uncertainty of future knowledge requirements high and/or the incongruity between product and knowledge domains is high, it is most beneficial to source the embedded software with a hybrid governance model.

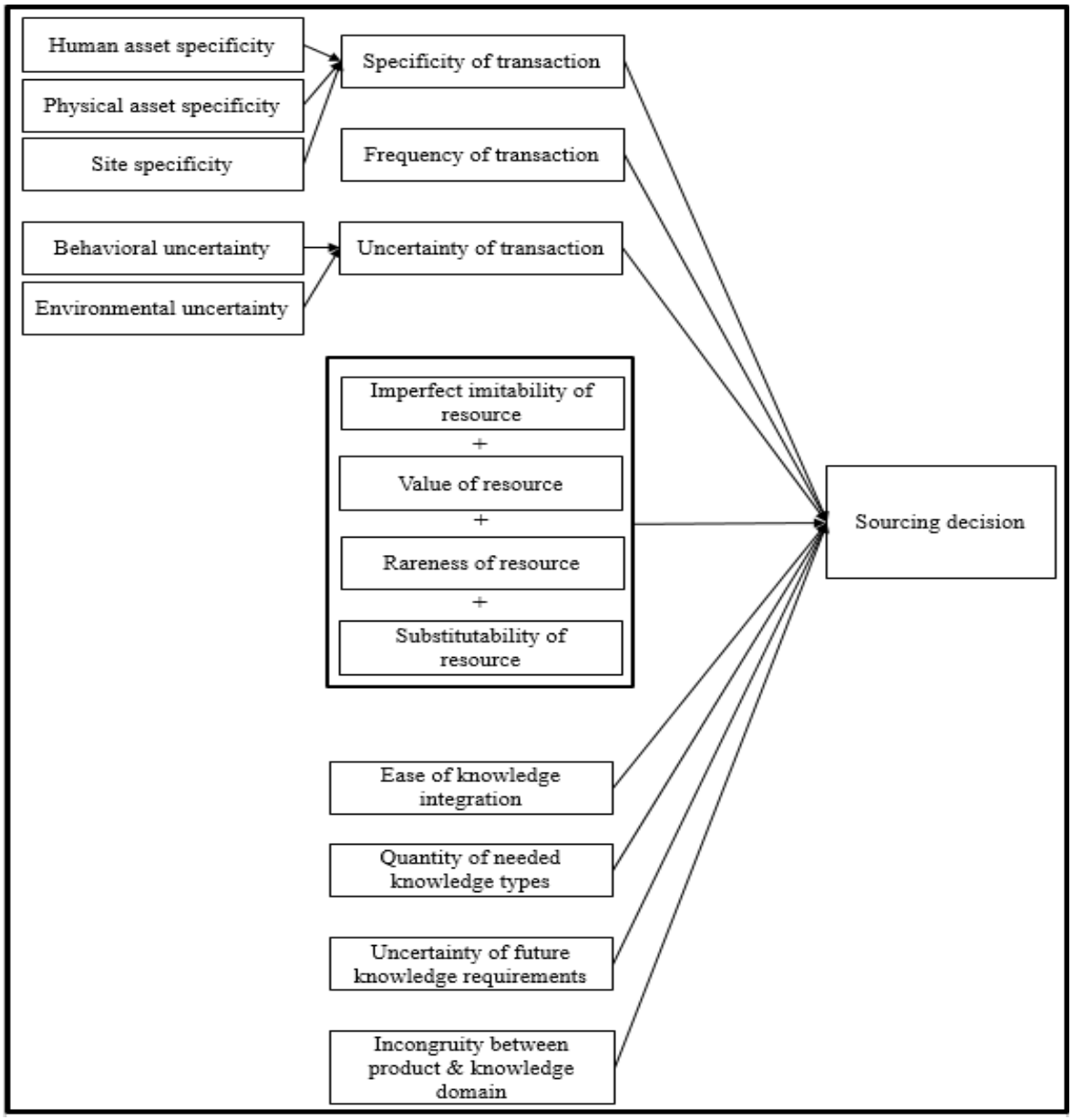
Proposition 3: If a Software has low asset specificity, high technological uncertainty, does not meet the VRIN characteristics and/or is a non-core-competence, it is most beneficial to source the embedded software with a market governance model.

Table 2: Theoretical sourcing decision influencers and their indicating sourcing model

Theory	Sourcing decision influencer	Degree of Influencer	Sourcing model
TCE	Asset specificity	high	Hierarchy
		medium	Hybrid
		low	Market
	Frequency (in present of asset specificity)	high	strong push to Hierarchy
		low	no additional effect
	Overall uncertainty (in present of asset specificity)	high	strong push to Hierarchy
		low	no additional effect
	Technological uncertainty	high	Market
		low	no statement
RBV	Potential VRIN resource	Presence	Hierarchy
		Absence	Hybrid or Market
	Degree towards core-competence	high	Hierarchy
		medium	Hybrid
		low	Market
KBV*	Ease of knowledge integration	low	Hybrid
		otherwise	Hierarchy
	Quantity of needed knowledge types	high	Hybrid
		otherwise	Hierarchy
	Uncertainty of future knowledge requirements	high	Hybrid
		otherwise	Hierarchy
	Incongruity between product & knowledge domain	high	Hybrid
		otherwise	Hierarchy

*The reviewed literature only names hybrid and hierarchy sourcing models. The option of sourcing by market governance is not named, could however be available.

Figure 5: Research model



3. Methods: A combination of word-café and case studies was used to evaluate the propositions

The aim of this research is to identify if theoretical factors influencing the sourcing decision and their concluding theoretical sourcing recommendation are also applicable for embedded software sourcing processes in the automobile industry. To do so, those relevant factors and recommendations have to be determined in theory and in practice. The theoretical ones already were detected in the previous section and put together in the research model. The practical ones have to be observed in the next part by evaluating the specified propositions in a realistic setting. The assessment of the propositions has two intentions.

First, to gather software sourcing recommendations and influential factors generally in practice. Second, to check if the theoretical influential sourcing decision factors and recommendation are also present in practice. By gathering and comparing practical influential factors and sourcing recommendations, the rightfulness of the propositions can be evaluated and the research question can be answered.

Collecting those practical insights requires access to employees in charge of the software sourcing decision making process. For this case company, the process structure has been observed and the main departments affecting the sourcing decision making are procurement and technical development departments. The demand and the request to source a certain software is created by the technical development department. They send a request with the specified needs of the software to the procurement department. In the following process procurement and technical development exchange supplier and sourcing preferences and make a final decision. Therefore, to collect practical insights those two business areas have to be involved.

To determine factors that influenced the sourcing decision in the past two qualitative research methods were adopted to gather data. At first, a world café with the embedded software sourcing employees of the research company was conducted. The results gave a first general overview of factors influencing the sourcing decision from a procurement perspective. Additionally, the identified factors were partially used to create interview questions for the second qualitative research method, the case studies. Nonrandom selected software sourcing cases were observed. Each case was analyzed. The examination contained interviews with sourcing decision makers and the review of secondary data like documents, reporting the decision-making process. In the following the reasoning for the chosen methods and the conduction itself will be clarified.

3.1. A World café generated a vast number of factors influencing the sourcing decision in practice

The execution of a world café is a fast method to gather opinions, collecting thoughts of and thus data from several individuals. It is a time-efficient method that fosters discussions, conversations and sharing of knowledge (Schiele, Krummaker, Kowalski, & Hoffmann, 2019, p. 10). The world café was used in this research for two purposes. First, to gain an initial impression and a general overview of factors that are influencing the software sourcing decision in a practical setting. The aim was to get this overview quickly by benefitting from the group discussion setting that generates first insights. The second

purpose of the world café was guidance for the case interview questionnaires. By gaining a broad overview over the practical influential factors, crucial factors could be determined. Insights about which factors seem to be critical to a vast number of participants then could be used to state more specific questions for the case studies.

The selection of the participants of the world café was, for practical reasons, limited. Ideally, all employees of the researched company, who are involved in the daily software sourcing decision process should have been involved, to gain a holistic overview of sourcing influencing factors. Mainly involved in the decision are the software procurement department and different technical software development departments. While the procurement department is centered at the same location and within one team, the technical employees are spread over several departments. This distribution of employees within the company and the timeframe of this research made it impractical to host a world café with procurement and technical employees. Since the purpose of the world café was to get a broad overview, it was therefore decided to only invite procurement employees. The complete embedded software procurement department was invited to the world café and the majority, thirteen employees, participated. Those thirteen participants were amongst the first employees of a recently founded procurement department, specialized in sourcing software. In their daily business they are sourcing software while being in constant exchange with the technical software development departments and software suppliers, making them suitable participants for the purpose of the world café.

Prior to the actual conduction of the world café, its setting had to be determined. One component of a world café is the round table structure, with each table having a different question, intending to solve a main issue. The principal question in this setting was “Which factors are influencing the choice of the sourcing model for software in practice?”. However, that question seemed rather broad, creating a potential threat of overlooking certain spectrums of factors. To prevent that, a classification of factors was used to create sub questions. The factor classification for this research used the categories of Quayle (1998) research paper to cover all type of factors influencing a sourcing decision (Quayle, 1998, p. 202). Quayle (1998) states that individuals, markets, products and organizations influence the sourcing decision (Quayle, 1998, p. 202). Copying those influencers lead to the following three factors used in this research: internal factors, external factors and software characteristics. The product dimension of Quayle (1998) was adopted more specifically into characteristics of software that influence the sourcing decision. The dimensions of

individuals and organizations were combined into “internal factors”. From this classification of factors influencing the sourcing decision the need for three sub questions and thus three tables for the world café emerged. Therefore, the layout of the conducted world café contained three tables, each table focusing on one of the following three sub questions:

- Which internal factors are influencing the choice of the sourcing model of software?
- Which external factors are influencing the choice of the sourcing model of software?
- Which software characteristics are influencing the choice of the sourcing model of software?

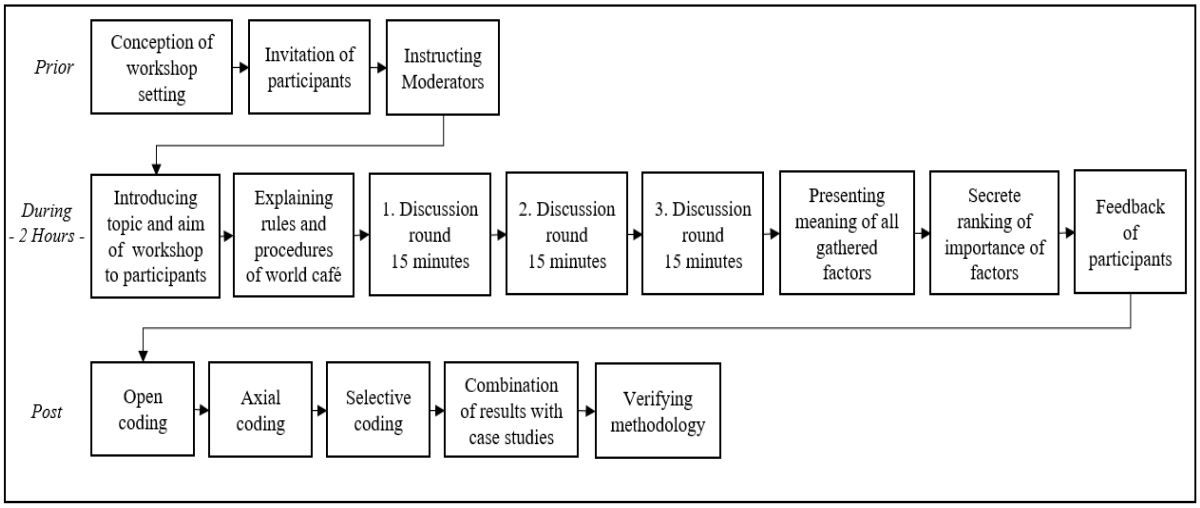
By splitting the main question into these, each table could have a more specific discussion and more focused answers were stated. However, it is not just of interest which factors influence the sourcing decision but also how and to what degree. Therefore, on every table the additional question “to which degree has the factor to be present to prefer a) insourcing, b) outsourcing, c) strategic partnership?” was stated.

To correctly conduct a world café each table in the setting needs a moderator. This moderator opens the discussions, summarizes the findings of the previous discussion rounds and can intervene in case the discussion stagnates. Prior to the world café three graduates were nominated to be a moderator at one of the tables. The moderators were prepared and instructed for the conduction. They already had knowledge about the research topic and were skilled to collect research data in group settings.

The conduction of the world café lasted two hours. At first, the participants were briefed about the content of this research in general, the aim of the world café and the connection of those. After that the rules and the procedure of the method were explained. Then the participants grouped around the three tables. In three discussion rounds, each lasting 15 minutes, the participants switched from table to table so that in the end each participant argued about each question with different participants. Thoughts were written down on paper tablecloths by the participants during the discussions and apart from that the moderators on each table fixed the results from the tables on an extra paper. After the last discussion round the results were presented. All influencing factors were collected and the meaning of the factors were summarized by the participants. Then, the participants were asked to rate the three most important internal-, external-, and software characteristic factors according to their importance. The rating was conducted secretly. Lastly, to make sure that the factor classification covered all areas and no influential factors that did not fit into the classification were left out, the participants were asked for feedback. They could not come up with any

other factors or categories. A visualization, summarizing the conduction process of the world café, can be found in Figure 6 below.

Figure 6: Conduction process world café



3.2. Three Case Studies examined factors that led to internal, external and hybrid sourcing

After gaining a first overview of factors influencing the software sourcing decision in practice more detailed case studies were conducted. The world café created factors that the participants are perceiving to be important in general, nonspecific situations. The participants were discussing generic questions and stated how factors might argue in favor of insourcing, outsourcing or partnerships based on a mixture of experience and assumptions. To put assumptions out of the equation, factors which actually lead to the decision to source a certain software

a) in-house

b) at the market

c) with a partnership arrangement

have to be determined. By picking three past software sourcing processes and conduct case studies of those three processes, it is possible to explore which factors, and the degree of those factors, were present and lead to the chosen sourcing model. Therefore, three cases were picked purposefully. One case explores a process in which a software was sourced at the market. By looking at secondary data, like internal notifications or presentations and by interviewing three stakeholders involved in the decision making, the factors that lead to the decision of sourcing the software at the market can be determined. Two sourcing employees and one technical development employee involved in the decision making, were interviewed. In the second case a software was sourced through a strategic partnership and

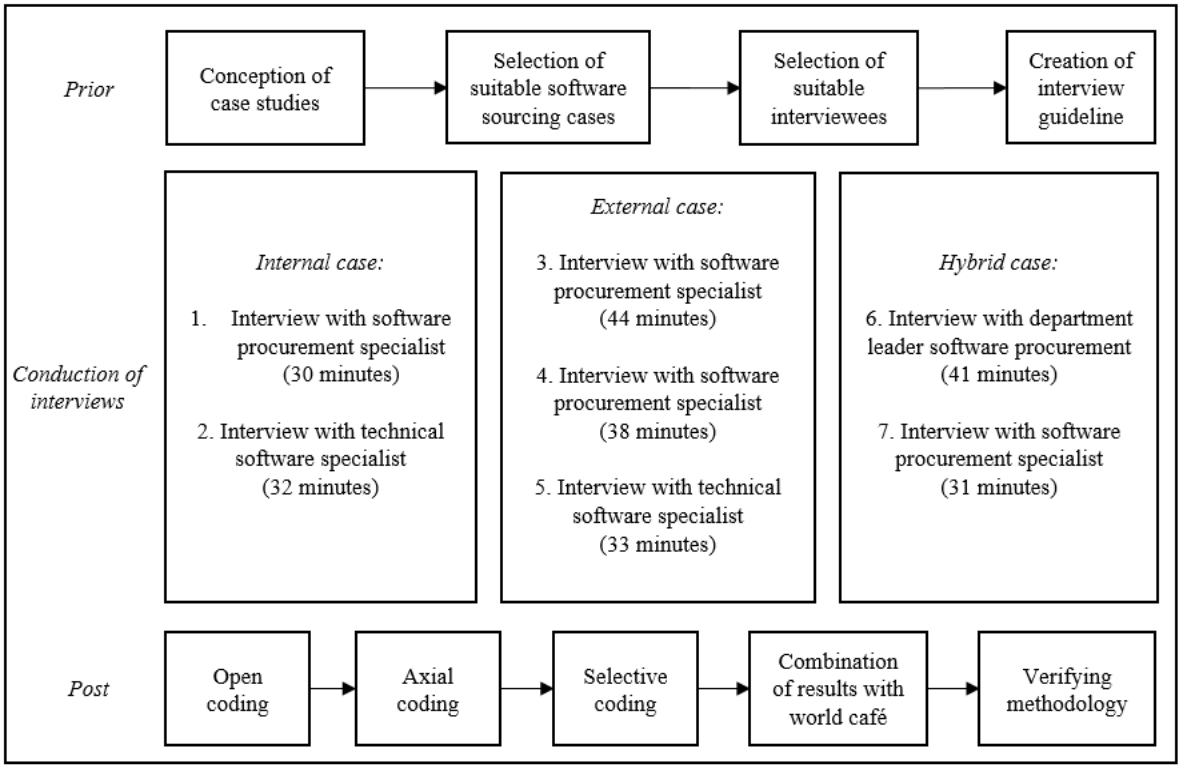
likewise by conducting interviews and screening existing data, the factors that lead to the decision of preferring a partnership over insourcing and outsourcing are inspected. For this case one sourcing clerk and the head of software sourcing were interviewed. Technical development employees involved in the decision were not available to the company anymore. As the final decision was made the CEO, for this case secondary data was crucial next to the two interviews. The third case states a sourcing process in which the software was produced within the company. Again, interviews with decision making responsible and secondary data is used to analyze which factors lead to the decision of sourcing that specific software internally. One sourcing employee and one technical software developer in charge of the decision making were interviewed. It was decided to screen three cases so that insights about each sourcing model and their influencing factors could be gained. The decision about those exact three cases was done nonrandom. After discussions with several employees, those three cases seemed to be promising because of their complexity and thus their variety of possibly influencing factors. According to Siggelkow (2007, p. 20) picking cases nonrandom, because of their specialty and their potential to give certain insights that other cases would not provide, is recommended and justifiable.

Access to secondary data for each case was made available by employees involved in the decision-making process. That data was screened and mentioned factors were highlighted and coded. For the primary data, interviews with the previous mentioned, involved employees per case were arranged. All interviewed employees influenced the sourcing decision of the case software to a certain degree. The seven interviews were semi-structural, lasted 30 to 44 minutes and contained questions that aimed in three directions. Firstly, gaining general knowledge about the sourced software, the sourcing process and the involved departments. Secondly, examining which factors influenced the sourcing decision. That interview part included one general question asking which factors were influential but also several very specific questions. All factors that influence the sourcing decision according to TCE, RBV, KBV were translated into specific questions, asking if the interviewee considered those theoretical sourcing decision influencers in the sourcing case. Lastly, the remaining questions were reflecting the decision. In this setting it was not just important to determine which factors lead to the specific sourcing decision but also to discover if the chosen sourcing model was the most beneficial one compared to the other two options. Therefore, the interviewees were asked for their impression if the sourcing model decision, looking back, was a good decision. Just because certain factors lead to one

sourcing model, it does not ensure that the chosen sourcing model turns out beneficial and superior to the others. Therefore, checking the current sourcing performance of the case software gives further insights into which sourcing model is favorable in which situation.

All interviews were conducted in German, as this was the mother language of the interviewees. The interviewees were participating voluntarily and were briefed about the intentions and goals of the research and the interviews. The interviews were recorded with permission and transcribed afterwards. A visualization, summarizing the conduction process of the case studies, can be found in Figure 7 below.

Figure 7: Conduction process case studies



3.3. Coding the world café and the interviews abstracted all gathered factors to fewer core variables influencing the sourcing model decision

To code the interviews, the software ATLAS.ti was used. Beginning with open coding, all mentioned sourcing model decision influencers were detected, classified and labeled into 31 codes. After that, axial coding helped to determine if all factors were coded and if some created codes were synonyms. In point of fact, code overlapping's were identified. Seven codes were very similar to others concerning the factor that they were describing. Those code equivalents were merged into one code, creating a remaining number of 24 detected codes. In the final selective coding stage those 24 codes were connected to eight variables.

The same procedure was conducted to code the world café. In this case however, the participants already carried out the open coding, by gathering their experiences and giving the main influential factors a label. They collected a total of 26 influencing factors. After the axial coding stages, in which synonyms were merged, 23 factors remained. Those factors then were generalized during the selective coding stage into eight variables influencing the sourcing decision.

To create a final combined result, the variables of the interviews and the ones of the world café again passed through the coding process. All eight variables of the world café and the eight variables of the interviews were compared and synonyms or doubles were merged, resulting in final nine variables influencing the software sourcing model decision making.

3.4. Verification and trustworthiness were consolidated by including additional researcher feedback

To verify the methodology of this research and to create trustworthiness, several steps were undertaken. Prior to the conduction of the world café and the interviews, the world café planning and the interview-guideline were shown to, evaluated and adjusted by another researcher. Also, the coding process was presented to another researcher to decrease subjective interpretation and to verify the method. The researcher found the coding process to be valid. Lastly, to verify that the transcriptions of the interviews were made correctly and that the content of those reflect what the interviewees were intending to express, the transcripts were shown to the participants. All interviewees agreed to the transcripts.

4. Results: The results section is classified

5. Discussion: Combining TCE, RBV and KBV proved beneficial but the combined research model still requires adaption

After stating the results of the conducted research, the main findings have to be discussed and theoretical as well as practical implications can be drawn. Generally, it was noted that the theories assume all the sourcing options to be present for each transaction. In practice however, governmental laws and regulations on the one hand can make the theoretical best option unavailable. On the other hand, a lack of internal knowhow and capabilities can make insourcing inaccessible. In the latter case, hybrid governance can be a valuable solution. Receiving less attention in literature than the typical make-or-buy decision, hybrid arrangements can be of great value, especially in new business areas where

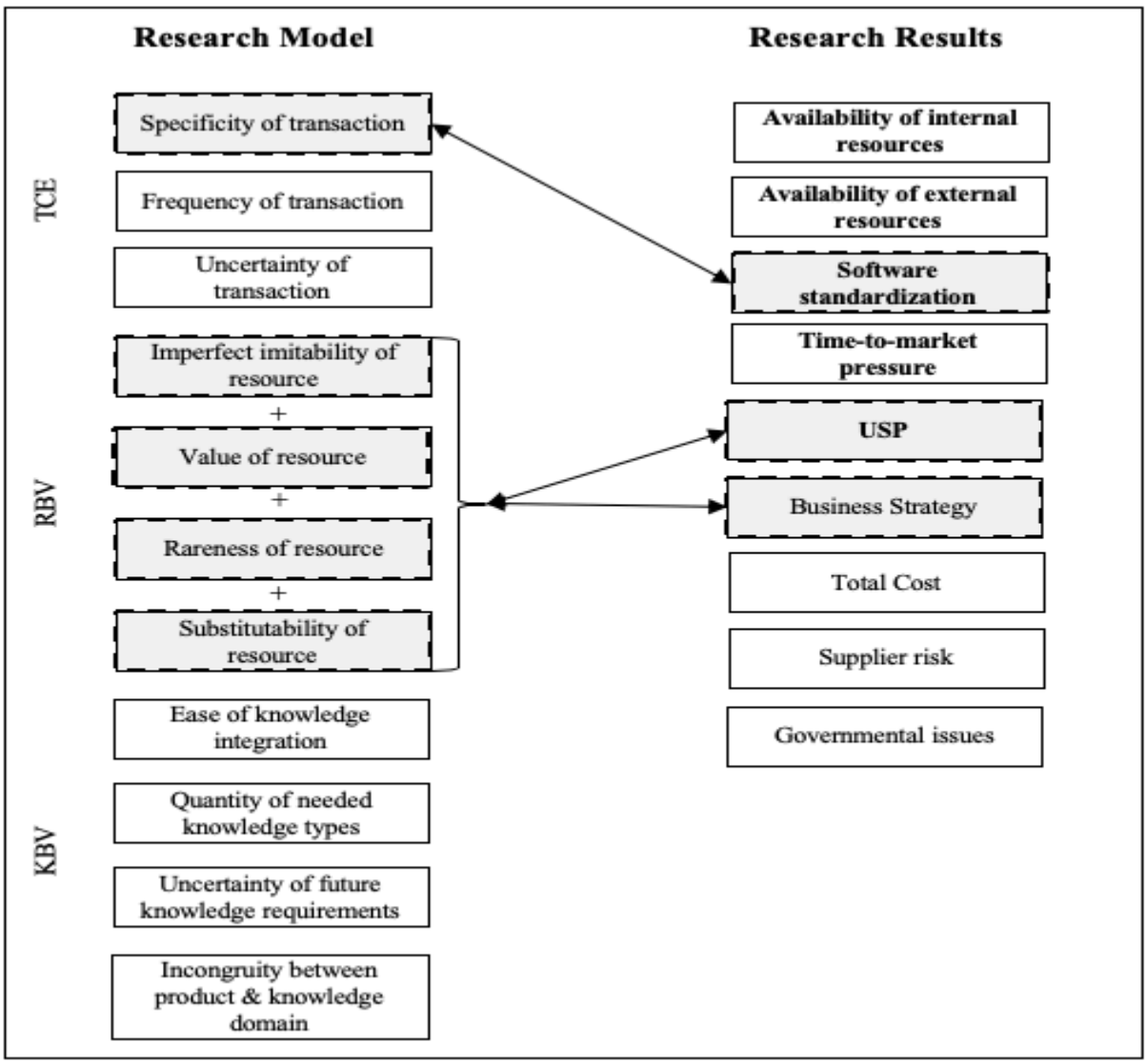
internal knowledge is missing and can be built with experienced partners. Sourcings which are conducted in a company's new business areas, should consider hybrid arrangements a beneficial solution to build and sustain internal capabilities.

Comparing the result model with the initial research model, similarities and differences between theory and practice can be made and including the screening of the cases, the propositions can be checked. The similarities between the research model and the practical results are highlighted grey in Figure 9. The remaining factors, not in grey, indicate the differences between the theories of TCE, RBV, KBV and the practical findings. Focusing first on the similarities between theory and practice, specificity of the transaction of the research model is related to the factor software standardization in the result model. But as mentioned previously the degree of asset specificity does not necessarily has the same importance and validity as it does in TCE. Further similarities can be detected between the variables of RBV and the practical factors business strategy and USP. The VRIN model is partially consistent with the research company's business strategy as the company wants to insource activities which deliver a competitive added value to the consumer. Creating software internally which creates a USP for customers is also aligned with the VRIN model. All other factors of the research model are not comparable with the research results, indicating differences between the current theory and the practical results. It might be that factors like frequency and uncertainty influenced unconscious the sourcing decision, consciously however those dimensions of the transaction were not refered to in the case studies and also were not mentioned during the world café. In Figure 9, practical factors which were highlighted by the participants as most important are marked in bold. Three of those in bold marked important factors, availability of internal resources, availability of external resources and time-to-market pressure are not covered by the theoretical models. These differences between theoretical and practical factors influencing the sourcing decision should be noted. Three factors, that apparently had a great impact on sourcing decisions are not captured in current theories of TCE, RBV and KBV. Out of the five most prioritized practical factors, only two of them are connected to the research model. These findings suggest to adjust the current theories with those influential factors, so that a more fitting tool for making sourcing decisions is created.

Assessing the three propositions, none of them can be completely supported. The case in which the software was sourced internally showed medium asset specificity and uncertainty, is not sourced frequently and does not fulfill the VRIN characteristics. Still all

interviewees agreed that sourcing the software internally was the optimal sourcing decision. This is partially contradicting with proposition one. The case in which the software was sourced with a hybrid model showed medium asset specificity, it is a complementary competence, the efficiency of knowledge integration is low and the uncertainty of future knowledge requirements is rather low. The sourcing decision again was rated as very positive. Expect for the low uncertainty of future knowledge requirements, the case confirms proposition two. The case in which the software was sourced at the market, the software was classified with high asset specificity, medium to low uncertainty and does not meet the VRIN characteristics. While one interviewee suggested that a partnership model would have led to smoother communication as there are slight problems with the supplier, the other two rated the sourcing model as optimal. This case classification partially contradicts with proposition three.

Figure 9: Similarities and differences between theoretical and practical influential factors



The comparison of the research model and the research results implies that combining TCE and RBV made the research model more powerful. If only one of the theories would have been used in this research the overlap between theoretical influential factors and practical factors would have been smaller. Combining the theories created a more significant research model. This contributes to current literature by showing that a combined model of the two theories is more valuable, accounting for more influential factors. It also supports the statement made by several researchers, that TCE needs to be combined with other theories to increase its explanatory power (Crook et al., 2013, p. 63; Lacity et al., 2011, p. 139; Schneider & Sunyaev, 2016, p. 2). However, the only partially approved propositions and the differences between the research model and result model, indicate that despite a combination of TCE and RBV the research model does not mirror reality sufficiently. This research detected several other factors like supplier risk, governmental issues and time-to-market pressure that are not considered in the theories but are significantly influencing sourcing decisions in practice. These deviations between the research model and the results can stem from several aspects. The first aspect considers that this research was conducted in the area of IT sourcing. These findings might support the assumption that sourcing IT is comparably special too complex and that it therefore needs more than a combination of make-or-buy theories (Lacity et al., 2011, p. 151). It could explain why this research determined six factors influencing the sourcing decision that are not mentioned TCE, RBV or KBV and in comparison, only finds three factors that are overlapping to those theories. Lacity et al. (2011, p. 151) state that new theories for IT sourcing have to be created and tested in a practical setting. The identified factors of this research could be part of this new theory, explaining influential factors in the IT sourcing decision. Furthermore, the research revealed that car software usually has high asset specificity. Control units, interfaces, interlinkages and unifying communication between those seem highly complex. This forces suppliers to invest human capital to adapt standardized software for each OEM and it limits buyer to switch suppliers easily, creating a lock-in effect. Lock-in effects are also described in TCE, however in the research company also software which can be classified as a commodity requires unique in-car-linkage, creating lock-in effects. As every case software was classified complex and specific, due to the software itself or the linkage in the car, the factor asset specificity of transactions appears insignificant. This again supports the claim that sourcing IT is special and needs more than a basis of TCE and RBV (Lacity et al., 2011, p. 151).

Another reason for the discrepancy between research model and research results could stem from the time of existence of the theories. Geyskens et al. (2006, p. 519) indicate that theories continuously have to be adapted, reformulated and expanded. Since TCE and RBV were established several decades ago, the business environment changed. Globalization, automation and new technology could for instance have an effect on resulting transaction costs, influencing the initial concept of TCE. Expanding the initial theories with further factors that are relevant in today's business environment could improve the practicability of the theories.

Lastly, the inconsistency between research model and research results could also stem from conducting the research in a business area that is new to the case company. Crook et al. (213, p. 72) urge to determine in future literature in which areas TCE works and it which it does not. It might be that the used theories in this research are not applicable in a new business area setting. The case company is only recently developing towards a software enabled car company. This recent creation of a new business area implicates an unstructured environment in which rules and processes still have to evolve and stabilize. Internal knowledge for creating embedded software was not needed until a few years ago and now needs to be gained and flourished. This might be a reason why the research model only partially fits the practical setting and the propositions could not be supported. TCE, RBV and KBV do not specifically consider situations in which not all three sourcing models are available. In the case company oftentimes insourcing in not yet a suitable option as internal resources are lacking. Furthermore, in the case company a generally high risk of opportunism was noted due to the lack of knowledge in the new environment. It frequently happened that the software suppliers new better than the research company what it actually needed. In TCE the risk of opportunism increases as transactions get more specific or uncertain. The incapability of specifying and understanding perfectly the internal demand increases the threat of opportunism, independently of the degree of software specificity or uncertainly. This lack of structure and internal capabilities needed for a new business area might make the chosen theories unsuitable.

5.1. Conclusion: More differences than similarities are detected between theoretical and practical sourcing decision influencers

After discussing the findings, the research question has to be answered. To recap, the research question asked about the similarities and differences between theoretical factors influencing the embedded software sourcing decision and practical factors in the automobile

industry. In order to answer the question, Figure 9 delivers a useful basis. Firstly, the similarities. This research detected the factors USP and business strategy to be influential in choosing a sourcing model. The factor USP evaluates if a software is creating added value for the consumer, if the software states a unique selling point to the consumer and if the software can compete with similar market products. In case those three variables are given the software should be sourced in-house. The factor business strategy influences the sourcing decision based on strategic goals. In the case of the research company the business strategy supports the factor USP as the strategy of the company is to produce in-house only software that uses internal business secrets and software that creates a competitive USP. Those two factors determined in this research are similar to the VRIN characteristics of the research model. Core-competences that are valuable and rare are recommended by theory and by the findings of this research to be sourced internally. The second similarity exists between the theoretical factor asset specificity and the practical factor software standardization. Both consider the degree of a products specificity and complexity which can lead to lock-ins with suppliers. However, in practice the factor not only considers how specific a software is but it also includes the classification of the software into commodity and not commodity. As mentioned previously the sourced software in the research company always showed medium to high asset specificity due to complex in-car connectivity. This slight difference leads to the practical recommendation to outsource software with high asset specificity if the software can be clustered as a commodity. Comparably, the theoretical recommendation is to source transactions with high asset specificity internally with not further adjustments.

The other six theoretical factors transaction frequency, transaction uncertainty, ease of knowledge integration, quantity of knowledge types, uncertainty of knowledge requirements and incongruity between product and knowledge domain were not recovered in practice, indicating that those factors have an inferior influence on the sourcing decision in the researched area.

The in total nine detected factors that are influencing the sourcing decision in practice can be used for further practical implications. By analyzing synergies between those factors and by individually creating a sourcing strategy and putting greater importance to certain factors, a company can create a decision tree. Building a decision tree by connecting all nine factors and their potential degree and make sourcing recommendations for each path can be valuable. Companies can benefit from those decision trees as they can support employees and management in making the optimal sourcing choice for each process. Furthermore, the

findings reveal the importance for companies to understand the supplier market and customer needs. As companies analyze the capabilities of existing suppliers and detect the needs and desires of their customers, internal decision about what to source internally and what to source externally can be made. It is important to detect USP's for the customer which deliver competitive added value. Once those are determined a company has to check whether or not resources needed to produce software with USP's are already available internally. If not, those resources have to be acquired for future internal sourcing as insourcing states the optimal sourcing model for software with a high USP. Depending on the time-to-market pressure those resources can either be acquired through long-term learning or faster by creating an alliance with a strategic partner. The supplier market has to be screened to check if the company can compete with the in the market existing quality and price of software with a USP. If the company cannot create the software competitively and cannot become more competitive in the future, sourcing the software at the market should be considered despite the unique value for the customer.

5.2. Limitations and further research: a broadened stakeholder view and further quantitative data can improve the validity of this research

Reviewing the theoretical framework and the methodology used in this research, some limitations have to be considered. First of all, theories such as TCE, RBV and KBV are generalized for the purpose of being broadly applicable to any industry or product. The goal of this research was to detect if the generalized theories are also applicable for embedded software in the automobile industry or if the theories are too broad, outdated or not relevant for the researched business area. The results indicate that the theories are only partially applicable, however, to state that with certainty further research has to be conducted. This research solely indicated a potential misfit. Secondly, a broader stakeholder view could have created more in-depth results concerning the research question. As mentioned, due to a shortage of time software development employees could not join the world café. Their input could have been valuable. Furthermore, for the case studies some employees involved in the sourcing decision making were not available in the company anymore. Their absence and the unavailability of further stakeholders like suppliers and internal programmer lowered the quality of this research outcomes. Especially the possibility to interview internal programmers would have been of great benefit. The factors influencing the sourcing decision created by the KBV are very specific. Asking purchasers or developer about the specific knowledge and its characteristics needed to code a certain software was

difficult. It was not the field of expertise of the interviewed employees and thus those KBV factors could not be evaluated in this research as further internal information were missing to evaluate KBV factors in practice. Next to that, the setting of this research does not allow for generalizability. If the findings are valid only for the research company, the automobile industry, IT sourcing or generally applicable cannot be stated with certainty, requesting further research. Lastly, the ranking the importance of the different factors was too broad. Although rankings have been conducted, especially the rankings during interviews leave room for improvement. A final workshop with several stakeholders in which the importance of the nine influencing factors, their synergies and connections are evaluated and a decision-tree is established can significantly increase the explanatory power of this research.

Conducting further case studies, including interviews with other stakeholders could improve the quality of these findings. Next to that, quantitative research testing the validity of the nine stated practical factors influencing the sourcing decision could be valuable. In quantitative research the rightfulness of those factors can be tested. It would be of interest to not just assess the relationship of those factors on the sourcing decision but also the relationship and synergies amongst those factors. Ultimately future quantitative research can determine if the identified factors are only applicable to the research firm, if they are applicable to sourcing software in general, if they are generalizable for sourcing in new business areas or if they are even relevant in any setting.

Acknowledgments

I would like to thank the case company for giving me the necessary insights for this research project and valuable lessons for my future career. Everyone's support gave me the needed understanding of the industry. Thank you to all the participation in the workshop and the interviews, it is highly appreciated. Furthermore, I would like to thank my supervisors for their valuable input and helpful feedback during the entire process. Lastly, I want to thank my family, my boyfriend and my friends for their patience, support and understanding during this stressful time. I am truly grateful.

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