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Master Thesis
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Purchasing and Supply Management

Analysis of Tactical Sourcing Levers and their Implementation in Relation to the Kraljic Matrix in the Chemical Industry - Time for a Product Recall?

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Abstract

In the 1970s Peter Kraljic introduced a portfolio approach to professionalize the sourcing strategy process at firms. Based on the profit impact and supply risk of purchasing items, it differentiates purchasing items in terms of complexity and importance of the purchasing items and thereby allows matching purchasing strategies and resources accordingly. Building on previous research on the usage of sourcing levers in relation to the Kraljic matrix in the automotive industry, this study replicates this approach in the chemical industry. This study aims to identify differences in the application of tactical sourcing levers as defined by Hesping and Schiele (2016a) in relation to the quadrants of the Kraljic matrix and differences in the implementation of sourcing measures in general. Within the direct sourcing department of a chemical firm in Germany, 60 sourcing categories are selected and analysed based on stratified sampling. Category strategies are reviewed for planned sourcing measures and followed up in semi-structured interviews to facilitate a thorough understanding of measures and the current implementation status. The Kruskal-Walis H and Mann-Whitney U test were applied to test for significant differences or similarities among the four Kraljic portfolio quadrants.

This study has four major findings that shed doubt on the usefulness of the Kraljic portfolio approach in practice. First, there are either no general trends regarding the usage of sourcing levers in the different quadrants of the Kraljic matrix or they differ per industry or company. Second, levers that do show significant differences among the portfolio quadrants are extension of supply base and optimization of supplier relationships that relate to the width of the supply base and depth of relationships. Other levers show no significant differences. This might indicate that the generic strategic recommendations according to Kraljic and other scholars have to be re-evaluated. The Kraljic classification might give some inspiration or direction, but eventually category managers seem to consider other contingency factors. In fact, sourcing strategies are multi-faceted and use different levers in addition to each other. Third, there are no overall differences in implementation success of measures among the Kraljic matrix. However, pairwise comparisons show strategic categories have a significantly higher implementation rate than non-critical and leverage categories. Finally, differences might be explained by two category factors that show differences in the implementation rate. Those are higher spend and strategic alignment with internal stakeholders. If products are relevant to internal and external stakeholders or strategies are well aligned internally, category strategies are more likely to be implemented.

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Abbreviations & Glossary

	Kraljic Matrix	Purchasing portfolio matrix introduced by Kraljic
MEUR	Million Euro	
PSM	Purchasing Supply Management	Short term for the research field of purchasing and supply management
RDT	Resource dependence theory	

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1 Introduction

1.1 Chemical procurement faces special challenges due to complex and intertwined value chains and index-driven pricing

Due to the complex and intertwined value chains in the chemical industry, chemical raw material procurement faces different challenges than other industries. Suppliers can at the same time be competitors and customer of a firm as no chemical firm is fully self-sufficient along its various value chains.[1] Even if a company operates along different stages of a value chain it does not necessarily buy its own products. Depending on product availability and price levels in the market, a company may decide to sell the product and buy it from suppliers to optimize the overall profitability. Hence, purchasing managers need to consider these interdependencies when making decisions. This increases the importance of flexible procurement strategies. Many chemical raw materials can be regarded as commodities. Commodities are strongly specified and uniform products with little potential for differentiation leading to competitive markets.[2] Although few products may account for high proportion of the overall expenditure in a chemical firm, different grades of the same product may be needed by different plants due to specialized processes and formulations. This divides the spend and adds a layer of complexity. Further, numerous additives and specialties may be bought in small amounts that define the capabilities of the end-product.[3] All in all, this leads to a vast number of material-plant-combinations and hence complexity. In addition, pricing must consider value chain impacts and complex relationships. Instead of lowest price possible chemical procurement strives to achieve better prices than the competition. Chemical raw materials are strongly tied to feedstocks and their price indices, such as the oil price. The margins that suppliers can achieve for their products and eventually the own firm are in the focus.[4]

Furthermore, supply markets are becoming less stable and rivalry is increasing, due to global supply chains and ever more quickly adapting industry players.[5] Beside globalization, outsourcing and e-business are causes of those fast-paced changes in the environment as well as rapid organisational changes.[6] Markets can turn from short to long or vice versa in terms of supply and demand balance in few years based on increased or

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[1] See Hapke (2004), p.13-15

[2] See Cousins, Lamming, Lawson & Squire (2007), p.266

[3] See Carpi, Moder, Plasschaert & Ziegler (2016), website

[4] See Hapke (2004), p.14

[5] See Kraljic (1977), p.74

[6] See Wynstra (2016), p.201

reduced capacities, market exits or entries. With accelerating market developments, markets can turn even more quickly. Consequently, procurement has to adapt quickly to changing market conditions to support the objectives of the firm.

1.2 Procurement levers in the chemical industry are similar to other industries

Procurement in the chemical industry must consider complex value chains, interdependencies and price indices among other factors. Yet, procurement levers appear to be comparable to other industries. In a publication on best practices a former head of raw material procurement of the focal company presented five different levers to maximize leverage towards the suppliers in the chemical industry.[7] First, buyers can increase competition by allocating the demand deliberately to single or numerous suppliers and add competition by additional suppliers. The higher the market share of the buying company, the stronger the leverage. Second, materials can be bundled across regions, divisions and products. Further, the buyer can join forces with another buying company and engage in collaborative buying bundling across different companies. In addition, to gain insights into suppliers' cost structures and keep supplier power at bay, buying firms regularly evaluate "make or buy" options and integrate backwards and thereby gain insights into production economics. Make or buy decisions are often made by general strategic management as they are at least as much of political as economic importance.[8] The last lever is supplier relationship management that aims at creating partnerships with suppliers based on common objectives and strategies. Especially in situations of mutual dependence, such win-win relationships allow for stable relationships.[9]

1.3 Research project is relevant to science and practitioners

1.3.1 Contribution to scientific literature on practical application of sourcing levers in relation to the Kraljic matrix and contextual factors

The Kraljic matrix evaluates sourcing items based on strategic importance of a product to the firm and supply risk.[10] Previous research has defined and empirically tested sourcing lever frameworks[11], explored the process of evaluating purchasing items in terms of supply

[7] See Hapke (2004), p.17-20

[8] See Cousins et al. (2007), p.14

[9] See Hapke (2004), p.19

[10] See Kraljic (1983), p.111

[11] See Schiele, Horn & Vos (2011), p.315; Hesping & Schiele (2016a), p.473

risk and profit impact[12], discussed measurement issues and added rigor to the dimensions by defining measurement methods[13]. Hesping and Schiele (2016b) have already empirically researched the application of tactical sourcing levers in relation to the Kraljic matrix in the automotive industry at one German OEM[14] following earlier research on industrial commodities such as metal parts[15]. Their study provides valuable insights into the practical application of sourcing levers in the different quadrants of the Kraljic matrix but is "unlikely to provide general guidelines for other industries".[16] Yet, it is unclear what levers category managers apply in other industries such as the chemical industry that sources a variety of basic chemical and refinery products as well as specialties and formulation additives. Hence, the central research question of this thesis is as follows:

- Does the application of tactical sourcing levers in the chemical industry vary among non-critical, leverage, bottleneck and strategic purchases in the Kraljic matrix in the chemical industry?

Further, there is little knowledge on what contextual factors influence the sourcing levers' application[17]. So far, "academia has provided minimal contribution to enhancing the understanding of sourcing category characteristics that will lead to a greater or lesser sourcing lever success."[18] Therefore, the second research question emerges:

- Does the implementation success of tactical sourcing levers in the chemical industry vary among non-critical, leverage, bottleneck and strategic purchases differ and what sourcing category characteristics and factors are associated with the success of sourcing levers?

To answer those questions, a literature review on the development of procurement strategies is conducted to facilitate an understanding for the category strategy practices.

[12] See Gelderman & Van Weele (2003), p.207

[13] See Olsen & Ellram (1997), p.101; Gelderman & Van Weele (2003), p.207; Padhi, Wagner & Aggarwal (2012), p.1; Hesping & Schiele (2016b), p.101; Montgomery, Ogden & Boehmke (2018), p.192;

[14] See Hesping & Schiele (2016b), p.105

[15] See Schiele, Horn & Vos (2011), p.325

[16] Hesping & Schiele (2016b), p.113

[17] See Hesping & Schiele (2015), p.148

[18] Hesping (2015), p.122

This research project on sourcing levers in the chemical industry contributes to the scientific PSM literature by conducting a similar empirical study on sourcing lever application in relation to the Kraljic matrix as it has been done in the automotive industry. Therefore, it adds to the literature on the practical application of the Kraljic matrix. On the one hand, this study will shed light on the sourcing levers employed in another industry and hence allow for comparisons. On the other hand, it adds to the rigor of the research on sourcing levers in relation to the Kraljic matrix by partially replicating previous research.[19] In addition, this study also strives to explore the success of lever implementation in relation to contextual factors that has received little attention on a category level so far.[20]

1.3.2 High relevance to practitioners due to insights on widely used Kraljic framework for procurement strategy making

Next to its theoretical contributions, this master's thesis contributes to the work of practitioners in different ways. First, as the project was triggered by the request of the direct procurement management of a chemical company, this project will create insights into the strategic and tactical work of category managers at the focal company. Purchasing portfolio models such as the Kraljic matrix have been adopted by many companies in their sourcing strategy processes.[21] Within and beyond the researched company, the study will create insights on the current usage of tactical sourcing levers in chemical procurement and allow for self-reflection and comparison. Hence, this project aims at better understanding the current procurement strategy practices and answer, whether and how planned and implemented sourcing levers to create value differ among non-critical, leverage, bottleneck and strategic products in the chemical industry. By empirically testing the usage of tactical sourcing levers in relation to the Kraljic matrix, this study aims to support or debunk the generic strategies presented by Kraljic (1983) for the different positionings. By identifying contextual factors that influence the success of levers, this study further provides valuable insights for practitioners in terms of organization design, procurement set up and how to drive successful sourcing and hence achieve cost savings.

[19] See Van Weele & Van Raaij (2014), p.65

[20] See Hesping (2015), p.122

[21] See Nellore & Söderquist (2000), p.246

2 Theory

2.1 Purchasing strategies are derived from the firm's overall strategy and consist of several hierarchies

Purchasing has a relevant influence on a firm's financial performance in two ways. First, purchasing contributes directly to a firm's financial results by improving cost performance. Second, it influences the sales due to its influence on quality and performance of products which is more difficult to quantify.[22] Purchasing is a "key component to a firm's competitiveness",[23] and following resource-based theory specific purchasing capabilities and systems may even be the source for sustained competitive advantage[24] if they are valuable, rare, imperfectly imitable and not substitutable[25]. Porter (1996) argues that "strategy is about combining activities"[26] and creating fit between different functions and activities by consistency. "Achieving excellence in individual activities or functions"[27] is "necessary but not sufficient"[28] for differentiation. To contribute to the overall business performance, the purchasing function must therefore translate the firm's overall objectives in purchasing objectives and achieve them by performing well in those areas deemed important.[29] The success however depends on both the environment a firm operates in and the strategic position within the firm.[30]

Reviewing literature on purchasing strategy, Hesping & Schiele (2015) suggest that there is a hierarchy of strategies instead of a single purchasing strategy.[31] Similarly, Nollet (2005) describes supply strategy as a "series of plans consolidated in a master plan for coherence and integrity"[32] differentiating between strategic, tactical and operational dimensions of supply strategy. This follows Mintzberg's (1987) definition of strategy as a deliberate plan. It describes a strategy as a "consciously intended course of action, a guideline (…) to deal with a situation".[33]

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[22] See Hartmann, Kerkfeld & Henke (2012), p.30; Jääskeläinen, Thitz & Heikkilä (2016), p.2

[23] See Carter & Narasimhan (1996), p.24

[24] See Barney (2012), p.4

[25] See Barney (1991). P.106-111

[26] Porter, (1996), p.70

[27] Porter (1996), p.70

[28] Porter (1996), p.61

[29] See Gonzales-Benito (2007), p.913; Tochekogué, Nollet & Robineau (2017), p.112-113

[30] See Tochekogué et al. (2017), p.112

[31] See Hesping & Schiele (2015), p.147

[32] Nollet, Ponce & Campbell (2005), p.137

[33] Mintzberg (1987), p.11

To apply the firm strategy to purchasing, it must be "disintegrated into executable and controllable activities".[34] First, a firm strategy is translated into a purchasing function strategy that determines how purchasing contributes to the overall firm performance by defining general guidelines and programs.[35] Second, this purchasing strategy is broken down into category specific strategies considering the supply market context[36] and the budget planning[37]. Such categories contain several materials and suppliers[38] grouped based on technical characteristics or common markets.[39] "Only when the activities and strategies of the purchasing function are aligned with the overall strategies of the firm can purchasing be a strategic function".[40]

2.2 Sourcing categories are groups with technical similarities or common markets that allow for the strategic management of supply across business units and regions

Firm strategies are translated into purchasing strategies and further into category strategies.[41] Category management, category sourcing planning or commodity management refers to the systematic categorization of goods and services in purchasing.[42] Categories can be formed based on similar product characteristics[43] or based on common supply markets[44]. Hesping and Schiele (2015) argue, that a supply market-focused formation of sourcing categories allows "market-, competence- or problem- oriented thinking"[45], to unfold the full potential in terms of e.g. innovation, costs and flexibility. If sourcing items are not managed as categories, they might be procured by regional purchasing managers[46] or bought on a project basis when needed only.

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[34] Hesping & Schiele (2015), p.138

[35] See Nollet et al. (2005), p.137; Gonzáles-Benito (2007), p.913; Cousins et al. (2007, p.14); Hesping & Schiele (2015) p.144

[36] See Hesping & Schiele (2015), p.144

[37] See Schiele (2019), p.57

[38] See Hesping & Schiele (2016a), p.475

[39] See Hesping & Schiele (2015), p.144

[40] Cousins et al. (2007), p.13

[41] See Hesping & Schiele (2015), p.147

[42] See Heikkilä & Kaipia (2009), p.2; Van Weele (2010), p.216; Heikkilä, Kaipia & Ojala (2018), p.4

[43] See Trautmann, Turkulainen, Harrtmann & Bals (2009), p.69; Van Weele (2010), p.85; Grajczyk, Amann & Essig (2013), p.3

[44] See Van Weele (2010), p.85; Grajczyk et al. (2013), p.3

[45] Hesping and Schiele (2015), p.144

[46] See Trautmann et al. (2009), p.62

The structure of sourcing categories may change, e.g. by adding new categories, due to changes in the business model or technological developments.[47] Further, the application of category management may differ per company, with regards to number and grouping of categories and hierarchy of categories.[48] While some companies analysed by Heikkilä and Kaipia (2009) have a limited number of categories with a strong focus on efficiency, others had hundreds of categories.[49] To manage this complexity, overarching main categories and subcategories are introduced. One of the major drivers of category management in purchasing is costs.[50] Firms use category management to achieve economies of scale and economies of learning by centralizing demand, processes and capabilities.[51] Therefore, the "organizational design of global sourcing organizations is dependent on the category-related synergies across geographical units".[52]

Purchasing categories are managed by category managers. Category managers especially within global organizations centralize decision making and are responsible for the global integration of information and demand.[53] They develop categories' purchasing strategies, steer the development of the category and manage the communication with stakeholders within and outside the organization.[54] Category managers, being responsible for strategies, "should be trained, highly skilled analytical thinkers capable of digesting a host of objective data and translating it into a desired direction for the firm".[55] However, strategy making may be seen as both art and science that needs structured processes and analytics as much as creative thinking.[56] Different categories have different competitive priorities that are the basis for category strategies.[57] To assure best performance of the category, category managers have to match their priorities and category strategies within the existing organization, practices, tools and competences.[58]

[47] See Heikkilä et al. (2018), p.4

[48] See Heikkilä et al. (2018), p.19

[49] See Heikkilä & Kaipia (2009), p.9

[50] See Heikkilä et al. (2018), p.10

[51] See Heikkilä & Kaipia (2009), p.7; Trautmann et al. (2009), p.64-66; Heikkilä et al. (2018), p.11

[52] Trautmann et al. (2009), p.58

[53] See Trautmann et al. (2009), p.66

[54] See Heikkilä et al. (2018), p.17

[55] Parnell & Lester (2003), p.292

[56] See Parnell & Lester (2003), p.292

[57] See Luzzini, Caniato, Ronchi and Spina (2012), p.1017; Grajczyk et al. (2013), p.3

[58] See Grajczyk et al. (2013), p.3

2.3 Traditional purchasing objectives of cost, quality and supply security are still most relevant

The literature lists different purchasing objectives (see appendix A1). Traditionally, purchasing is focused on supplying products with appropriate quality at lowest possible costs.[59] Supply security may also be considered a traditional objective[60], but is often regarded as a basic objective of procurement and hence, not considered by several authors.[61] Further, delivery time and lead times[62], delivery flexibility[63], efficiency[64], innovation[65], sustainability[66] and access to limited resources for competitive advantage[67] are mentioned as purchasing objectives. According to Schiele (2019), facilitation of innovation and privileged access to resources for competitive advantage can be considered as newer objectives.[68]

In a survey of purchasing professionals on purchasing category priorities, Luzzini et al. (2012) identified cost as main priority of category strategies, followed by continuous and good delivery performance and quality.[69] Only then, respondents rank innovation and efficiency with sustainability taking the last position. All categories independent of supply risk and strategic importance have cost as most important objective. While steady categories with low market uncertainty also focus on product quality and innovation, categories with higher market volatility are less long-term focused and aims to control price and demand.[70]

Category sourcing strategies can have both quantitative objectives focused on cost reduction as well as qualitative objectives related to improving the supply security or

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[59] See Kruse, Pagell and Curkovic, (2001), p.500-501; Luzzini et al. (2012), p.1027-1028; Cousins et al. (2007), p.107; Van Weele (2010), p.217; Schiele (2019), p.48

[60] See Schiele (2019), p.48

[61] See e.g. Kruse et al. (2001), p.500-501; Van Weele (2010), p.217; Luzzini et al. (2012), p.1027-1028

[62] See Kruse et al. (2001), p.500-501; Cousins et al. (2007), p.107; Van Weele (2010), p.217; Luzzini et al. (2012), p.1027-1028

[63] See Kruse et al. (2001), p.500-501; Cousins et al. (2007), p.107

[64] See Van Weele (2010), p.217; Luzzini et al. (2012), p.1027-1028

[65] See Kruse et al. (2001), p.500-501; Cousins et al. (2008), p.107; Luzzini et al. (2012), p.1027-1028; Schiele (2019), p.49

[66] See Luzzini et al. (2012), p.1027-1028

[67] See Schiele, (2019), p.49

[68] See Schiele (2019), p.48

[69] See Luzzini et al. (2012), p.1028

[70] See Luzzini et al. (2012), p.1015

quality of deliveries, etc., that in later stages may lead to cost reductions.[71] Not all objectives are easily transferable into quantitative and measurable goals. To consider the total costs, firms also need to evaluate the costs and probability of disruptions of the supply chain and compare them to investments for risk mitigation.[72] It can hence be argued, that all objectives of category strategies are directly or indirectly associated with costs. Van Weele (2010) mentions six quantifiable objectives of category strategies.[73] Those are cost reduction, quality improvement, lead-time reduction, inventory reduction, reduction of transaction cost and reduction of working capital. Because strategies are focused, one category strategy cannot consider all objectives and should rather focus on one or two objectives based on the importance to the internal stakeholders.[74]

2.4 Category supply strategy describes a company's approach how to deal with its supply markets and suppliers

A supply strategy or category sourcing plan provides "general orientation indicating how a company plans to purchase a particular commodity"[75], by explaining "how the company is going to deal with certain supply markets and its key suppliers"[76]. Although it is key to analyse the supply side and processes and develop a strategy, supply strategies are the outcome of many amendments and changes to the initial plan further refine it or to solve unforeseen problems.[77] A supply strategy generally covers three topics: the scope of supply, the supply base and the configuration and intensity of supplier relationships.[78] A more elaborate typology is described by Arnold (1997), who describes seven concepts to be covered by a sourcing category strategy.[79] It should illustrate the value creation model (1) , clarify the sourcing object (2), define the supply chain model (3), state the number of suppliers (4), provide a location concept (5) and a pooling concept (6) and address planned sourcing levers (7). The value creation model deals with the scope of internal production and sourcing and defines if a company wants to make or buy a product or cooperate with others to obtain a product. Next to that, a category strategy should address the sourcing

[71] See Hofmann, Maucher, Kotula, & Kreienbrink (2012), p.23-24

[72] See Kleindorfer & Saad. (2005), p.57

[73] See Van Weele (2010), p.217

[74] See Cousins et al. (2007), p.107

[75] Schiele, Horn & Vos (2011), p.319

[76] Van Weele (2010), p.216

[77] See Gadde & Snehota (2000), p.306-307

[78] See Gadde & Snehota (2000), p.307

[79] See Arnold (1997), p.93-122; Schiele (2019), p.57

object and explain whether raw materials, components or complete systems or finished products are bought. The supply chain model clarifies the supply chain set-up, e.g. whether the product is to be kept on stock or delivered just in time. Further, the category strategy defines the number of suppliers, meaning whether a product is single sourced, dual sourced, etc. Moreover, a category strategy provides a locational concept that describes for which demand products are to be procured locally, regionally or globally. The pooling concept clarifies how the demand is bundled across production sites and entities. Lastly, tactical sourcing levers detail how the category manager wants to create value in the category. In addition to that, Van Weele (2010) demands clear performance requirements and measurements in form of KPI, e.g. inventory reduction, as well as specifics regarding contractual aspects, e.g. if pricing should be based on costs or performance.[80] Sourcing strategies aim to improve the buyer's leverage in the future by understanding of the power-relations between buyer and supplier and supply and demand.[81] In order to achieve this target, decisions have to be made where to intervene, to which extend, with what type of initiative on what organisational level.[82] Triggered by the rise of supply chain management and increasing integration with suppliers, relationships with suppliers have become more long-term and collaborative.[83] Such relationships with suppliers are important due to the value they provide to the company[84] but are also costly to maintain. While a relationship to a certain supplier may bring cost improvements or revenue benefits, those need to be balanced with relationship handling costs that arise from intensive communication to maintain and develop the relationship, mutual adaptations and investments to processes and structures.[85] Hence, companies need to evaluate their relationships with regards to benefits and costs and define the fitting relationship posture.[86] Yet, the benefits of supplier relationships may exceed the costs for two reasons. On the one hand, a supplier might represent a significant business volume. On the other hand, a supplier might offer technology and know-how that are important for the future development of a firm due to their impact on product quality or performance.[87] The impact of a supplier relationship does not depend on the provided product or service itself, but

[80] See Van Weele (2010), p.216-217

[81] See Cox (2001b), p.44

[82] See Harland (2002), p.29-33

[83] Cousins et al. (2007), p.13

[84] See Sheth & Sharma (1997), p.93-94

[85] See Gadde & Snehota (2000), p.308

[86] See Gadde & Snehota (2000), p.305

[87] See Gadde & Snehota (2000), p.307

rather on how it affects other supplier and customer relationships and how well the supplier "fits into the operations and the strategy of the buying company".[88] Therefore, "cost competitiveness is a necessary but not a sufficient condition for a key supplier status"[89] due to the increasing importance of supplier innovation and network effects.

2.5 Purchasing portfolio models as the Kraljic matrix help category managers to systematically evaluate purchasing items and use resources efficiently

Purchasing just as other disciplines in modern management uses tools for rational decision making. For example, portfolio models are used to support strategy development in procurement. By defining abstract models of reality, such tools suggest decisions based on historic and contextual data. To describe such tools and methods, March introduced the term *technologies of rationality*.[90] Although portfolio models used in purchasing are target of critique, Gelderman & Van Weele (2005) view them as clear signs of purchasing sophistication which describes the professionalism of purchasing and its strategic position within a firm.[91] Generally, portfolio models help to organize information through a systematic approach and relative evaluation[92]. Further, they facilitate consensus among different stakeholders by clear guidelines and provide support for further actions.[93] Thereby, purchasing portfolio models help firms to focus resources[94] and set priorities[95] to develop diversified purchasing strategies[96].

A commonly used purchasing portfolio model that has gained attention in academia and firms is the portfolio model by Kraljic.[97] This portfolio model assesses purchasing items based on profit impact and supply risk.[98] The profit impact is determined by the purchasing

[88] Gadde & Snehota (2000), p.307

[89] Jääskeläinen et al. (2016), p.12

[90] See March (2006), p.203

[91] See Gelderman & Van Weele (2005), p.21

[92] See Nellore & Söderquist (2000), p.246

[93] See Mikkola (2000), p.425

[94] See Kempeners & Van Weele (1997), p.86

[95] See Gelderman & Semeijn (2006), p.213

[96] See Stekelenborg & Kornelius (1994)

[97] See e.g. Kempeners & Van Weele (1997); Olsen and Ellram (1997), p.102; Handfield, Krause, Scannell & Monczka (2000), p.39; Nellore & Söderquist (2000), p.246; de Boer, Labro & Morlacchi (2001), p.78; Gelderman & Van Weele (2003), p.207; Visser & Van Goor (2006), p.244-245; Cousins et al. (2007), p.47; Skjøtt-Larsen et al. (2007), p.241

[98] See Kraljic (1977), p.72-75; Kraljic (1983), p.111

volumes, the share of total purchase costs, the impact on product quality and growth of the firm.[99] The supply risk is defined by the availability of the item, the number of suppliers, the competitors' demand, potential substitutes or make-or-buy options and the ability to store the product.[100]

Illustration 1: Kraljic matrix and generic strategies adapted from Kraljic (1983)

Yet, Kraljic does not provide a comprehensive list of characteristics and measurement scales.[101] Therefore, Olsen and Ellram (1997) in their adaptation widen the scope and define the dimensions as strategic importance of the purchase and difficulty of managing the purchasing situation. Next to Kraljic's purely economic view, Olsen and Ellram evaluate the strategic importance by the extent to which a purchase affects the knowledge and technological competence of the firm or whether it is part of a firm's core competencies, as well as image factors relating to brand image and environmental or safety concerns.[102] The difficulty of managing the purchasing situation is related to product characteristics, such as novelty and complexity, to supply market characteristics, meaning supplier power and competence, as well as environmental characteristics, as risk and

[99] See Kraljic (1983), p.112

[100] See Kraljic (1983), p.111

[101] See Olsen & Ellram (1997), p.105; Luzzini et al. (2012), p.1023

[102] See Olsen & Ellram (1997), p.104

uncertainty.[103] Gelderman & Van Weele (2003) found that firms use additional information such as "the overall business strategy, the situations on supply markets, and the performance capacities and intentions of (individual) suppliers".[104] In practice, this leads to diverse approaches to evaluate items and measure of supply risk and profit impact.[105] Overall, there are three different approaches to the positioning process for portfolio models.[106] First, companies may engage in an open discussion of stakeholders that leads to a consensus on a positioning considering different perspectives. Second, in the one-by-one method one measure is assigned to each dimension of the matrix allowing quick and unambiguous assessment. Third, companies can customize the assessment and fit the matrix to their needs by giving weights to the different factors.[107] If objectivity is key, a one-on-one approach is suggested. If firms want to consider many factors, the consensus or weighed factor method are recommended.[108] The positioning in the portfolio matrix may strongly depend on the perspective of the evaluator. Hence, colleagues with different backgrounds and functions should be involved to apply the portfolio model with a holistic view.[109]

Based on the evaluation of profit impact and supply risk, purchase items are sorted into one of the four quadrants of the matrix. There are strategic items with high profit impact and high supply risk, bottleneck items with high supply risk and low profit impact, leverage items with low supply risk and high profit impact and non-critical items with low supply risk and low profit impact.

[103] See Olsen & Ellram (1997), p.104

[104] Gelderman & Van Weele (2003), p.212

[105] Gelderman & Van Weele (2003), p.215

[106] Gelderman & Van Weele (2003), p.210-211

[107] See Olsen & Ellram (1997), p.112-113; Gelderman & Van Weele (2003), p.210-211

[108] See Gelderman & Van Weele (2003), p.214

[109] See Gelderman & Van Weele (2003), p.210

Positioning	Main tasks	Required information	Decision level
Strategic items	• Accurate demand forecasting • Detailed market research • Development of long-term supply relationships • Make-or-buy decisions • Contract staggering • Risk analysis • Contingency planning • Logistics, inventory and vendor control	• Highly detailed market data • Long term supply and demand trend • Good competitive intelligence • Industry cost curves	Top level (e.g. vice president purchasing)
Bottleneck items	• Volume insurance (at cost premium if necessary) • Control of vendors • Security of inventories • Backup plan	• Medium-term supply and demand forecasts • Very good market data • Inventory costs • Maintenance plans	Higher level (e.g. department heads)
Leverage items	• Exploitation of full purchasing power • Vendor selection • Product substitution • Targeted / pricing strategies/ negotiations • Contract/spot purchasing mix • Order volume optimization	• Good market data • Short-to-medium term demand planning • Accurate vendor data • Price/transport rate forecast	Medium level (e.g. chief buyer)
Non-critical items	• Product standardization • Order volume monitoring / optimization • Efficient processing • Inventory optimization	• Good market overview • Short-term demand forecast • Economic order quantity • Inventory levels	Lower levels (e.g. buyers)

Table 1: Kraljic portfolio quadrants and recommended approach (Kraljic, 1983)

2.6 Beside category focused portfolio approaches, other purchasing portfolios evaluate individual relationships based on account attractiveness or power-relations

While the Kraljic portfolio model and its adaptations evaluate products, other matrices relate to buyer-supplier relationships and often aim to show power relations and dependence. Those are vital to understand buyer-supplier relationships."[110] Examples for such matrices are the competence development matrix by Møller, Johansen & Boer (2003) that assesses the contribution of knowledge from both buyers and suppliers[111] or the framework by Bensaou (1999) that evaluates relationship specific investments of buyers and suppliers[112]. In strategic partnerships, buyers and suppliers invest time, effort or tangibles in the relationship that result in a dependence on the other party.

Further models relate to the attractiveness of business partners which can be evaluated from both the buyer's and supplier's perspective. An early model presented by Fiocca (1982) first identifies important accounts by evaluating strategic importance and complexity of managing each account. In a second step, it displays the attractiveness of important customers in relation to the relationship between buyer and seller.[113] Ellram and Olsen (1997) present this portfolio approach from the buyer's perspective and describe three types of actions: strengthening supplier relationship, improving supplier attractiveness or performance or reduction of resources allocated to a relationship.[114] Similarly, a newer model mentioned by Schiele, Zachau and Hüttinger (2011) evaluates whether the supplier recognizes the buying firm as preferred or standard customer in relation to its competitive position in the market. It allows buying firms to strategically optimize buyer-supplier relationships and thereby gain preferential treatment of strategic suppliers, access to resources and innovation.[115]

Another purchasing portfolio approach takes a power perspective and evaluates the supplier's power relative to the buyer and vice versa.[116] The Purchasing Chessboard® by A.T. Kearney, for example, is based on the evaluation of supply and demand power.[117]

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[110] Gelderman (2003), p.116

[111] See Møller, Johansen & Boer (2003), p.372

[112] See Bensaou (1999), p.38-39

[113] See Fiocca (1982), p.54

[114] See Olsen & Ellram (1997), p.107

[115] See Schiele, Zachau & Hüttinger (2011), p.24

[116] See Cox (2001a), p.14;

[117] See Schuh et al. (2017), p.11-13

Also, Kraljic (1983) suggests mapping relationships for strategic items in such a matrix.[118] Cox (2001a) argues that a thoroughly developed strategy for procurement depends on factors that are out of the buyer's control, because the execution of a strategy depends on the relative buyer and supplier power.[119] Resource dependency theory "suggests that these different sources of power in buyer-supplier relations result in different levels of relative dependency, which in turn result in different levels of purchasing power".[120] Gelderman (2003) points out that those products with low supply risk and profit impact are also of little importance to the firm, while products with high supply risk and profit impact are of high importance with regards to resource dependence theory.[121] "Parties are inclined to seek for possibilities of influencing their relative power position".[122]Strategies based on the positioning matrix usually strive to reduce supplier dependence or increase buying power.[123] If a firm can exert dominance over its suppliers and at the same time have dominance over customer relationships it will be able to earn above normal returns[124]. In a power matrix, supplier and buyer power can be mapped[125] to identify whether buyer or supplier are dominant or if they are interdependent or independent[126]. Kraljic suggests exploiting, balancing or diversifying the supply base based on power relations.[127] If the demand and supply power are low, Schuh et a. (2017) suggest managing the spend, e.g. by reducing consumption or demand bundling. When demand power is high buyers should leverage the competition and when the supply power is high, they should attempt to change the demand e.g. by substitution. If both supply and demand power are high, the authors suggest creating win-win situations, or joint advantages. [128]

[118] See Kraljic (1983), p.113-114

[119] See Cox (2001a), p.9

[120] Pazirandeh (2014), p.24

[121] See Gelderman (2003), p.108

[122] Gelderman & Van Weele (2003), p.209

[123] See Gelderman & Van Weele (2003), p.213; Caniëls & Gelderman (2005), p.142

[124] See Cox (2001a), p.10-12

[125] See Kraljic (1983), p.113-114; Cox (2001a), p.13; Schuh et al. (2017), p.11-13

[126] See Cox (2001a), p.13-14

[127] See Kraljic (1983), p.113-114

[128] See Schuh et al. (2017), p.11-13

2.7 Power and dependence are connected to supply risk and profit impact and can be linked to the Kraljic portfolio model – dependence is not necessarily negative while dominance should not always be exploited

Power is rooted in dependence of one party on another[129] and in buyer-supplier relationships relates to the potential influence of buyer or supplier. There are different potential areas of influence. Commercial details such as prices, terms and conditions or volumes, are most relevant to buyers.[130] While a firm may adapt to the power asymmetry in unfavourable relationships, firms may also attempt to change or use safeguards against power exploitation, e.g. by collaborative buying or building long-term and trust-based relationships.[131] Cox (2001b) suggests, that buyers may change supplier dominance to buyer dominance e.g. by commoditization and standardization of the supply and by transparency on costs and quality.[132] Further, a buying company may increase a supplier's dependence on the buyer by joint development and ownership of products and technology as well as sharing innovation. Another way to reduce dependence on the supplier is to reduce switching costs or to standardize qualities to simplify substitution. Similarly, buyer dominance in cases of interdependence may be fostered by increased competition and exchangeability, control over intellectual property or increased buying volume. In contrast to this, Olsen and Ellram (1997) warn from exploiting a given asymmetry of power as markets are shifting quickly the situation may change to the disadvantage of the buying company.[133]

Some scholars directly link the idea of power to the Kraljic portfolio model and argue that power positions of buyers and supplier for products differ among the different quadrants.[134] Kempeners and Van Weele (1997) and Gelderman (2003) theorize that for products, where the profit risk exceeds the supply risk, the buyer dominates, while supply risk exceeding profit impact means suppliers dominate[135]. Only along the diagonal at about equal supply risk and profit impact, the power is balanced. This is depicted in illustration 2. In contrast, a later case study finds that buyer dependence exceeds supplier dependence for bottleneck and strategic items, while leverage items are buyer dominant. Non-critical items

[129] See Emerson (1962), p.32

[130] See Emerson (1962), p.32; Meehan & Wright (2011), p.38

[131] See Cox (2001a), p.13; Cox (2001b), p.44; Pazirandeh (2014), p.95

[132] See Cox (2001b), p.44

[133] See Olsen & Ellram (1997), p.106

[134] See Kempeners & Van Weele (1997), p.94; Caniëls & Gelderman (2005) p.142, p.; Caniëls & Gelderman (2007), p.221-222

[135] See Kempeners & Van Weele (1997), p.93-94); Gelderman (2003), p.107

are characterized by balanced dependence levels.[136] Generally, purchasing portfolio models assume that power relations define, how gains are distributed among the buyer and supplier,[137] suggesting to either exploit power or avoid risks depending on whether buyer or supplier have a better bargaining position.[138] Strategies aim at defending the own position of power or at achieving dominance over the other equally strong or more powerful party.[139] Yet, Caniëls and Gelderman (2007) argue that successful strategic partnerships are not dependent on balance of power, finding satisfactory supplier-dominated partnerships for strategic items[140]. The existence of power imbalance does not mean that this power is also used or misused.[141] But, dependence limits the "freedom of choice of actions"[142], meaning that not all measures may be suitable to all power-relations. Also, interdependence due to "counterpart-specific adjustments (…) may reduce total costs and/or increase the value of exchanges".[143] Despite the disagreement on the power relations it can be concluded that different positions in the Kraljic matrix seem to have different market conditions with regards to supply security and profit impact and hence power relations.

[136] See Caniëls & Gelderman (2005), p.152; Caniëls & Gelderman (2007), p.227

[137] See Dubois & Pedersen (2002), p.40

[138] See Kraljic (1983), p.113-114; Dubois & Pedersen (2002), p.40

[139] See Kempeners & Van Weele (1997), p.94-95

[140] See Caniëls & Gelderman (2007), p.227

[141] See Kempeners & Van Weele (1997), p.90; Gelderman (2003), p.116

[142] Gelderman (2003), p.118

[143] Dubois & Pedersen (2002), p.40

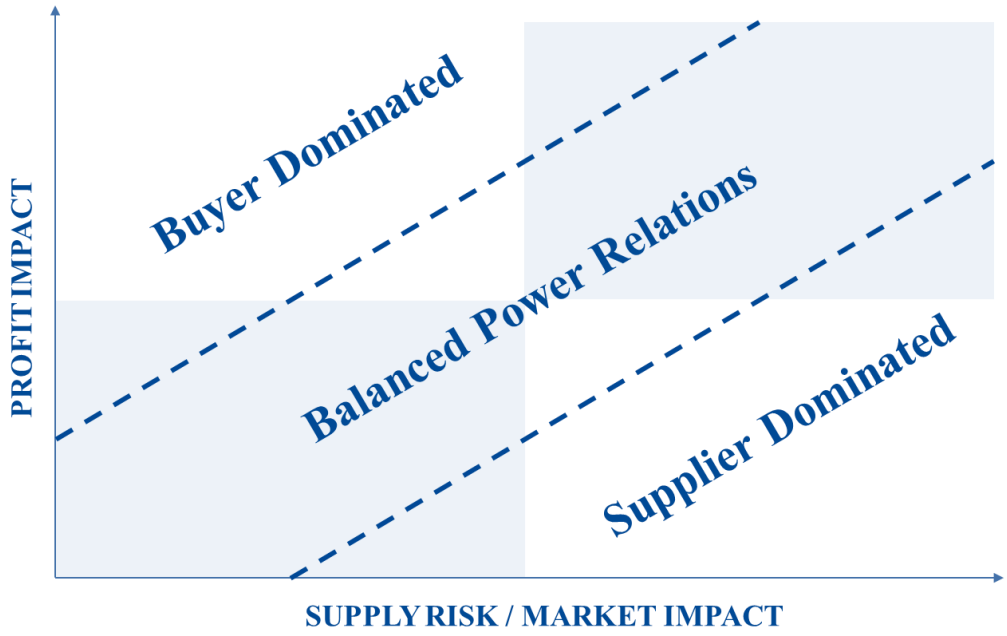

Illustration 2: Power relations for products in the Kraljic matrix according to Kempeners & Van Weele (1997)

2.8 Depending on their positioning in the Kraljic matrix, category managers are suggested to pursue different strategic directions

Based on the different market situations in the different quadrants the literature suggests different purchasing and management approaches based on the positioning in the matrix to meet the strategic needs of the purchasing item with sufficient attention and tools.[144] Strategies based on the Kraljic matrix usually strive to reduce supplier dependence or increase buying power[145] and accordingly define action plans based on the relation of company strength to supply market strength[146]. The higher the strategic importance or risk for the firm, the more emphasis should be put on collecting detailed market information as well as strategy and planning.[147]

While non-critical categories should focus on efficiency, leverage categories should use their commercial advantage to achieve attractive deals. Bottleneck categories should focus on assuring continuous supply while strategic categories should engage in cooperation and long-term relationships to assure supply security[148] while benefiting from supplier know-

[144] See Kraljic (1983), p.112; Nellore & Söderquist (2000), p.263; Macbeth (2002), p.61

[145] See Gelderman & Van Weele (2003), p.213; Caniëls & Gelderman (2005), p.142

[146] See Kraljic (1983), p.113-114

[147] See Kraljic (1977), p.76

[148] See Kraljic (1977), p.73; Kraljic (1983), p.111-112

how and technology[149]. Due to the strategic importance of strategic and bottleneck products, decision making should include top or higher management.

The non-critical quadrant is reported to typically contain most products.[150] Due to the workload that non-critical items produce despite their low strategic importance and market complexity, they are considered as "nuisance"[151] to buyer and supplier. Hence, some companies aim to reduce the number of items in the non-critical quadrant.[152] Typical non-critical items would be commodities with low prices.[153] At the focal company, non-critical categories contain a wide range of products from utilities to large commodities. The available literature suggests sourcing measures focused on reducing transaction costs.[154] Hence, many scholars suggest process optimizations such as standardizing and simplifying the buying process by e.g. credit cards and e-commerce tools[155], improving the purchase to pay process[156], optimizing inventory management[157], e.g. by implementing vendor managed inventory, monitoring orders and ordered volumes[158] or combining and integrating several small products by pooling[159]. Moreover, product optimization with a focus on standardization may reduce the number of variants and enable further pooling of demand.[160] Furthermore, few sources suggest looking for alternative sources or price evaluation to reduce costs.[161]

[149] See Cousins et al. (2007), p.47

[150] See Macbeth, 2002, p.55

[151] Macbeth (2002), p.55

[152] See Gelderman & Van Weele (2003), p.212

[153] See Macbeth (2002), p.55

[154] See Olsen & Ellram (1997), p.105; Macbeth (2002), p.5; Gelderman & Van Weele (2003), p.213; Cousins et al. (2007), p.51

[155] See Olsen & Ellram (1997), p.105; Macbeth (2002), p.55; Gelderman & Van Weele (2003), Caniels & Gelderman (2005), p.146; p.213; Gelderman & Semeijn (2006), p.214; Heß (2010), p.36

[156] See Gelderman & Semeijn (2006), p.214

[157] See Kraljic (1983), p.112; Gelderman & Van Weele (2003), p.213

[158] See Kraljic (1983), p.112

[159] See Olsen & Ellram (1997), p.105; Macbeth (2002), p.55; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.145

[160] See Kraljic (1983), p.112; Olsen & Ellram (1997), p.105; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.146

[161] See Macbeth (2002), p.55; Cousins et al. (2007), p.51

Bottleneck is considered as unfavourable position for categories. Therefore, companies also aim to reduce the number of categories classified as bottlenecks.[162] Often, bottleneck products are "unique in some way"[163] and suppliers have a monopoly. Therefore, category strategies are suggested to find alternative suppliers[164] or product optimization to reduce uniqueness and be able to accept other suppliers[165]. In addition, risk management is advised with risk analysis and contingency plans[166], safety or consignment stocks[167], improved market and supplier intelligence[168]. Other options are to achieve better control over the supplier[169] by building and improving supplier relationships to streamline processes and collaborate to achieve lower operational costs[170] or long-term contracts that may contain damage clauses[171]. In the worst case for the buying firm, the product must be secured by paying a price premium.[172]

For leverage categories with a low supply risk but high profit impact buying companies are suggested to focus on costs[173] and exploit their purchasing power fully in order to benefit from their advantageous position.[174] Many scholars suggest extending the supply base and switching to the supplier with best conditions or using the threat of replacement to renegotiate and gain better prices and conditions by incumbent suppliers.[175] Optimizing the spot-contract ratio for standard products is a typical measure that utilizes the exchangeability.[176] Based on the rivalry in the market, buyers can retender contracts[177] or

[162] See Gelderman & van Weele (2003), p.212

[163] See Macbeth (2002), p.54

[164] See Olsen & Ellram (1997), p.105; Macbeth (2002), p.54; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.145; Gelderman & Semeijn (2006), p.214

[165] See Olsen & Ellram (1997), p.105; Macbeth (2002), p.54; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.145

[166] See Kraljic (1983), p.112; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.143

[167] See Kraljic (1983), p.112; Gelderman & Van Weele (2003), p.213; Caniels & Gelderman (2005), p.145; Gelderman & Semeijn (2006), p.214

[168] See Macbeth (2002), p.56

[169] See Kraljic (1983), p.112

[170] See Olsen & Ellram (1997), p.105

[171] See Gelderman & Van Weele (2003), p.213; Cousins et al (2007), p.51

[172] See Kraljic (1983), p.112; Caniels & Gelderman (2005), p.145

[173] See Macbeth (2002), p.56

[174] See Kraljic (1983), p.112

[175] See Kraljic (1983), p.112; Cousins et al. (2007), p.51; Macbeth (2002), p.54; Caniels & Gelderman (2005), p.145

[176] See Kraljic (1983), p.112

use competitive bidding[178] and target pricing or negotiate on cost-plus basis[179]. To limit the dependence on suppliers, only few sources suggest optimizations of the supplier relationship by performance monitoring and supplier development[180] or cooperation[181] to contribute to the competitive advantage. Due to a good bargaining position, single sourcing for economies of scale or demand bundling[182], e.g. by framework agreements[183], are suggested seldom.

Strategic products due to their high impact on the firm and the high market complexity should engage in the relationships with supplier for mutual benefit.[184] Those products demand lots of attention from management.[185] Hence, the generally suggested tactic is to develop strategic or long-term partnerships with mutual objectives[186], to collaborate on innovation[187] or reduce costs from performance issues[188]. Beside supplier relationships, a second focus topic is process optimization. The literature suggests extensive market research and demand planning as basis for decision making on such impactful products, risk analysis and contingency plans to mitigate risks for supply disruptions, contract staggering, logistics and inventory optimization[189] as well as digital integration, e.g. via EDI[190]. Due to the relevance of the product for the firm, Kraljic suggests make or buy evaluations.[191] To reduce the dependence, a firm may look for alternative suppliers, too.[192]

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[177] See Macbeth (2002), p.56

[178] See Gelderman & Van Weele (2003), p.214; Caniels & Gelderman (2005), p.145

[179] See Kraljic (1983), p.112; Macbeth (2002), p.56; Cousins et al. (2007), p.47

[180] See Gelderman & Semeijn (2006), p.214

[181] See Gelderman & Van Weele (2003), p.214; Gelderman & Laeven (2005), p.8; Caniels & Gelderman (2005), p.146

[182] See Cousins et al. (2007) p.51

[183] See Caniels & Gelderman (2005), p.145

[184] See Olsen & Ellram (1997), p.105; Nellore & Söderquist (2000), p.248; Macbeth (2002), p.54; Gelderman & Van Weele (2003), p.214

[185] See Visser & Van Goor (2006), p.246

[186] See Kraljic (1983), p.112; Olsen & Ellram (1997), p.105; Macbeth (2002), p.58; Gelderman & Van Weele (2003), p.214; Caniels & Gelderman (2005), p.143; Gelderman & Semeijn (2006), p.214; Cousins et al. (2007), p.51; Heß (2010), p.36

[187] See Olsen & Ellram (1997), p.105; Nellore & Söderquist (2000), p.251; Cousins et al (2007), p.52

[188] See Olsen & Ellram (1997), p.105

[189] See Kraljic (1983), p.112

[190] See Kraljic (1983), p.112; Nellore & Söderquist (2000), p.251

[191] See Kraljic (1983), p.112

[192] See Caniels & Gelderman (2005), p.143

However, due to the mutual dependence and the level of integration, a change of suppliers is expected to be costly and difficult.

With the positioning assessed, firms have two strategic options, to accept the position in the matrix or deliberately take actions to change it.[193] If a firm accepts the dependency on few suppliers for bottleneck items, it must manage the risk, e.g. by assessing risks and planning counter measures, closing long-term contracts and holding safety stocks.[194] If firms however want to reduce supply risk and thereby move towards a non-critical position, they will strive to broaden specifications, search for alternative suppliers or even develop substitutes to current sources.[195] For non-critical items, firms may pool demand and bundle items by contracting whole packages with preferred suppliers, using e-procurement catalogues to move the whole bundle towards leverage.[196] For leverage items, firms may engage in a strategic partnership if a supplier can contribute to the competitive advantage of a firm.[196] With strategic items, firms may want to change suppliers and terminate long-term engagements if supplier performance becomes inacceptable.[196]

Beside category-specific and positioning related objectives, e.g. relating to all bottleneck-categories, firms may also have matrix objectives referring to the overall distribution of categories among the matrix, e.g. eliminate all bottleneck items.[197] Cousin et al. (2008) map sourcing structures per quadrant of Kraljic's matrix based on the strategies.[198] While multiple sourcing is assigned to non-critical products to create efficiency and achieve lowest costs, leverage products should be sourced by tiering suppliers to reduce complexity while maintaining competition down the tiers. Sole sourcing is suggested for bottleneck products to have a more detailed view on the situation.

2.9 Critique on portfolio models in general and the Kraljic portfolio model focuses on the measurement of the dimensions, the evaluation of items and the validity of strategic recommendations

Portfolio approaches, such as the Kraljic portfolio model, are criticized for their selection of measurement items as basis for the classification and the disregard of interdependencies

[193] See Gelderman & Van Weele (2003), p.215

[194] See Gelderman & Van Weele (2003), p.213-214; Caniëls & Gelderman (2005), p.150

[195] See Caniëels & Gelderman (2005), p.144-145

[196] See Gelderman & Van Weele (2003), p.213-214; Caniëels & Gelderman (2005), p.144-146

[197] See Gelderman & Van Weele (2003), p.212

[198] See Cousin et al. (2008), p.54-57

among classified items.[199] Further, outsiders need a good understanding of the model and its dimensions to understand the classification and draw the correct conclusion.[200]

Portfolio models capture a variable at a moment in time. However, especially long-term business relationships are bound to a history and change[201] that can hardly be captured by a two-dimensional matrix[202]. Further, each relationship is part of a bigger network of interdependent relationships of a company that may affect each other.[203] Portfolio models as a way of managing business relationships are "based on a particular set of assumptions about how industrial markets operate"[204]. Purchasing portfolio models simplify context and relationships and fail to create a holistic view by defining two distinct dimensions.[205] Hence, "to understand the interactive nature of customer–supplier relationships in business markets and their dynamics, the scope of analysis needs to be broadened".[206]

This is also valid for the Kraljic portfolio model. First, the measurement of variables is unclear as Kraljic did neither provide a comprehensive list of measurement items nor details on how to measure those he mentions making the evaluation subjective.[207] Also, the demarcation between high or low supply risk or profit impact is unclear and depends on the individual application.[208] However, if the assessment fails to differentiate between high and low profit impact or supply risk, "then the classification of products will be arbitrary and so will be the provided recommendations."[209] Recently, Montgomery et al. (2018) published a quantified approach to the Kraljic matrix tackling the issues of subjective positioning while suggesting a way to prioritize items based on rank-orders of a set of measures[210]. Further, it is stated that those two dimensions of profit impact and supply risk are not sufficient to capture the full picture and derive sufficient actions.[211] Moreover, Olsen and Ellram (1997) criticize that the interdependencies of items and categories cannot

[199] See Nellore & Söderquist (2000), p.246

[200] See Mikkola (2000), p.426

[201] See Dubois & Pedersen (2002), p.36

[202] See Gadde & Snehota (2000), p.315; Dubois & Pedersen (2002), p.40

[203] See Gadde & Snehota (2000) p.315; Dubois & Pedersen (2002), p.36

[204] Dubois & Pedersen (2002), p.36

[205] See Dubois & Pedersen (2002), p.40

[206] Gadde & Snehota (2000), p.315

[207] See Olsen & Ellram (1997), p.104-105; Gelderman & Van Weele (2003), p.208; Padhi et al. (2012), p.2; Montgomery et al. (2018), p.193

[208] See Heß (2010), p.151

[209] Gelderman & Van Weele (2003), p.208

[210] See Montgomery, Ogden & Boehmke (2018), p.195

[211] See Gelderman & Van Weele (2003), p.215; Luzzini et al. (2012), p.1027

be depicted in the portfolio model that evaluates individual purchasing items and categories.[212] In addition, the perspective of the suppliers is completely disregarded for the evaluation of the market.[213] Consequently, Kraljic's matrix only considers the buyer's point of view and thereby might ignore important aspects related to earlier stages of the supply chain that might influence a supplier's decision making.

Next to the critique related to the dimensions of the matrix and evaluation of items, some scholars also criticize the strategic recommendations given by the matrix. The portfolio model does not give guidance in choosing the right set of actions in the right order, as it does only propose several generic options.[213] Kraljic (1983) points out that an item may change its position and should therefore be reviewed regularly.[214] But, he does not discuss deliberate movements in the matrix by changing the supply risk or profit impact.[215]

2.10 Tactical sourcing levers are the building blocks of supply strategies that may be combined with regards to certain trade-offs

Based on the evaluation of products, category managers define sourcing strategies. While sourcing strategies describe an overall goal and path for a category of goods or services that should be achieved, the sourcing levers describe the path to meet them on a tactical level.[216] Tactical sourcing levers are improvement measures and may be understood as *'building blocks'* of category strategies that can be used in different combinations and contexts.[217] They provide a "common basis for creative and open, but integrated, cross-functional planning of actions".[218] "Firms may have to choose a set of internally consistent sourcing levers that, when aggregated, form a coherent sourcing strategy".[219] Such levers are e.g. demand bundling or price evaluation. According to Hesping and Schiele (2015) they allow for estimations of potential savings in relation to specific categories and markets.[220]

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[212] See Olsen & Ellram (1997), p.102

[213] See Gelderman & Van Weele (2003), p.214-215; Heß (2010), p.154

[214] See Kraljic (1983), p.113

[215] See Gelderman & Van Weele (2003), p.213; Caniëels & Gelderman (2005), p.142

[216] See Schiele, Horn & Vos (2011), p.322; Hesping & Schiele (2016b), p.102

[217] See Schiele et al. (2011), p.331

[218] Hesping & Schiele (2015), p.146

[219] Schiele et al. (2011), p.317

[220] See Hesping and Schiele (2015), p.146

Different lever frameworks have been presented in scholarly and managerial literature.[221] Based on literature, Schiele et al. (2011) identify seven tactical sourcing levers that are later taken up by Hesping and Schiele (2016a): Pooling of demand and volume bundling, Price evaluation through enhanced negotiation concepts, International sourcing and extension of the supply base, Product optimization, Process optimization, Supplier integration strategies or optimization of relationships and Commodity-spanning levers.[222] A list of those levers including the associated activities can be found in the appendix A4. The first three levers were identified to be used in most projects in a study of sourcing projects at an OEM. Hesping & Schiele (2016b) assume that those levers may be separated in two groups, transaction-oriented and relationship-oriented levers[223], based on the shift in procurement philosophy towards relationship-orientation described.[224]

During workshops to discuss the savings potential of different sourcing levers Schiele et al. (2011) found that demand pooling, price evaluation and product optimization seem to be the most applied levers.[225] However, most savings were expected from product optimization, demand pooling and international sourcing. Yet, a "balanced sourcing approach is more effective than an emphasis on any single tactic".[226]

Although Kraljic (1983) makes generic recommendations[227] that does not mean other options are to be excluded.[228] Linking sourcing levers to a category's location in the Kraljic portfolio matrix at an international OEM, Hesping and Schiele (2016b) found that purchasing professionals employed a diverse range of sourcing levers for categories in all quadrants of the Kraljic matrix.[228] Therefore, also within this project it is expected to find a diverse range of sourcing levers among all quadrants.

Strategic fit of a sourcing strategy and its tactics relates to the fit to the context but also to the internal fit. While some sourcing levers in combination yield even higher savings than any of them would individually, others in combination lower the savings potential.[229] Previous research indicates, that not all sourcing levers may be combined successfully as there seem to be trade-offs, e.g. between global sourcing and relationship improvements or

[221] See e.g. Schiele et al. (2011), p. 322-323; Hesping (2015), p.46; Schuh et al. (2017), p.11-13

[222] See Schiele et al. (2011), p.322-323; Hesping & Schiele (2016a), p.479-481

[223] See Hesping & Schiele (2016b), p.111

[224] See Sheth & Sharma (1997), p.94

[225] See Schiele et al. (2011), p.322-323

[226] Schiele et al. (2011), p.330

[227] See Kraljic (1983), p.112

[228] See Hesping & Schiele (2016b), p.111

[229] See Schiele et al. (2011), p.317

product improvements. While international sourcing increases competition for suppliers, integration and product optimization rely on close relationships and joint efforts. Hence, the tactics have different relational goals.[230] In contrast, international sourcing and price evaluation together are more effective in generating savings, potentially because both measures are transactional.[230]

2.11 Measuring the success of procurement and its contribution to the firm success

With the increasing importance of procurement for the success of the firm, firms need a systematic procurement controlling to show how procurement is supporting the overall firm strategy with its own objectives.[231] This also means, to follow up on measures from supply strategies to "gather, analyse and review achievements against the planned strategic direction".[232] Procurement may not only have quantitative objectives related to cost reductions, but also qualitative targets, e.g. to reduce risk.[233] A framework by Heß (2010) differentiates contributions by procurement on costs, revenue, financing or risk due to changes to products procured or processes.[234] It is depicted in the following illustration. Costs are determined by both changes of the material and prices as well as process costs. Procurement however also adds value due to suppliers' impact on product quality and supplier innovation, as well as delivery performance. By adjusting incoterms and payment term or reducing raw material inventories, purchasing can contribute to the financing of the firm by improved liquidity. Last, purchasing has a direct influence on supply risk stemming from its supply chains.

[230] See Schiele et al. (2011), p.329-330

[231] See Heß (2016), p.9

[232] Macbeth (2002), p.62

[233] See Hofmann et al. (2012), p.23-24

[234] See Heß (2016), p.11

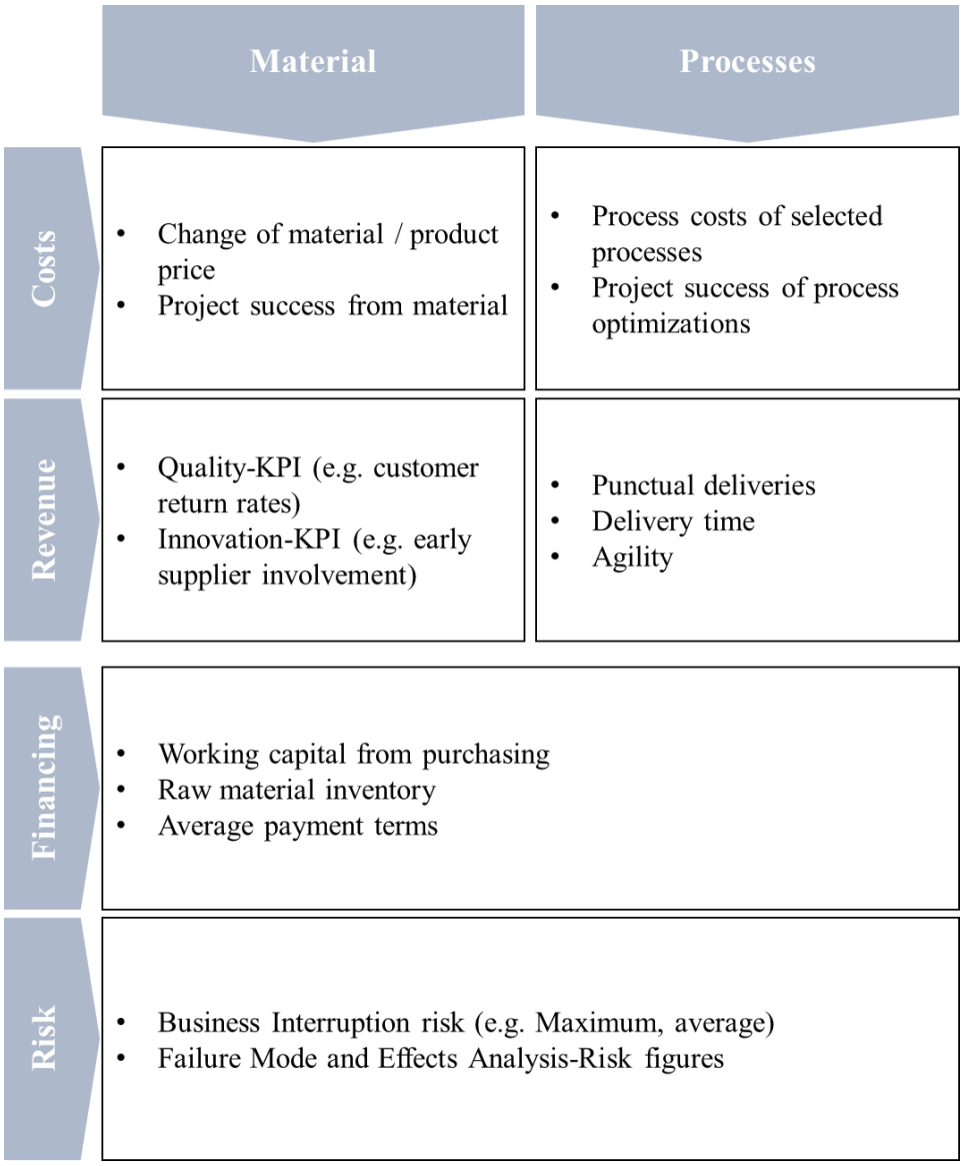

Illustration 3: KPI for Controlling of Purchasing Contribution to Firm Success, adapted from Heß (2010)

3 Methodology

3.1 Research combines testing application of sourcing levers in relation to Kraljic portfolio model and their implementation in relation to category characteristics and contextual factors

This research project aims to analyse the application of tactical sourcing levers in the different quadrants of Kraljic's portfolio matrix to identify potential differences for non-critical, bottleneck, leverage and strategic purchasing items. It is guided by Hesping's and Schiele's research on sourcing levers and their application in context of Kraljic's portfolio matrix.[235] A second part focuses on the implementation rate of sourcing measures in general in relation to the Kraljic matrix and explores contextual influence factors for implementation success of sourcing levers. After an initial literature review to facilitate a thorough understanding of the topic, data is collected from strategy documents and followed up in interviews with category managers.

To test for differences of sourcing lever usage among the portfolio quadrants an ANOVA is the method of choice. However, due to the small sample sizes of leverage and strategic categories, the differences in variance, and the moderate to high skewness, instead the Kruskal-Wallis H test can be applied.[236] It is not based on assumptions regarding the data distribution as it is based on ranks and instead only requires the dependent variables to be at least ordinal and the distributions to be continuous.[237] A comparison of histograms as well as tests of assumptions can be found in appendix A11. The Kruskal-Wallis test only tests for the differences of groups but does not show which groups differ from each other. Hence, in order to identify which portfolio quadrants differ by comparing them pairwise, a two-sample t-test could be used.[238] It assumes independence of the categories with different positioning, and demands randomized data collection which is fulfilled. However, it also assumes a normal distribution of the independent and homogeneous populations. As the histograms depicted in the annexures (appendix A11) show that levers and implementation rate are not distributed normally and in many cases skewed, the usage of the t-test is not advised. Hence, a rank-based non-parametric test is used. The Mann-Whitney U test enables the separate analysis of pairs of quadrants without assumptions regarding the normality or shape of data.[239] To test for the effect of contextual factors on

[235] See Hesping & Schiele (2016a), p.473; Hesping & Schiele(2016b), p.101

[236] See De Veaux, Velleman & Bock (2012), p.727-729

[237] See Dickinson Gibbons (1993), p.54; Moore, McCabe & Craig (2012), p.15-29

[238] See De Veaux et al. (2012), p.582

[239] Moore, McCabe & Craig (2012), p.15-5

lever implementation success, Mann-Whitney U tests are used. As the independent variables are categorical the Pearson Correlation cannot be used to show associations of variables with measure success.[240] An MANOVA that is also able to identify interaction effects cannot be used as the assumptions, such as homoscedasticity, are not met.[241] Consequently, the Mann-Whitney test was chosen for the exploration of factors that are associated with lever success although this does not allow for a correct analysis of interaction effects. Also, as multiple tests are used instead of one, the type 1 error increases which has to be considered when looking at the results.

3.2 Sample frame and data collection: By stratified random sampling categories were chosen for semi-structured interviews to understand all planned measures and their implementation status

The relevant raw material procurement departments of the focal firm were informed about objectives and the research methodology of this project via email by a senior executive, as well as presentations by the researcher in front of the different sub-departments, in person or via conference calls. To assure, that the interviewed category managers were well aware of the measures of the last category strategy, only categories with strategies written in 2015 or later were considered out of all available categories. Categories are divided into six sub-departments based on the characteristics of the raw materials or their application. Further, categories differed in terms of height of spend and whether they were managed globally or regionally. In addition, they had different positionings in Kraljic's matrix (appendix A10). To control for the effect of those characteristics and assure an accurate proportional representation of the variety in the raw material procurement at the focal company, stratified sampling was chosen, considering the procurement cluster, global or regionality, spend and well as positioning. On the one hand, this simplified the selection by limiting the pool of categories per strata. On the other hand, stratified sampling assured that the sample is representative of the whole European and global raw material procurement.[242] Sample characteristics were afterwards compared to the overall population of categories to control for representativeness. By sampling from the whole variety of direct sourcing categories of the sourcing company, the issue of external validity or generalizability to the chemical industry were accounted for as much as possible.[243] Yet, due to different products and

[240] See De Veaux et al. (2012), p.157

[241] See De Veaux et al. (2012), p.727-729

[242] See Neyman (1934), p.570; Bryman & Bell (2015). p.192

[243] See Lincoln & Guba (1985), p.291

hence different sourcing category setups in other firms, findings might not be generalizable to all other chemical firms.

The data collection took place in two ways. General data was available in a category index file. Each category had a documented category strategy that is renewed every three to four years. For all selected categories those category strategies were collected and reviewed to identify potential sourcing levers and create an initial understanding for the context of each category. Also, the exact ratings for supply risk and profit impact were extracted. Second, based on this initial data, semi-structured interviews were conducted with the category managers as key informants to better understand proposed measures and follow-up on the implementation status. The interviews took place in the work environment of the interviewees at the focal firm in a conference room or via a call if interviewees were located outside of Germany. Similar to previous research on sourcing levers, another means of data collection than a survey was chosen for reliability reasons.[244] First, category managers might have different understandings of sourcing levers. To facilitate a universal understanding, extensive descriptions would have had to be added to a questionnaire without guarantee that the category managers take time to read and understand the lever framework. Also, survey items or interview questions simplify and code daily activities. Therefore, they may impede ecological validity if they do not actually reflect the actual activities of respondents but rather forced choices.[245] In addition, a structured interview approach would have imposed boundaries to the interviewer's and the interviewee's interaction and thereby hindered the discussion on for example the separation of measures that are initially presented as one in the strategy documents. Semi-structured interviews allowed for thorough explanations of the planned measures and an interactive communication through follow up questions as reactions to previous statements of the interviewee.[246] Also, a semi-structured interview provided a more conversational atmosphere for the category managers to be open, whereas a survey might have been perceived as an audit leading to less willingness to cooperate and answer questions.

Based on the literature study and familiarization with the strategy process at the focal company, an interview guide was developed that covers questions on general information about category and market, follow up on all measures including degree of implementation and reasons for non-implementation or cancelation. The interview guide was challenged

[244] See Schiele et al (2011), p.324

[245] See Cicourel (1982), p.16-19

[246] See Opdenakker (2006), p.3; Bryman & Bell (2015), p.213

with category managers and a vice president of procurement. It is presented in appendix A8. Pilot interviews were conducted in form of field testing with potential participants to assure that the questions were well understandable and covered the relevant information[247] and to prepare the author as interviewer by practicing the interviewing skills and techniques.[248]

Although it is common to record interviews and transcribe them verbatim, interviewees "might feel inhibited by the presence of a recorder"[249]. As the pilot interviewees and management expressed concerns about recording the interviews, notes were taken by the interviewer throughout the interview instead. Immediately afterwards, the interviews were elaborated and transcribed into an excel file. This structured data is sent to the category managers for respondent validation, also known as member checks, to assure all information is captured accurately and interpreted correctly.[250] Category managers were asked to provide feedback if necessary. Hence, no response was considered as confirmation.

3.2 Measures from category supply strategies are sorted into empirically tested lever framework

Each category strategy entails different measures, such as standardization of product grades, vendor managed inventory or auctioning among others. Although there are numerous different kinds of measures that category managers plan to implement in their categories, all of them are directly or indirectly focused on cost reduction. While some measures directly aim to reduce costs, others aim to mitigate supply risk and disruptions which in turn indirectly saves costs from disruptions of the production process[251]. Initially, measures are identified from category strategies and then elaborated in interviews with category managers to facilitate a better understanding. To identify the tactical sourcing levers employed by the focal company, this study followed both a bottom up and top down approach to assure correct classification. First, each individual measure was evaluated and grouped by the researcher with similar activities, e.g. logistics optimization or collaborative buying. This led to about 50 different kinds of measures. To allow for a comparison of sourcing levers among non-critical, bottleneck, leverage and strategic

[247] See Kallio, Pietilä, Johnson & Kangasniemi (2016), p.2960

[248] See Whiting (2008), p.36

[249] See Whiting (2008), p.36-37

[250] See Lincoln & Guba (1985), p.314; Whiting (2008), p.38

[251] See Kleindorfer & Saad (2005). p.57; Hofmann et al. (2012). p.23-24

products, the empirically tested framework by Hesping and Schiele (2012a; 2012b) was applied leading to 7 tactical sourcing levers.[252] This framework was developed in world café discussions with purchasing professionals and tested with a sample of 107 sourcing projects at an OEM.[253] It was chosen for three reasons. First, it is rooted in previous research and has been refined gradually. In addition, it has been tested empirically in relation to the Kraljic matrix. Finally, it provides a detailed list of activities associated with the respective measures.

3.3 Supply risk and profit impact are evaluated as part of the strategy process at the focal company through an own adaptation of the Kraljic matrix with a set of questions

This research aims to analyse the application of sourcing levers in Kraljic's portfolio matrix. However, Kraljic only describes certain generic steps to evaluate purchasing items and lacks clarification on measurements.[254] Thus, **"**there is no simple, standardized blue print for the application of the [Kraljic] portfolio analysis. It requires reflecting on results, critical thinking and sophistication of purchasing management".[255] In practice, the measurements of firms for evaluation may be customized and may include additional information, e.g. on the business strategy or the situations in the supply market.[256] Yet, the portfolio approach provides a "framework for analysing purchasing problems and possibilities"[257] and allows for prioritization[258].

In contrast to Hesping and Schiele (2016b), who themselves classified each category according to Kraljic's portfolio matrix with self-developed survey items,[259] all sourcing categories at the focal company are evaluated according to Kraljic as part of the strategy process. Those evaluations of categories are used in this project.

[252] See Hesping & Schiele (2016a), p.473; Hesping & Schiele (2016b), p.107

[253] See Hesping & Schiele (2016a), p.486

[254] See e.g. Kraljic (1977), p.74-75; Olsen & Ellram (1997), p.105; Luzzini et al. (2012), p.1023

[255] Gelderman & Van Weele (2003), p.207

[256] See Gelderman & Van Weele (2003), p.212; See Gelderman & Semeijn (2006), p.213

[257] Gelderman & Semeijn (2006), p.215

[258] Gelderman & Semeijn (2006), p.213

[259]See Hesping & Schiele (2016b), p.105-6

3.4 Degree of implementation is identified for all measures and contextual factors of categories are collected as potential explanations

3.4.1 Degree of implementation to measure successful implementation

Next to evaluating measures in relation to their positioning in the Kraljic matrix, this research project also looks at characteristics that affect the success or failure of sourcing levers. So far, academic research has provided few insights into this topic, as stated by Hesping (2015).[260] Therefore, the success of levers needs to be defined. At the focal company, only few measures are linked to estimated savings and the success of measures is not followed up financially in detail. Also, each category strategy consists of various measures that influence the spend directly and indirectly. Further, some measures may reduce costs only indirectly, e.g. by mitigating supply risks.[261] Hence, a direct association of measures and savings or category development cannot be evaluated due to interactions of measures. Thus, the degree of implementation is used in this study as indicator for the implementation status as it enables to differentiate implemented from cancelled measures. The degree of implementation differentiates the different stages of the measure development and implementation process.[262] This research will use the following operationalization of the degree of implementation scale: identification of potential for improvement (1), development of solutions (2), planned initiatives (3), ongoing implementation processes (4), successfully implemented measures (5) as well as cancelled and non-successful implementations (6). Cancelled and non-successful measures capture all projects that were cancelled, stopped or abandoned.

Generally, all measures in strategies are considered as planned measures corresponding with degree 3. All measures in the process of implementation are considered as degree 4. However, some measures take more time to implement than others due to a bigger scope. All measures that are implemented are considered as degree 5. As not all measures are implemented successfully, cancelled or non-successful measures are considered as degree 6, which was added to the framework.

[260] See Hesping (2015), p.122

[261] See Hofmann et al. (2012), p.23-24

[262] See Bühlmeyer, Kluge & Krug (2016), p.21

3.4.2 Contextual factors as potential explanations for differences in implementation rate

As the scales of supply security and profit impact are continuous scales, product categories may have an *unclear positioning* if categories are located in between quadrants or close to the borders. Although recommendations should generally not be considered as imperatives, a careful consideration of actions is suggested with unclear positioning close to the demarcation lines.[263] The Kraljic matrix supports companies in setting a focus for certain activities by highlighting problems and potential for improvement and thereby allows prioritization. [264] As the recommendations for categories positioned unclear are less clear, category managers must either focus on one quadrant's target or follow both. The matrix becomes less helpful in providing orientation and prioritization. Hence, this study assumes that unclearly positioned categories will implement less suitable measures and yield lower implementation rates. Categories that deviate less than 0,25 points from the demarcation line of supply risk and profit impact are considered to be positioned less clearly.

Spend is one of the major characteristics of categories looked at in procurement. The higher the spend, the more relevant is a category to the overall spend of a firm and the higher is the absolute cost reduction potential. Therefore, it is assumed that categories with a higher spend are exposed to higher management attention within procurement, of higher relevance to the other stakeholders in the firm and more attractive to suppliers due to significant volumes. Therefore, categories with a higher spend are assumed to have a higher implementation rate due to the higher involvement of internal and external stakeholders. Here, categories with a spend below and above 70 MEUR are differentiated and compared.

Although the category manager is responsible for developing and driving category strategies, the implementation of many proposed levers depends on other *alignment with internal stakeholders*. Like projects all strategies have other internal stakeholders outside of procurement such as production, R&D or controlling that make demands[265]. It is key to create fit among the different functions and activities[266] and contribute to the firm's

[263] See Homburg (1995), p.292

[264] See Gelderman & Semeijn (2006), p.215

[265] See Knights & Mueller (2004), p.59

[266] See Porter (1996), p.70

success by the aligning purchasing strategies.[267] Therefore, it is assumed that strategies that have been challenged and aligned with internal stakeholders will be more successful in the implementation, resulting in a higher implementation rate. Qualifying new suppliers, for example, is a process that involves lab tests as well as production trials while holding all other factors constant (ceteris paribus). To engage in such a costly and resource intensive procedure, the benefits need to outweigh the costs. Also, lab capacities and production capacities need to be available. The effect of levers is therefore often dependent on the support of other stakeholders and hence on the alignment on common objectives and measures.

Categories can be formed based on similar product characteristics[268] or based on common supply markets.[269] Categories with a common supply market allow for a more focused market research and deeper understanding of market dynamics. In contrast, products that are grouped in a category due to common functionality or application may have different markets and demand a wider less focused approach to the category management. Therefore, it is assumed that categories whose products have a *common upstream value chain* allow for deeper market knowledge and economies of information leading to more successful measure implementation.

Sometimes there are *category manager changes* so that one category manager writes a strategy and another one is responsible for the implementation or finalization of the implementation. This discontinuity leads to a loss of expertise and know-how that is assumed to negatively impact lever implementation. Hence, category manager changes are assumed to lead to lower success in implementation.

Lastly, some category managers are also category buyers and thus have a *combined category manager and buyer role.* Therefore, they must also deal with a lot of operational tasks and less time and attention is left for dealing with strategic topics. It is assumed that those category managers that are also buyers will be less successful in implementing measures.

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[267] See Gonzales-Benito (2007), p.913

[268] See Trautmann et al. (2009), p.69; Van Weele, 2010, p.85; Grajczyk et al. (2013), p.3

[269] See Van Weele (2010), p.85; Grajczyk et al. (2013), p.3

3.6 Validity and reliability have been considered in the design of this research

The topics of validity and reliability have already been addressed to some extent in the previous chapter. By sampling a wide variety of sourcing categories based on stratified sampling, the research attempts to have a sample representative for the whole firm. By including all different business applications and kinds of materials the data is as representative for the whole chemical industry as possible as the firm is active in different segments, assuring external validity. By the design of the data collection on lever usage, issues in the understanding of levers and associated activities or implementation status are accounted for by letting the researcher classify measures. As research terms and construct names, such as levers, are not part of the interviewees' work or education they might have classified measures wrong and individually differently. All data is collected and transcribed in a table format. That the measures are understood and transcribed correctly including their status is assured by member checks. Hence, a potential threat to the validity is rooted in the correct classification of measures into lever constructs.[270] In order to assure that the lever constructs used in this study are able to reflect different tactical sourcing activities, a lever framework is used that is rooted in a literature review, refined in collaboration with practitioners in a world café method and empirically validated.[271] This lever framework has already been applied in a similar research to identify potential differences and similarities of tactical sourcing activities across the Kraljic matrix.[272] Measures here were classified as levers according to activities defined by Hesping and Schiele (2016b). Hence, the construct validity of analysed levers is assured.[273] The data collection took place within the time period of two months and dealt with category strategies developed from 2015 onwards. Thus, there are no direct time threats to the internal validity of the usage of tactical sourcing measures.[274] Yet, it has to be considered that due to the ongoing execution of strategies, the implementation status of measures might be affected by the time since a strategy was finalised. Therefore, the analysis of implementation rates only considers successfully finalised or cancelled measures and none that are still ongoing or planned.

Without reliability there is no validity. Stability defines whether a retest would yield the

[270] See Dooley (2009), p.267

[271] See Hesping & Schiele (2016a), p.483-486

[272] See Hesping & Schiele (2016b), p.105

[273] See Dooley (2009), p.270

[274] See Dooley (2009), p.266, p.271

same number of levers.[275] As measures were identified from sourcing strategy documents by the researcher and later discussed in interviews it can be argued that a repetition of the procedure would yield the same data. A second aspect is the inter-rater reliability.[276] As only one researcher has been categorizing the measures into the lever framework and the implementation status, there is no variation between raters. In appendix A9 an overview of cues is presented for the evaluation of methods. This allows for a potential re-evaluation based on those guidelines.

Due to the scope of this research project, one topic relevant to the internal validity of the research is not addressed: the measurement of the independent variables profit impact and supply risk in the Kraljic matrix. In previous works Hesping and Schiele (2016a) have developed and tested survey items to measure both dimensions assuring construct validity.[277] However, as the focal company has an own process with questions to define the position in the Kraljic matrix, this step was omitted. If the constructs to measure profit impact and supply risk were not valid, this would limit the validity of the research. Yet, there are three major reasons for the chosen approach. First, the scope of this project is limited. Second, the literature suggests to adapt the matrix to the own firm and hence different versions of the same matrix approach exist. Last, category managers themselves position the category after careful consideration and internal discussion which can barely be challenged.

[275] See Brymann & Bell (2015), p.168

[276] See Brymann & Bell (2015), p.168

[277] See Hesping & Schiele (2016a), p.107

4 Analysis and Findings

4.1 Levers are analysed in relation to the Kraljic matrix

The data on tactical measures from strategy documents and semi-structured interviews is used for further analysis. In a first step, subcategories with different positionings are split to allow for testing differences in lever application in the different quadrants. This leads to 60 separate categories and subcategories. On this level, the absolute number of measures per lever is aggregated per category for further comparison. Overall 474 measures have been identified within the 60 subcategories and the 7 levers.

The Kruskal-Wallis test is used to identify general differences among portfolio quadrants in lever application, while the Mann-Whitney Test is used to do pairwise comparisons to identify which quadrants differ specifically. The results of both tests are described in this chapter and reported in appendix A7 in table 10. In the following chapter, the findings will be discussed in the context of the previous works done by Hesping and Schiele (2016b) and generic strategies associated with the Kraljic portfolio matrix. Therefore, each positioning will be looked at individually, to describe lever usage and point out differences and similarities.

As this research is based on direct sourcing categories of one global chemical company, the results should be regarded as indicative for the lever application in the chemical industry. Potential biases and risks are addressed by the design of this research project. The evaluation of categories regarding supply risk and profit impact is done as part of the strategic category management process and has no connection to this project. Measures are based on existing strategies and have been elaborated and followed up in interviews. Yet, due to the limited insights into the successful implementation of measures category managers, due to social desirability bias, might have overstated the successful implementation of their measures.

4.2 Focus on process optimization and extension of supply base, some price evaluation and optimization of supplier relationships and few product optimization, volume bundling and category-spanned initiatives

Disregarding the positioning and looking at the overall usage of tactical sourcing levers in the categories, most measures relate to process optimization (2,38). Across the different quadrants there is a strong focus on optimizing logistics and streamlining processes.

The second most used lever is extension of the supply base (1,98), followed by optimization of the supplier relationships (1,17). Hence, both extending the supply base

and improving supplier relationships and collaborating on e.g. innovation projects appear to be relevant levers of sourcing categories. Further, on average each category contains at least one measure related to price evaluation meaning prices and cost structures are either analysed in depth or compared among different suppliers. Product optimization (0,63) and demand bundling (0,57) are of lower importance which can be explained by practical reasons. Central procurement at the focal company bundles the demand of various group companies and their plants globally. Hence, bundling is often disregarded as tactical measure as various demands are combined by default. As there are so many different applications for raw materials in different operating divisions and business units of the overall company, there is little potential for overarching product optimization and changing the requirements. Also, category spanned initiatives (0,12) are barely ever used, which means that cost improvements are mainly pursued on a category level. Yet, this means that the full leverage of the focal company is not used as suggested by Kraljic, due to strong category focus that does not look at common suppliers and co-products across category boundaries, if they are not already combined in one category.[278] One reason is that it is difficult to cooperate among categories due to the different internal customers. A second reason is, that even if one supplier delivers products of two categories for the same internal customers, those might come from different business units of the supplier.

Based on the Kruskal-Wallis test for differences of levers among the different quadrants of the positioning matrix, two levers show significant differences. P-values below 0,01 are considered as highly significant, values between 0,05 and 0,01 as moderately significant and values between 0,05 und 0,1 are considered as slightly significant. Optimization of supplier relationships is highly significant (1,17; p=0,009). Extension of supply base is slightly significant (1,98; p=0,051). Overall, it can be concluded that all measures are used in all portfolio quadrants, with significant differences only for two levers. This supports the notion of measures are being used in an additive manner rather than alternatives.[279] This could mean that there are other defining factors relevant to categories beside supply risk and profit impact, as suggested by Luzzini et al. (2012)[280] that might also impact the choice of measures. As the Kruskal Wallis test only shows differences for two levers, a hierarchical cluster analysis is run on the usage patterns of all seven levers to find other potential groupings of categories beside supply risk and profit impact that appear to have a

[278] See Kraljic (1977), p.73

[279] See Hesping & Schiele (2016b), p.112.

[280] See Luzzini et al. (2012), p.1029.

minor role. Average linkage is used as agglomeration method to account for the skewness of the lever usage as it is less affected by outliers.[281] Distance of objects is calculated using squared Euclidian distance. The cluster analysis does neither provide a clear clustering (see dedrogram in appendix A12), nor does it yield any meaningful clusters based on the known characteristics. If there are patterns based on certain underlying variables, those are not yet known. In his dissertation, Hesping (2016) also looked at the moderating effect of complexity, dynamism and competition in relation to technology, supply markets and relationships as contingency factors on sourcing levers.[282] Before that, Luzzini et al. (2012) already argued, that the dimensions of the Kraljic matrix were not sufficiently capturing the differences of sourcing categories and their differences in competitive priorities. They proposed to also evaluate the degree of technological uncertainty, supply market volatility supplier power and customization. [283]

4.3 Non-Critical categories use process optimization most strongly and focus less on introducing new suppliers or optimizing existing relationships

While non-critical categories account for almost half of all categories (n=28; 46,7%), they only represent about 192 or 40,5% of measures employed. As the name describes, those categories are less critical to the firm due to moderate to low supply risk and profit impact.

Non-critical categories focus most strongly on process optimizations (2,57). As the profit impact of non-critical purchasing categories is lower than leverage or strategic categories, cost savings can be achieved by improving transactions and logistics mainly. In addition, price evaluation (1,18) is used above average. However, extension of supply base (1,32), optimization of supplier relationships (0,61) as well as product optimizations (0,50) are used less often in non-critical categories. The lever usage of non-critical categories, beside the other positionings, is depicted in appendix A5.

The lower impact on the focal company does not allow for many expensive supplier qualifications in smaller categories or changes of formulations to standardize grades. Collaborations with suppliers are not as relevant as in categories that are important to key-products. In contrast, many non-critical categories use tail-end management to reduce the transaction costs for smaller products. Non-critical categories only sometimes use volume bundling (0,57), which is explained by the overall design of the procurement organization of the focal company. Lastly, very few categories seem to cooperate with other

[281] See Hair, Black, Babin & Anderson (2009), p.504

[282] See Hesping (2016), p.126

[283] See Luzzini et al. (2012), p.1015; p.30

departments and categories (0,12). In comparison to bottleneck categories, non-critical categories use extension of supply base (-1,12; p=0,019) and optimization of supplier relationships (-0,61; p=0,051) less strongly. Similarly, non-critical categories also use extension of supply base (-1,54; p=0,034) less often than strategic categories and put less emphasis on optimization of supplier relationships (-2,25; p=0,001). With higher supply risk the importance of a portfolio of suppliers as well as good relationships to suppliers seems to increase. Also, non-critical and bottleneck categories liken each other in their usage of category spanning initiatives (0; p=0,967), but due to the generally low usage of this lever this practically does not provide much insights.

Non-critical products are theorized to focus on demand bundling, process improvements relating to transactions, logistics and storage as well as reducing requirements.[284] At the focal company, there is a clear focus on optimizing internal and delivery processes for lowest logistics costs or risk mitigation and less emphasis on introducing new suppliers. Suppliers are expected to provide the expected quality without a need for deeper relationships.[285] Due to the limited strategic importance, cost intensive product optimizations that require changes of production processes or intensive supplier relationships are not justified. It can be argued, that category managers accept the non-critical position as favourable or are not able to change their categories' strategic importance, e.g. by bundling,[286] due to the complex requirements by diverse internal customers and production plants.

4.4 Bottleneck categories significantly focus on extension of supply base and optimizations of supplier relationships next to the overall strong process optimizations

Bottleneck categories are the second biggest group (n=18; 30%) and account for 32% of all measures. They have a low impact on the overall company in terms of profit but are difficult to acquire. Following process optimization (2,50), extension of the supply base (2,44) is therefore similarly important to bottleneck categories. The third most used lever is optimization of the supplier relationships (1,22). To acquire bottleneck products, the buying company attempts to build up partnerships by e.g. establishing regular meetings, long-term contracts or R&D collaborations. Bottleneck categories bundle volumes (0,78) more often than categories do on average. The same holds for product optimization (0,72).

[284] See Kraljic (1977), p.73

[285] See Nellore & Söderquist (2000), p.258-259

[286] See Caniels & Gelderman (2005), p.146

Yet, not all categories that are classified as bottlenecks use those levers. Although there is a high market risk associated with bottleneck items, the low profit impact makes it difficult, to justify costly changes of formulations. Supply security is in the focus sometimes even at higher costs.[287]

In comparison to non-critical purchases, bottleneck categories emphasize extension of the supply base (+1,12; p.=0,019) and optimization of the supplier relationship (+0,61; p=0,051). Due to the limited number of available sources, bottleneck categories must cooperate with suppliers and take care of their relationships.[288] Yet, bottleneck categories use measures to optimize the supplier relationships significantly less than strategic categories (-1,64; p.=0,040).

Kraljic suggests that bottleneck categories secure products even at higher costs, control suppliers, introduce safety stocks and contingency plans.[289] This would relate to accepting the disadvantageous position characterized by dependence resulting in lower buying power.[290] In contrast, here it is shown that category managers aim to find alternative sources through extension of the supply base and hence reducing the supply risk, besides employing measures to mitigate the risk along the supply chain by process improvements. As a result, introducing new sources could move the category to a less critical position in the matrix.[291]

4.5 Leverage categories optimize commercial advantage by extending the supply base, optimizing processes and supplier relationships

Leverage categories are defined by a low supply risk but a higher impact on the profit of the company. At the focal company 7 categories or 11,7% of categories are classified as leverage and account for 11,8% of all measures. Leverage categories most strongly use extensions of supply base (2,57) as tactical lever aiming for price optimizations. At the same time, leverage categories optimize processes (1,71) and supplier relationships (1,57). Also, on average all leverage categories engage in at least one measure to optimize products and portfolio (1,00). Leverage categories however use price evaluations (0,86) or volume bundling (0,78) less often than all categories on average. Less used are category spanning initiatives reiterating the overall trend seen before.

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[287] See Kraljic (1977), p.73

[288] See Nellore & Söderquist (2000), p.259

[289] See Kraljic (1977), p.73; Caniels & Gelderman (2005), p.145

[290] See Caniels & Gelderman (2005), p.145

[291] See Caniels & Gelderman (2005), p.146.

Leverage categories aim to optimize the commercial advantage. In theory, high spend in combination with low supply risk allow for hard negotiations and an aggressive approach towards the suppliers and there is no need for long-term contracts.[292] According to previous research, leverage categories are in the position to exert dominance over their suppliers due to higher buying power and hence focus on competitive measures such as volume bundling, extension of the supply base and price evaluation.[293] Kraljic himself suggests bundling demand, exchanging suppliers and products, clear price strategies as well as using a mix of spot and contract volumes.[294] The focal company however extends the supplier base to introduce more competition while engaging in relationships and partnerships with suppliers. In fact, leverage categories in this project show a similarly strong usage of optimization of the supplier relationship (-0,35; p=1,000) as bottleneck categories, potentially with the aim to develop strategic partnerships[295]. Also, leverage and strategic categories use volume bundling similarly strong (0; p=1,000). However, the overall usage of volume bundling is low and hence the practical difference to other quadrants is generally low.

4.6 Strategic categories focus on both extension of the supply base and optimization of supplier relationships

Categories with high profit impact and high supply risk are defined as strategic categories (n=7). Those account for 11,7% of categories and 15,6% of measures. Strategic categories use extension of supply base (2,86) as well as optimization of supplier relationships (2,86) most strongly across all quadrants. This supports the idea that categories can pursue transactional and relationship-oriented measures at the same time by e.g. addressing different sub-products or maintaining long-term relationships with key suppliers while introducing competition by newer suppliers. Category managers pursue price evaluation (1,71) measures more often than categories on average. Also, strategic categories use process optimizations strongly (2,00), but less often than categories on average. Product optimizations (0,57) are less common for strategic categories. Both, volume bundling (0,29) and category spanning initiatives are barely used.

In comparison to other portfolio quadrants, strategic categories show a stronger usage of extension of the supply base to non-critical categories (+1,54; p=0,034) as well as

[292] See Gelderman & Laeven (2005), p.4

[293] See Gelderman & Van Weele (2003), p.214; Kraljic (1983), p.112

[294] See Kraljic (1977), p.73

[295] See Caniels & Gelderman (2005), p.146

optimization of supplier relationships (+2,25; p=0,001). In fact, extension of supply base is strongest for strategic categories compared to all other quadrants and even significantly stronger than for bottleneck categories (+1,64; p=0,040).

As strategic items are more complex and have the biggest strategic impact on the firm, they require a "larger battery of analytic techniques"[296] and measures. Beside detailed market intelligence and exact estimations of internal demand, Kraljic and other scholars suggest strategically selecting and developing world-class suppliers[297] as well as long-term relationships[298] and. Further, Kraljic suggests mitigating risks by observing risk factors, contingency plans, safety stocks, and controlling logistics up to insourcing production.[299]

The analysis has shown that strategic categories in fact focus on optimizing supplier relationships as suggested by Kraljic. As some strategic products are vital to the end-products final capabilities, close relationships with suppliers are needed for quick and fruitful collaboration on innovation.[300] Yet, at the same time they control for supplier dependence by extensions of the supply base.

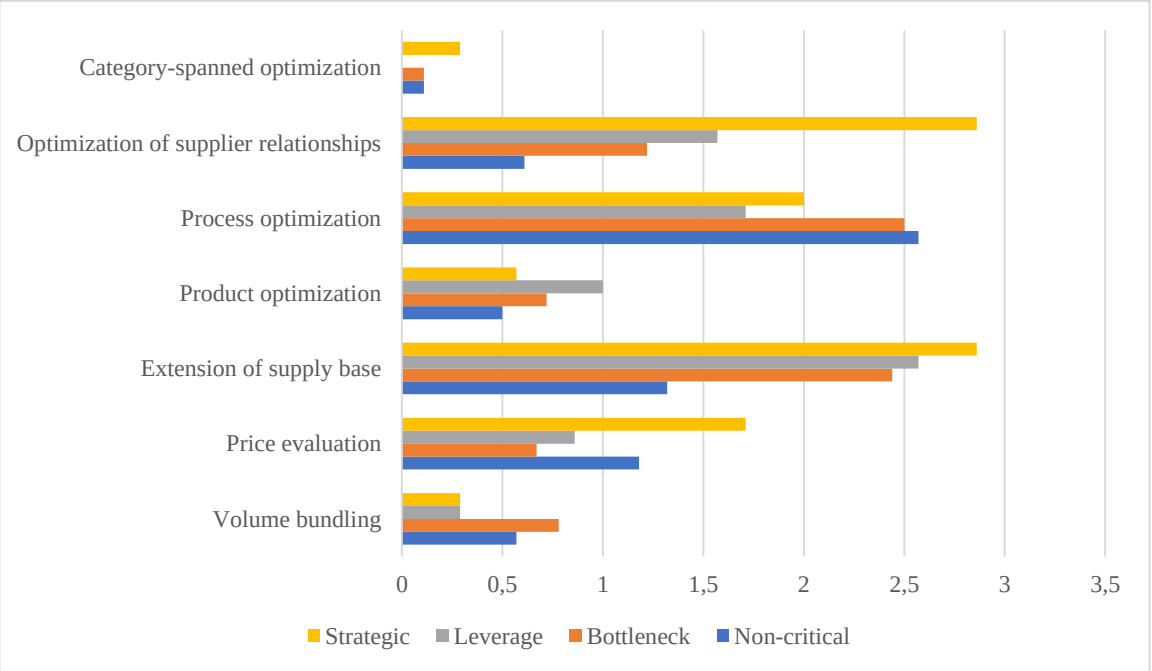

Illustration 4: Lever application in relation to Kraljic portfolio quadrants

[296] Kraljic (1983), p.112

[297] See Handfield et al. (2000), p.39

[298] See Kraljic (1977), p.73

[299] See Kraljic (1977), p.73

[300] See Nellore & Söderquist (2000), p.260

4.7 Implementation rate of measures is highest for strategic categories and lowest for leverage categories

Not all measures are finalized at the point of the analysis. Hence, this analysis of the implementation rate in relation to the portfolio quadrant does only consider all measures that are either finalized or discontinued. The average implementation rate of measures among all categories is 66,3%. Looking at the different positionings, this implementation rate ranges from 59% for leverage categories to 84,2% for strategic categories. Non-critical categories are slightly below the average with 63,6% of measures implemented. Bottleneck categories implement 66,5% of measures and therefore are close to the average. Applying the Kruskal-Wallis test, there is no significant difference among categories. However, pairwise comparisons show, that strategic categories have a significantly higher implementation rate than non-critical categories (-0,206; p=0,023) as well as leverage categories (-0,25; p=0,07).

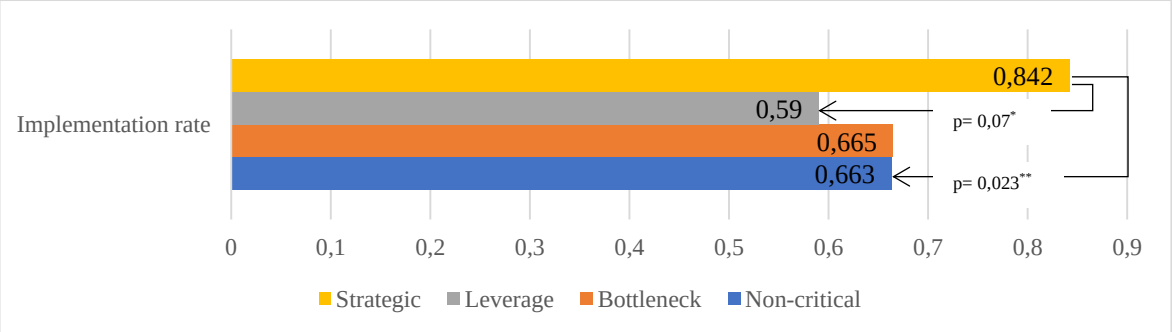

Illustration 5: Implementation rate in relation to Kraljic portfolio quadrants

The following table shows the share of implemented measures per lever. To calculate the implementation rate on a lever level, the average of all implemented measures of all measures finalized and cancelled is identified. The percentages are descriptive but give an idea of the success of levers at the focal company. Product optimization has the lowest implementation rate with 43% while process optimization is most successful with 82%.

Lever	Implementation rate
Volume bundling	59,3%
Price evaluation	77,8%
Extension of supply base	63,0%
Product optimization	42,9%
Process optimization	82,2%
Optimization of supplier relationships	71,7%
Category-spanned optimization	75,0%

Table 2: Implementation rate per lever

4.8 Spend and strategic alignment with internal customers are associated with a change in the implementation rate

To test for the influence on different factors and category characteristics on the implementation rate, separate Mann-Whitney-U tests were conducted for different categorical or ordinal independent variables. Tested factors are category spend (<70MEUR; ≥70MEUR), alignment with internal stakeholders (category strategy challenged with internal customer; no challenging or unclear challenging), category type (upstream / supply market category; downstream / application category), change of category manager (change; no change), supply risk (high supply risk, low supply risk) and profit impact (high profit risk; low profit risk). As depicted in the following table, only spend (p=0,011) and alignment with internal stakeholders (p=0,004) show significant differences with regards to the implementation rate. As expected, a higher spend and a clear alignment with the internal business partners also results in a higher implementation rate. Categories with a spend above 70 MEUR show a share of implemented measures that is 13,6% higher than the average category. If the category strategy has been aligned and challenged with the internal stakeholders, the percentage of implemented measures is 8,4% higher than the average. Factors such as clear positioning, common upstream value chain and stable category management do not show a significant effect. Also, controlling for the effect of low or high supply risk or profit risk shows no significant difference.

	Expected outcome	Implementation rate	Deviation from mean	Significance
High spend	+	0,799	+0,136	0,011**
Clear positioning	+	0,655	-0,008	0,277
Alignment with internal stakeholders	+	0,747	+0,084	0,004**
Common upstream value chain	+	0,690	+0,027	0,225
No category manager changes	+	0,739	+0,076	0,153
Combined category manager and buyer role	-	0,622	-0,041	0,106
Low supply Risk	+	0,616	-0,047	0,161
Low profit Impact	+	0,650	-0,013	0,150

Table 3: Category characteristics and factors with influence on mean implementation rate

5 Discussion

5.1 Lever usage in chemical industry shows similarities and differences in relation to previous study on sourcing levers in relation to Kraljic portfolio quadrants

5.1.1 Strong usage of extension of the supply base by strategic categories in line with previous research, yet bottleneck categories use it more in this study

This research aims to answer the question whether the usage of tactical sourcing levers differs among the different quadrants of Kraljic's portfolio matrix. Generally, this research does not suggest strong differences of lever usage such as it might have been expected. Yet, some differences are identified, especially related to extension of the supply base and optimization of the supplier relationships. The usage of each lever per quadrant as well as significant differences are shown in appendix A6. Optimization of supplier relationships differs highly significant, while extension of the supply base differs slightly significant in relation to the different quadrants. Both levers relate the supply base structure, that depends on the sourcing strategy but also on profit impact and supply risk[301]. Extension of the supply base extends the supply base width, while optimization of supplier relationships defines the depth of individual relationships. Therefore, this discussion focuses on those two levers and aims to explain their usage in relation to previous research by Hesping and Schiele, before briefly looking at the other levers. Also, the implementation rate is discussed in relation to portfolio quadrants and levers as well as influence factors.

One of the basic levers of procurement is the e*xtension of the supply base.* Extension of the supply base entails measures such as screening the market for alternatives and qualifying new suppliers, localization and geographical diversification, establishing toll manufacturing or changing plant configuration to accept other suppliers. It is the second most common lever in this study after process optimization. Bottleneck (2,44) and strategic categories (2,86) use this lever significantly more than non-critical categories (1,32). Both have a higher supply risk and consequently a stronger dependence on few suppliers. By screening the market for alternatives and qualifying new suppliers, the supply risk can be mitigated. Consequently, by finding alternatives, the own competitive position might improve. Yet, finding a suitable or capable supplier is very difficult. In their research at an automotive OEM, Hesping and Schiele (2016b) found that leverage and non-critical categories use extension of the supply base most strongly followed by strategic

[301] See Ates, Wynstra & van Raaij (2015), p.215

categories.[302] Further, they identified lowest usage for bottleneck categories that were using this lever significantly less than strategic categories. In contrast to the previous study, a similar approach at a chemical firms shows opposite trends for non-critical and bottleneck categories.

As suggested by the literature, bottleneck categories do in fact use significantly more measures to extend the supply base, than non-critical categories, that aim for low transaction costs and can hardly support high switching cost. However, strategic categories show a significant and even stronger usage of extension of the supply base than non-critical categories. This is an unexpected finding considering the hypothesized mutual dependence of suppliers and buyers in strategic categories and hence suggested partnerships,[303] but in line with Hesping's and Schiele's research. A previous exploratory study on multiple sourcing categories found different supply base structures within strategic categories related to size of suppliers, organizational characteristics, technological capabilities, and geographical distance, interaction among suppliers, information transparency and contract durations.[304] These authors have looked at diverse factors to describe the supply base structure. The width of the supply base in terms of number suppliers is one factor, but might not be an exhaustive to describe the supply base structure and hence the relationship of a buying firm with its suppliers. There is not one supply base structure that suits all categories, but different set ups can be successful. Although profit impact and supply risk play an important role, they do not appear to be the only determinants for supply base structure or successful strategy implementation.[305] The supply base structure is defined by more factors than the width of the active supplier portfolio. In their exploratory study, the researchers found that the quadrants of the Kraljic matrix do not differ in all aspects of the supply base structure, such as high level of competition and limited collaboration among suppliers and short to moderate contract durations.[306] The decision to extend the supply base must therefore be based on a holistic view of the supply base and consider those different dimensions. Profit impact and supply risk can give suggestions of potential for extensions of the supply base, but they do not suffice to make final decision.

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[302] See Hesping & Schiele (2016b), p.110

[303] See Olsen & Ellram (1997), p.105; Nellore & Söderquist (2000), p.248; Macbeth (2002), p.54; Gelderman & Van Weele (2003), p.214

[304] See Ates et al. (2015), p.210-212

[305] See Ates et al. (2015), p.212

[306] See Ates et al. (2015), p.212

5.1.2 Optimization of supplier relationships is consistently used by all categories with high supply risk and by some leverage categories

By optimizing supplier relationships firms may change the depth of individual supplier relationships and thereby also affect the supply base structure. Optimization of supplier relationships is the second lever with significant differences among the different quadrants of the Kraljic matrix. The findings of this research project support the generic strategic recommendation for strategic categories[307] that do in fact use more measures to optimize the supplier relationships and engage in partnerships than categories with a non-critical or bottleneck classification. This replicates the findings by Hesping and Schiele (2016b) on the usage patterns among the different quadrants of the Kraljic matrix[308]. However, in this study on the chemical industry strategic categories even show a significantly stronger usage than bottleneck categories.

With a higher supply risk, the importance for partnerships seems to rise. Profit impact is an additional but not necessary condition for the optimization of supplier relationships, as leverage categories show no consistently different usage of this lever. It is theorized, that leverage categories should use their favourable position and even exploit their bargaining power, while bottleneck categories are more dependent on their suppliers,[309] giving them a stronger incentive to take care of supplier relationships. Despite those totally different situations and assumed differences in power relations[310], both categories show a significantly similar usage of this lever. On average, leverage categories even use more measures to optimize the relationships. Previous research on leverage and strategic strategies found a positive impact of both arms-length and collaborative relationships on business outcomes,[311] casting doubt upon the generic strategy for leverage categories to focus on competitive arms-length relations. On the one hand, this means that Kraljic's initially suggested generic strategies have to be viewed with caution as other strategies may be applied and also successful. Further, this supports the idea that successful

[307] See Olsen & Ellram (1997), p.105; Nellore & Söderquist (2000), p.248; Macbeth (2002), p.54; Gelderman & Van Weele (2003), p.214

[308] See Hesping & Schiele (2016b), p.110

[309] See Kraljic (1983), p.112

[310] See See Kempeners & Van Weele (1997), p.94; Caniëls & Gelderman (2005) p.142, p.; Caniëls & Gelderman (2007), p.221-222

[311] See Cousins & Lawson (2007), p.133

partnerships do not depend on balance of power[312] or buyer dominated supplier relationships. Rather, if products matter to a company due to their high supply risk relationship building is a consistently used measure. If products have a high profit impact, relationship building is an option. If both factors come together, strengthening supplier relationships becomes one of the top priorities.

5.1.3 As intensive supplier relationships are costly to build, categories optimize key supplier relationships combined with extension of the supply base, as categories contain different product and plant combinations

Overall, optimization of the supplier relationships is the third most used lever. One reason for the efforts to build relationships might be to gain the status of a preferred customer and hence gain better treatment than other customers from a supplier, in terms of product quality and availability, support in the sourcing process, delivery or/and prices."[313] To become a preferred customer buyers have to gain the suppliers attention and offer an attractive value through this relationship.[314] "Customer attractiveness is based on the expectations that a supplier has towards the buyer at the moment of initiating or intensifying a business relationship"[315] and hence depends on the evaluation of a supplier of its exchange relationships with other buying firms. To gain the preferred customer status, a buying firm needs to not only meet or exceed supplier expectations, but also perform better than other customers.[316] Factors that impact supplier satisfaction and hence customer attractiveness are growth opportunities, operational excellence and the behaviour towards suppliers.[317] Further, profitability of a relationship for the supplier might be a factor.[318] A preferred customer status is relevant, as mere supplier satisfaction does not guarantee that the supplier will continue the relationship[319] or grant access to resources in case of scarcity. In fact, previous research found a positive and significant relation of both customer attractiveness and supplier satisfaction with preferential resource allocation[320] as well as a positive influence of a preferred customer status on benevolent pricing and

[312] See Caniëls and Gelderman (2007), p.227

[313] See Nollet, Rebolledo & Popel (2012), p.1187

[314] See Nollet et al. (2012), p.1188

[315] Schiele, Calvi & Gibbert (2012), p.1180

[316] Nollet et al. (2012), p.1190

[317] See Hüttinger, Schiele & Schröer (2014), p.708

[318] See Vos, Schiele & Hüttinger (2016) p.4621

[319] See Schiele et al. (2012), p.1181; Pulles, Schiele, Veldman & Hüttinger (2016), p.137

[320] See Pulles et al. (2016), p.136

supplier innovativeness.[321] Especially if purchasing is viewed as a source of competitive advantage, a preferred customer status and hence preferential treatment might be the basis.[322] In practice this means, that suppliers will give priority to customers that source a range of products from one supplier with a long-term relationship than to buyers that are only interested in spot buying.[323]

While many scholars and practitioners argue that partnerships with suppliers are important to get most out of supplier relationships, Gadde and Snehota (2000) criticize this as overly simplified.[324] The development of supplier-buyer partnerships is a demanding process. Such partnerships are the "result of contractors' continuous effort to improve results in the relationship with suppliers, rather than a technique which can be adapted and applied in a short time"[325]. In fact, "collaboration is not the only choice available for managing suppliers, nor may it be the most appropriate choice for the buyer under all circumstances."[326] As the build-up and maintenance of partnerships is resource intensive, only some relationships exceed their costs with benefits. Focusing on fewer strategic supplier relationships "can be effective options in a supply strategy, but they are not always the only means that companies have to make good use of suppliers."[327] Hence, a multi-facetted approach is needed. Yet, the stronger a relationship with a supplier has grown, the stronger are the incentives to develop the incumbent supplier instead of investing resources into searching and developing new suppliers.[328]

Both extension of the supply base and optimization of supplier relationships are used in all quadrants of the positioning matrix. They are the two most and equally strongly used levers by strategic categories. The question arises, how those levers can be combined. A category usually contains numerous variants of the products and has diverse supplier relationships. Also, "all types of supplier relationship invariably contain elements of both competition and cooperation, with arms-length relationships not always conflicting, and partnership approaches not always genial".[329] Hence, the term partnership as a result of

[321] See Schiele, Veldman & Hüttinger (2011), p.15

[322] See Schiele et al (2012), p.1183; Pulles et al. (2016), p.136

[323] See Dubois & Pedersen (2002), p.41

[324] See Gadde & Snehota (2000), p.305

[325] Van Weele (2010), p.222

[326] Cox (2001b), p.42

[327] Gadde & Snehota (2000), p.306

[328] See Olsen & Ellram (1997), p.109

[329] Cousins & Lawson (2007), p.124

deep supplier relations might be misleading and fail to capture the full complexity of buyer-supplier relationships. It can be assumed, that category managers selectively invest into relationships with key suppliers, while searching for and qualifying alternative suppliers that are treated at arms-length. This assures supply security in case of disruptions of the key suppliers or complements gaps in the portfolio of those.

"Collaboration is not the only choice available for managing suppliers, nor may it be the most appropriate choice for the buyer under all circumstances."[330] However, if firms want to engage in strategic partnerships, a short-term result and cost-driven decision making may negatively affect the trust of suppliers and hence would counter efforts to improve supplier relationships.[331] In fact, this might trigger suppliers to forward integrate and seek other opportunities beside the intended buyer-supplier relationship driving the partners apart.[332]

5.1.4 Other levers how differences in usage compared to previous study in automotive industry

The other levers do not show significant differences among the portfolio quadrants. However, compared to Hesping and Schiele (2016b), lever usage seems to differ.

Process optimizations seem to be most common measures and relate to a wide range of initiatives to improve the processes related to managing the category and suppliers and improving the effectiveness of purchasing. Process optimization is the most important lever for non-critical (2,57) and bottleneck categories (2,50) and second most important for leverage (1,72) and strategic categories (2,00). This is contrary to the findings by Hesping and Schiele, who found that strategic and leverage categories were using process optimization stronger than non-critical and bottleneck categories. A potential explanation for this usage might be the difference in profit impact on the focal firm. The more relevant transport and process costs are in relation to the product value, the more do companies engage in efforts to improve e.g. the logistics for non-critical commodities to reduce process and transaction costs. Similarly, category managers aim to reduce supply and price risk by improving contingency plans and risk analyses.

Price evaluation is a key task of procurement and takes place in all categories. Although a previous study at an OEM found price evaluation to be the second most used lever[333], this

[330] Cox (2001b), p.42

[331] See Macbeth (2002) p.58; Rosetti & Choi (2005), p.50-51

[332] See Rosetti & Choi (2005), p.51

[333] See Hesping & Schiele (2016b), p.110

study finds extension of the supply base only on rank four. Price evaluation happens through auctions and tenders, through renegotiations or price comparisons. Strategic categories (1,71) and non-critical categories (1,18) use price evaluations most strongly. While strategic categories demand the buying firm to have good knowledge on production costs for negotiations, e.g. due to custom specifications, non-critical products have a lower importance for the profit. Comparison of different offers is a basic tool to reduce costs here. Hesping and Schiele (2016b) found strongest usage of price evaluation at leverage categories, significantly stronger than strategic or bottleneck categories[334]. Together, both studies support the notion that bottleneck categories (0,65) have to accept price premiums to secure supply security if no alternative is available. In contrast to Hesping's and Schiele's findings, in this study leverage categories appear to rely on other levers such as extension of the supply base.

Product optimization requires a strong cross-functional support by internal customers. Similar to the extension of the supply base, a change of specifications might change the positioning of the product and allow for sourcing from a wider portfolio of sources. If product specifications are altered, production processes need to adapt. Redesigning the product, especially helpful for bottleneck categories to find alternative suppliers may prove an "insurmountable challenge because of personalities, power structures or simply the time and systems costs to effect the change".[335] Hence, this measure is only used to a limited extend. Leverage categories however use it most strongly (1,00) followed by bottleneck categories (0,72). A significantly stronger usage by strategic and bottleneck categories in comparison to non-critical categories found in previous research could not be identified here.[336]

The categories analysed in this project only use little *volume bundling*, as the organizational design of purchasing in centralized procurement categories bundles demand of multiple business units and plants. To steer the sourcing activities of the firm globally purchasing demand is integrated and coordinated across production locations worldwide."[337] Bottleneck categories (0,78) followed by non-critical categories (0,57) use volume bundling strongest. Hesping and Schiele found the opposite with strongest usage of volume bundling at strategic and leverage categories.[338]

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[334] See Hesping & Schiele (2016b), p.110

[335] Macbeth (2002), p.56

[336] See Hesping & Schiele (2016b), p.110

[337] See Trent & Moncka (2003), p.26

[338] See Hesping & Schiele (2016b), p.110

Due to the individual profile of internal customers and applications at the focal company that serves a wide and deep portfolio of customer industries, cooperation of categories may be difficult and hence result in few *category-spanning initiatives*.

5.1.5 Results on lever usage suggest three different conclusions: industry specific lever usage, company specific lever usage or no general trends of lever usage

Only two levers show significant differences among the Kraljic matrix in this study. There are both similarities and differences to the identified lever usage patterns in the automotive industry by Hesping and Schiele (2016b). This allows three potential conclusions. First, there might be industry specific trends in lever usage that explain the differences of this study at a chemical firm and previous results from an automotive OEM. Second, trends might not be linked to the industry itself but to the company specific organisation, procurement practices and traditions. This would mean every company has a different usage pattern of sourcing levers. Lastly, it might also be that there are no generally observable trends that are constant throughout time but rather dependent on the observed organisations, sourcing items, their complex market developments and the time of the evaluation.

This nurtures the idea that the usage of the Kraljic portfolio approach itself eventually does not yield diversified strategies among the different portfolio quadrants and homogeneous sourcing strategies within quadrants. Consequently, taking a functionalist view, either the Kraljic portfolio itself or the users' application of it can be the cause of failure.[339] March (2006) argues that such tools, described as technologies of rationality, are effective instruments for focused applications with limited complexity, but fail their purpose for complex problems with wider timely and locational scope and may even lead to wrong estimations and failures.[340] It might even be argued that such rational tools limit creative outcomes and innovative strategies as they are rooted in rationality and conventional knowledge.[341] However, from a practice perspective the Kraljic portfolio approach could also be regarded as useful to users if it helps them to make sense of a situation, legitimizes decisions and provides a platform for discussion and interaction on strategic matters.[342] The usefulness of the tool might therefore not be rooted purely in its functionality but in the insights and discussions it allows for. Depending on the users' intentions and needs it might yield different outcomes. "Interpretive flexibility is neither a failure of the tool nor

[339] See Jarzablonski & Kaplan (2008), p.6

[340] See March (2006), p.207-208

[341] See March (2006), p.209

[342] See Jarzablonski & Kaplan (2008), p.5-6; Jarzablonski & Kaplan (2015), p.544

the user of the tool, but an indication of its use in complex social practices of making strategy in interaction between multiple actors."[343] All in all, it can be argued that the Kraljic portfolio approach yet has to proof that it allows for the development of sound and effective sourcing strategies and tactics within industries or for individual companies. Yet, companies might also simply use it as a platform for discussion and interaction and less as prescriptive tool and therefore still value its indirect contribution to the strategy development.

5.2 No significant general difference of implementation rates of tactical sourcing measures among the different portfolio quadrants, yet pairwise differences

5.2.1 Higher implementation rate by strategic categories may be explained by relevance to internal stakeholders and suppliers

The second research question aims to identify potential differences with regards to the success of tactical sourcing levers among non-critical, leverage, bottleneck and strategic categories and wonders what factors are associated with the success. The success of sourcing levers and measures in general in relation to the Kraljic matrix has not been analysed thoroughly before. This research on the one hand analyses the implementation rate of all levers in relation to a categories positioning, on the other hand identifies factors that are associated with changes in the implementation rate.

There is no fail-proof strategy. From the point of initiation of a new category sourcing strategy, there are four stages that might explain failed measures. First, a strategy can be based on wrong assumptions about the environment as every analysis of the environment is imperfect.[344] If the analysis and therefore the assumptions are correct, still the wrong measures might be chosen due to a certain degree of risk and uncertainty with different alternatives.[345] All finalized category strategies are challenged within procurement by the management and often also with the respective internal customers. This is the final gate before strategies are being implemented and only feasible and desirable measures that are supported by other internal stakeholders should pass. A failed challenging may not revoke measures that will not be supported by other functions or backed by management. Later, during the implementation, measures may fail due to internal reasons such as wrong project management, lack of resources or external reasons such as unforeseen market

[343] Jarzablonski & Kaplan (2008), p.5

[344] See Parnell & Lester (2003), p.296

[345] See Parnell & Lester (2003), p.296

changes. As markets are changing quickly due to globalization and e-procurement[346] strategies become outdated more quickly. With all effort invested into a thorough analysis and strategy development, project management and allocated resources by the buying company, success is not guaranteed. Sales managers of suppliers may similarly evaluate their products and supply relationships and adapt their own strategies.[347] Therefore, suppliers might counter measures by own efforts. Just as buyers may have preferred suppliers, those might have preferred customers that get beneficial treatment.[348]

Consequently, there are many stages in the strategy process at which measures can fail that are not linked to the position in the Kraljic matrix. Overall, the Kruskal-Wallis test did not show significant differences among the quadrants of the Kraljic matrix. However, pairwise testing does hint at some differences. Categories classified as strategic (84%) show a significantly higher implementation rate in comparison to non-critical and leverage categories. This may be explained by the higher average monetary and strategic value of those categories to the firm, but also its suppliers. On the one hand, it can be assumed that categories with higher strategic importance receive attention and are provided with resources within the firm from procurement, management, internal customers and other functions. On the other hand, suppliers as external stakeholders have a stake in strategic products due to their high volumes or profitability of sold products that directly impact their financial performance, beside other factors.[349] This is especially relevant to the chemical industry as process industry with large scale production plants that need a certain base load. The analysis has also shown that categories with a spend above 70 MEUR have a significantly higher implementation rate which also supports this reasoning.
It remains unclear, why leverage categories with 59% of measures have the lowest implementation rate. If it is assumed that leverage categories are evaluated correctly, it can be assumed that categories face additional obstacles that are not captured by the initial Kraljic dimension. Markets are turning quickly and a trend to increasingly specialized companies due to outsourcing,[350] fewer suppliers are able to either provide the needed quantities or the desired product specifications for specialties. Consequently, a long market might turn tight within a year due to suppliers adjusting capacities and closing plants or

[346] See Wynstra (2016), p.201

[347] See Macbeth (2002), p.58

[348] See Macbeth (2002) p.60

[349] See Walter, Ritter & Gemuenden (2001), p.367

[350] See Wynstra (2016), p.201

exiting businesses. If suppliers are pushed to the limits of profitability this might increase this development.

5.2.2 Procurement is more successful in driving levers that relate to procurement core activities and suppliers and less successful with cross-functional levers

The average implementation rate of all measures is 69,9%. The implementation per lever varies from 42,9% to 82,2%. Clearly, product optimizations have the lowest implementation rate with 42,9%. In order to optimize products, specifications have to change; processes in production need to be adapted and formulation of finished goods have to be altered. This requires the support of the internal customers and business partners that have to provide those resources or even fully drive such efforts. As mentioned before, this might lead to "insurmountable challenge because of personalities, power structures or simply the time and systems costs to effect the change".[351] Procurement can bring those challenges up but is not able overcome them alone. The analysis of influence factors associated with the implementation rate has shown that categories that have aligned their strategies with internal customers have a significantly higher implementation rate. Strategic alignment is hence key, to assure the provision of resources and support. This is especially needed for product optimization measures that require cross-functional efforts.

Volume bundling only succeeds in 59% of cases. Potential reasons for cancellation might be an increasing effort to mitigate price risks and synchronize contractual periods that do not allow for bundling across different business units.

Extension of the supply base shows an implementation rate of 63%. By extending the supply base suppliers can introduce competition and reduce dependence. However, in many cases relationships appear to be locked in by certain factors that undermine the exchange of suppliers.[352] Such factors are barriers from adapted relational structures that hinder an exit and new entrant, the dominance of the incumbent supplier with knowledge on the buyer-supplier specific relationship, as well as risk aversion from potential switching costs and performance losses.[353] The roots of the lock-in situation are conviction of the supplier's capabilities and performance, personal ties and trust from historic relations and the integration of processes and structure that due to their interplay lead to

[351] Macbeth (2002), p.56

[352] See Schmitz, Schweiger & Daft (2016), p.28

[353] See Schmitz, Schweiger & Daft (2016), p.28

dependence.[354] "There will always be circumstances when the best deal a buyer can achieve will involve working closely with a supplier and sharing the benefits of such collaboration."[355] For example, it might be more efficient to work with active suppliers for bottleneck or strategic items, than to invest in building up new suppliers.[356] However, collaboration is not always the strategy of choice. "Since cooperation requires substantial amounts of resources, it limits the size of the supply base and substitutability, and may even result in single sourcing."[357] It is difficult to differentiate dependence from lock-in situation.[358]

A successful partnership should be based on a mutual strategic intent and requires buyer and supplier to match their intentions and strategies.[359] Yet, "even if the two companies mutually agree that supplier development is important, success is not a foregone conclusion."[360] This is reflected in the failed or cancelled measures related to optimization of the supplier relationship with an implementation rate of 71,7%.

Some of the levers are more closely related to procurement and its suppliers, e.g. price evaluation while other levers require extensive cross-functional cooperation with quality assurance, logistics and production/technology departments[361]. Process optimizations have the highest implementation rate with 82%, followed by price evaluation with 78%, category spanned initiatives with 75% and optimizations of supplier relationship with 72%. It can therefore be assumed, that not all levers can be controlled by procurement, but their success depends on other departments with own sometimes diverging objectives. While procurement is most interested in finding alternatives for bottleneck products, a plant manager that has to provide capacity for testing alternatives is evaluated based on the utilization and runtime of the plant.

[354] See Schmitz, Schweiger & Daft (2016), p.29

[355] Cox (2001b), p.42

[356] See Olsen & Ellram (1997), p.109

[357] Pazirandeh, (2014), p.26

[358] See Schmitz, Schweiger & Daft (2016), p.30

[359] See Gelderman & Van Weele (2003), p.208

[360] Handfield et al. (2000), p.38

[361] See Hesping & Schiele (2016b), p.105

5.3 Two factors – spend and alignment with internal stakeholders – are associated with higher implementation rate

Next to company internal factors, other factors may explain differences in the number of implemented measures. For example, supply base characteristics may be an explanation for the success of categories, e.g. number of suppliers, contract duration, supplier competition.[362] Similar to a previous exploratory study that found high and low performing categories across the Kraljic matrix[363], this research also could not identify a difference of implemented measures between categories with low or high supply risk and low or high profit impact. Other factors looked at are clearness of the positioning, a common upstream value chain, no category manager changes, separate category manager and category buyer roles, but they do not show a significant difference in the implementation rate.

Due to the lack of research on such topics, the reasons can only be assumed at this point. As the analysis has shown, there are some differences among the different portfolio quadrants regarding lever usage, but generally category managers use a wide variety of measures. Clearness of positioning appears to have no significant difference on implementation in comparison to unclearly positioned categories. As the non-critical, bottleneck, leverage and strategic categories do not use measures only depending on their positioning in the matrix, clearness of positioning might be less relevant.

Categories can either be based on a common supply market or application. A common upstream value chain for categories formed based on a common supply market also does not show a significant effect on the implementation rate as initially theorized. The findings suggest that no matter how a category is made up, there is better approach in terms of implementation.

Another factor analysed is the change of category managers during the implementation of measures. Category manager changes involve handovers of responsibilities and might impede the success of category strategies. This factor is not significant, which indicates that there is no clear pattern among categories.

Eventually, the implementation rate is controlled for different the job roles. Some category managers are also category buyers with additional operational tasks. This additional workload might affect the successful implementation. However, this factor is also not significant.

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[362] See Ates et al. (2015), p.215

[363] See Ates et al. (2015), p.210

Due to the timely limitations of this project and its design not all possible factors and category characteristics could be considered. One potential reason for differences in implementation rates that is not considered in this study might be the misfit of category sourcing strategy and structure. Findings of a recent study suggest that the successful outcome of a category strategy also depends on the fit of strategy and structure. [364] While cost strategies demand high centralization and formalization of the purchasing function with low cross-functionality, innovation strategies require low centralization and formalization and high cross-functional cooperation. As the analysed categories are all part of the highly centralized purchasing function of the firm with formalized processes and are less close to other functions of the group firms, this might suggest that strategies that aim at innovation might be less successful.

In addition, this project did not look at individual measures that are part of the levers. Hence, differences within the individual levers are not observed in this project. Furthermore, differences of the seven levers in combination with the quadrants of the positioning matrix could not be analysed due to the design of the study and the format of the collected data. Additional research would be needed to identify whether measures that match the generic strategies suggested by the literature for a certain quadrant are more successful than other measures.

[364] See Ates, van Raaijn & Wynstra (2018), p.77

6 Conclusion

6.1 Research yields insights into practical application of Kraljic matrix and tactical sourcing lever application in the chemical industry – It might be time for a product recall, as there is little connection of Kraljic matrix and lever usage

The aim of this study is to identify and analyse the usage of sourcing levers in relation to the different quadrants of the Kraljic matrix in the chemical industry. Therefore, a research project is conducted within the direct procurement department of a chemical firm from Germany. Based on stratified sampling to account for the right proportion of non-critical, bottleneck, leverage and strategic purchasing categories, different heights of spend, global or regional categories and different sub-departments, data from 50 sourcing categories is collected. First, category strategies are looked at to identify sub-categories with different positions in the Kraljic matrix and associated planned sourcing measures. Then, semi-structured interviews are conducted with category managers, personally or via web-conference, to facilitate a deep understanding of the different measures and follow up on their implementation status. All measures are sorted into a lever framework elaborated by Hesping and Schiele (2016a;b). Based on those 60 categories and subcategories with distinct positioning, the usage of the different levers, calculated as sum of all measures within one lever, is compared using non-parametric testing to identify general differences and do pairwise testing.

Overall, significantly different usage of levers appears to mostly relate to the structure and composition of the supply base structure. While extension of the supply base impacts the width of the supply base, optimization of supplier relationships defines the depth of individual relationships. Only those two levers show significant differences among non-critical, leverage, bottleneck and strategic categories. Pairwise comparisons show that bottleneck and strategic categories use extension of the supply base and optimization of supplier relationships significantly stronger than non-critical categories. In fact, strategic categories use optimization of supplier relationships even significantly more than bottleneck categories. Overall, process optimization is the most used measure, but the application does not differ consistently among the different Kraljic portfolio quadrants. Two levers are hardly used. As the centralization of the procurement function automatically bundles volumes, volume bundling is mentioned rarely in category strategies. Further, there are only few initiatives across the borders of categories.

Comparing the findings to Hesping's and Schiele's (2016b) research in the automotive

industry, this replication study finds both similarities and differences of lever usage among both studies. While usage patterns of optimization of supplier relationships liken the previous study, other levers showed differences. Extension of the supply base at the automotive OEM was used most strongly in leverage and non-critical categories and least strongly in bottleneck categories. In this study in the chemical industry, non-critical categories use it least and bottleneck categories even show a significantly higher usage, close to leverage categories.

It can be assumed that tactical sourcing levers, just as theorized by Hesping and Schiele, are used in as additive manner rather than alternatives. [365] Similarly to Hesping and Schiele (2016b), this study supports the idea that while the Kraljic matrix prescribes the usage of certain levers, category managers actually apply a variety of levers in each portfolio quadrant. While category managers strive to build deeper relationships with some suppliers, they treat others at arms-length and strive to find alternatives, combining a set of different initiatives. Therefore, the way Kraljic's portfolio approach is understood has to be revised. It is understood, as if there was only one correct strategy for categories with similar profit impact and supply risk, e.g. to simplify processes and reduce transaction costs for non-critical items. However, it appears that although there are certain trends that might be associated with those generic strategic suggestions, category managers pursue different kinds of tactical options and are not limited to single levers.

It might be asked, whether it is still relevant to differentiate products based on a portfolio approach. Kraljic's initial reasoning that differentiation of purchasing items based on strategic importance is needed, to apply the correct level of attention, analysis, strategic detail and resources[366], seems logically sound. Yet, two studies on lever usage in relation to the Kraljic matrix that do not support a strong relation of lever application and portfolio quadrant cast doubt on the sound application or usefulness of the portfolio analysis tool in deriving strategic actions. It surely is time to revise the initial idea of limited strategic options per portfolio quadrants and replace it with the found multitude of additive lever usage options. Moreover, it might even be time to consider a product recall of the Kraljic's matrix to replace it with an analysis tool that really provides helpful strategic support to category managers. So far, the major purpose of the Kraljic matrix seems to be of an indirect nature, e.g. to provide a platform for discussion and exchange with limited effect

[365] See Hesping & Schiele (2016b), p.111

[366] See Kraljic (1977), p.76

on the actual strategy.

With regards to success of sourcing levers in relation to the category positioning, this research could not identify significant differences of implementation rates of measures among the differently positioned categories. Differences could be caused by differences in difficulty of purchasing situations or focused attention and usage of resources for categories in certain quadrants. Pairwise comparisons show that strategic categories are significantly more successful in implementing measures than non-critical and leverage categories. The analysis of category characteristics and factors associated with implementation rate yields two significant influence factors. Those are clear alignment with internal stakeholders as well as higher spend. Both factors individually appear together with higher implementation rates. Those factors might explain the higher implementation rate of strategic categories that are of high interest to internal stakeholders and management due to their monetary volume and critical supply markets. Further, due to their volumes, they are interesting to suppliers that are more likely to invest in such relationships.

Levers such as product optimization demand a lot of cross-functional efforts. Therefore, procurement alone cannot drive the implementation but depends on other departments and their support. This might explain why product optimization is used only to a limited extend and with limited success, as it has the lowest implementation rate of all levers. Instead, levers that relate to procurement and suppliers mostly, such as optimization of supplier relationships and price evaluation have a higher implementation rate.

To summarize, this study has four major findings. First, there are either no general trends regarding the usage of sourcing levers in the different quadrants of the Kraljic matrix or they differ per industry. Second, levers that do show significant differences among the portfolio quadrants are extension of supply base and optimization of supplier relationships that relate to the width of the supply base and depth of relationships. Other levers show no significant differences. This might indicate that the generic strategic recommendation according to Kraljic and other scholars have to be re-evaluated. The Kraljic classification might give some recommendations but eventually category managers seem to consider other factors and multi-faceted strategies that uses lever in addition to each other. Third, there are no overall differences in implementation success of measures among the Kraljic matrix. However, pairwise comparisons show strategic categories have a significantly higher implementation rate than non-critical and leverage categories. Finally, differences

might be explained by two category factors that have shown differences in implementation rate. Those are higher spend and strategic alignment with internal stakeholders. If products are relevant to internal and external stakeholders or strategies are well aligned internally, category strategies are more likely to be implemented.

6.2 Limitations from research design and methodology are addressed – further empirical research is needed to understand if there are industry patterns

This research project and its findings have to be interpreted with regards to their limitations. Those are rooted in the dimensions of the purchasing portfolio model by Kraljic and its measurement, the setting of this project in one firm in the chemical industry, as well as the lever framework and the limitations within the data collection.

Firstly, the focal firm uses their adaptation of the portfolio model by Kraljic that is applied to all direct categories. The model has been criticized, as it does not consider factors such as "technological uncertainty, supply market volatility, and the level of customization"[367]. Further, because several factors are summarized in the dimensions of the Kraljic matrix, a scoring model for evaluation will give categories with different configurations of markets and impacts on the company with the same value.[368]

As this research was conducted in one globally leading firm active in many different sectors of the chemical industry, it can be argued that this study based on 50 sourcing categories provides insights into the width of chemical procurement. Yet, it is only based on one firm and bound to its chemical industry context. Besides that, the research is contextually bound to the time that sourcing strategies are valid for. The data collection took place from September to November in 2018 and referred to sourcing strategies introduced from end of 2014 to end of 2017.

Lastly, the lever framework used is one framework introduced and developed by scholars based on previous models. Yet, other models exist and there is not one true model that captures all kinds and variants of levers being used. Therefore, the classification was bound to some interpretation. Due to different names and formulations of actions the classification of measures is to some degree bound to the understanding of the measure. To control for misunderstandings the category managers were asked to explain the strategic measures that were planned in detail. Also, the notes of the interviews have been sent to the interviewees in a table format facilitating a clear understanding. To assure correct

[367] Luzzini et al. (2012) p.2-3

[368] See Heß (2010), p.37

classification and avoid a potential ill-classification by category managers, the classification followed both a bottom up and top down approach. First, measures were classified based on the identified actions and extensive explanations from the category managers. This led to about 60 fine grained measure differentiations. In order to condense this complexity, measures were reviewed again and similar measure groups were joined when reasonable.

Also, the data collection was bound to constraints. A potential reason for differences in choice of lever and implementation success might be the education and professional background of a category manager. Maybe, chemists have a stronger focus on the chemical value chain and production processes while those with a background in business administration rather use commercial measures. However, the management decided not to look at personal factors for this project. Also, ethical considerations were a major reason.

Finally, the size of the dataset due to limited number of leverage and strategic categories might be a limitation to the generalizability of the data and hence affect the analysis.

Overall, this research project has answered its major research questions and added to the literature on the practical application of both sourcing levers and the Kraljic matrix in industrial procurement. Now research can take three different trajectories to improve the understanding of sourcing levers and purchasing portfolio tools. First, further research tactical sourcing levers in relation to the Kraljic matrix is needed to understand whether there are general patterns of lever usage across or within industries. In addition, the topic of sourcing strategies and their implementation needs further empirical research with bigger sample sizes to test for differences in success of levers in relation to the Kraljic matrix and test identified factors as well as potential other factors that have not been addresses so far. Second, the Kraljic portfolio matrix should be analysed in use to better understand reasons for the widespread usage of the tool, its actual application and the value that its users derive from it. This would help to identify potential other values beside the apparently limited support in strategic differentiation of sourcing strategies. Last, a cluster analysis considering potential contingency factors such as complexity and volatility among others on lever usage patterns might yield potentially different explanations for differences in category strategies and allow refining the Kraljic matrix or building a new tool.

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Annexures

A1 Content and Objectives of Supply Strategies

Content of supply strategies	**Mentioned by**
Scope of Procurement (Make or Buy)	Gadde & Snehota (2000) Schiele (2019), p.57 based on Arnold (1997), p.93-122
Number of suppliers	Gadde & Snehota (2000) Van Weele (2010) Schiele (2019), p.57 based on Arnold (1997), p.93-122
Supplier relationship	Gadde & Snehota (2000) Van Weele (2010)
Locational concept	Van Weele (2010) Schiele (2019), p.57 based on Arnold (1997), p.93-122
Supply chain model	Schiele (2019), p.57 based on Arnold (1997), p.93-122
Sourcing object	Schiele (2019), p.57 based on Arnold (1997), p.93-122
Pooling concept	Schiele (2019), p.57 based on Arnold (1997), p.93-122
Purchasing levers	Schiele (2019), p.57 based on Arnold (1997), p.93-122
Contract type and pricing	Van Weele (2010)

Performance requirements	Van Weele (2010)
Performance measurement (KPI)	Van Weele (2010)

Table 4: Content of sourcing strategies for materials

Objective	Mentioned in
Cost	Cousins et al. (2008), p.107 Kruse et al. (2001), pp.500-501 Luzzini et al. (2012), pp.1027-1028 Schiele (2019), XX Van Weele (2010), p.217
Quality	Cousins et al. (2008), p.107 Kruse et al. (2001), pp.500-501 Luzzini et al. (2012), pp.1027-1028 Schiele (2019), XX Van Weele (2010), p.217
Delivery time	Cousins et al. (2008), p.107 Kruse et al. (2001), pp.500-501 Luzzini et al. (2012), pp.1027-1028 Van Weele (2010), p.217
Delivery Flexibility	Cousins et al. (2008), p.107 Kruse et al. (2001), pp.500-501
Innovation	Cousins et al. (2008), p.107 Kruse et al. (2001), pp.500-501 Luzzini et al. (2012), pp.1027-1028
Sustainability	Luzzini et al. (2012), pp.1027-1028
Efficiency	Luzzini et al. (2012), pp.1027-1028 Van Weele (2010), p.217
Supply security	Schiele (2019), XX
Access for competitive advantage	Schiele (2019), XX

Table 5: Objectives of supply strategies in the literature

A2 Kraljic Matrix

Illustration 6: Kraljic matrix with generic strategies

A4 Levers and Measures

Lever	Levers according to Hesping & Schiele (2016b)	Activities identified here
Volume bundling	• Allocate volumes to one or few suppliers • Bundling on BU or regions • Add new allocations to current volumes • Bundle requests into package	• Bundle demand with dew suppliers • Bundling across BU or regions • Collaborative buying
Price evaluation	• Define price target for negotiation • Gather additional offers • Recalculation of the offered price	• Auction & Tender • In-depth price analysis • Adjust payment terms • Price formula
Extension of the supply base	• (Stepwise) build up suppliers • Global sourcing and low-cost country sourcing • Localization	• Screen for new suppliers • Find alternative sources / substitutes • Qualify known supplier • Invest in plant to accept other suppliers • Tolling / contract manufacturing • Qualify other production site • Buy from spot market • Geographical diversification • Localization • Increase direct sourcing
Process optimization	• Optimize logistics • Improve capacity and demand planning • Quality dialogues with suppliers	• Improve market intelligence • Improve forecasting • Improve processes and define guidelines • Improve production processes

		• Optimize logistics • Introduce strategic stocks and volume flexibility
Product optimization	• Standardization • Drive usage of other technology for costs • Early involvement in product development teams with suppliers	• Make or buy analysis • Standardization • Widen specifications • Change to higher quality to improve production process
Optimization of the supplier relationship	• Improve attractiveness to suppliers • Build up supplier capabilities • Use individual contract conditions	• Long-term contracts • Supplier relationship management • Partnership • Collaboration on R&D and innovation • Support supplier projects
Category spanned initiatives	• Align with adjacent categories • Bundle volumes across categories • Collaborate on technical optimization	• Bundle volumes across categories / joint negotiation • In case of interdependence, leverage own sales

Table 8: Lever framework: Comparison of Hesping & Schiele (2016a) and own classification of measures

A5 Lever Usage per Positioning

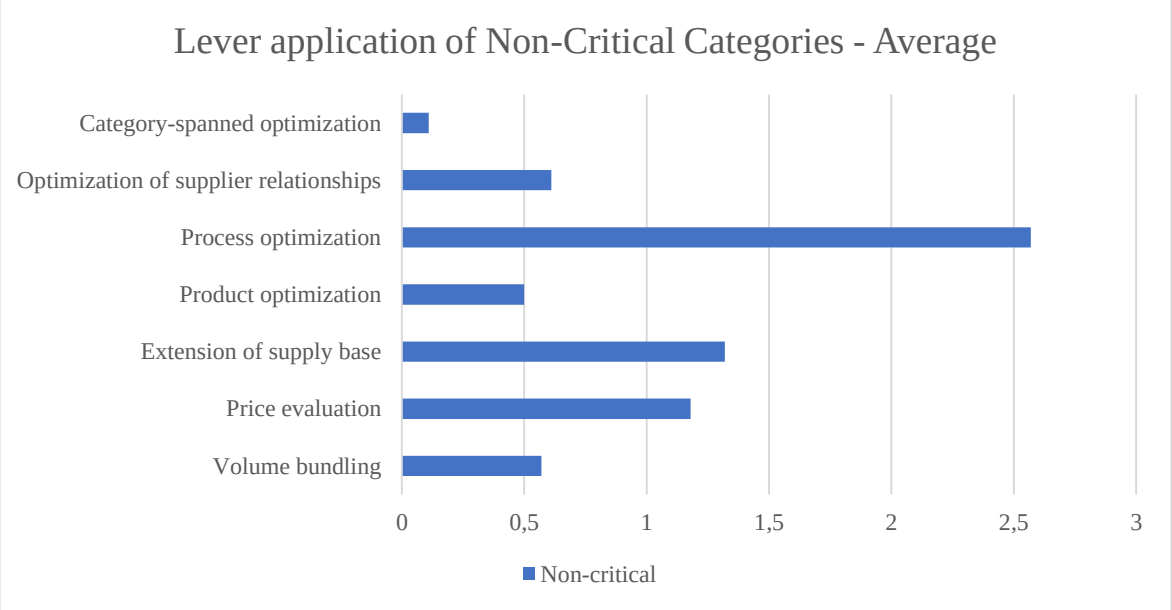

Illustration 7: Lever application of Non-Critical Categories - Average

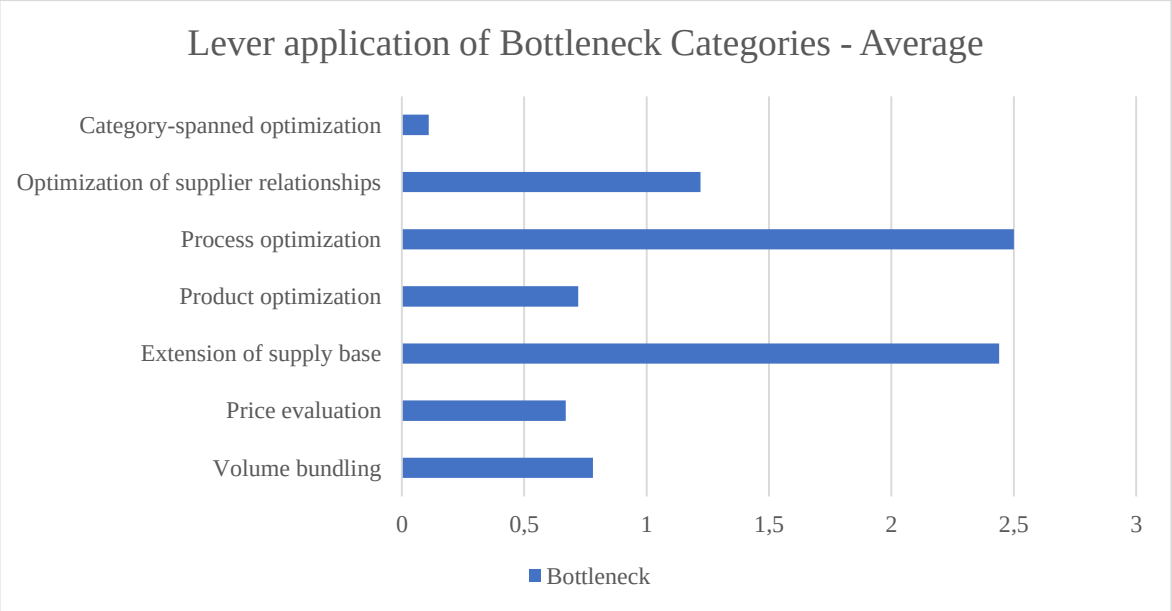

Illustration 8: Lever application of Bottleneck Categories - Average

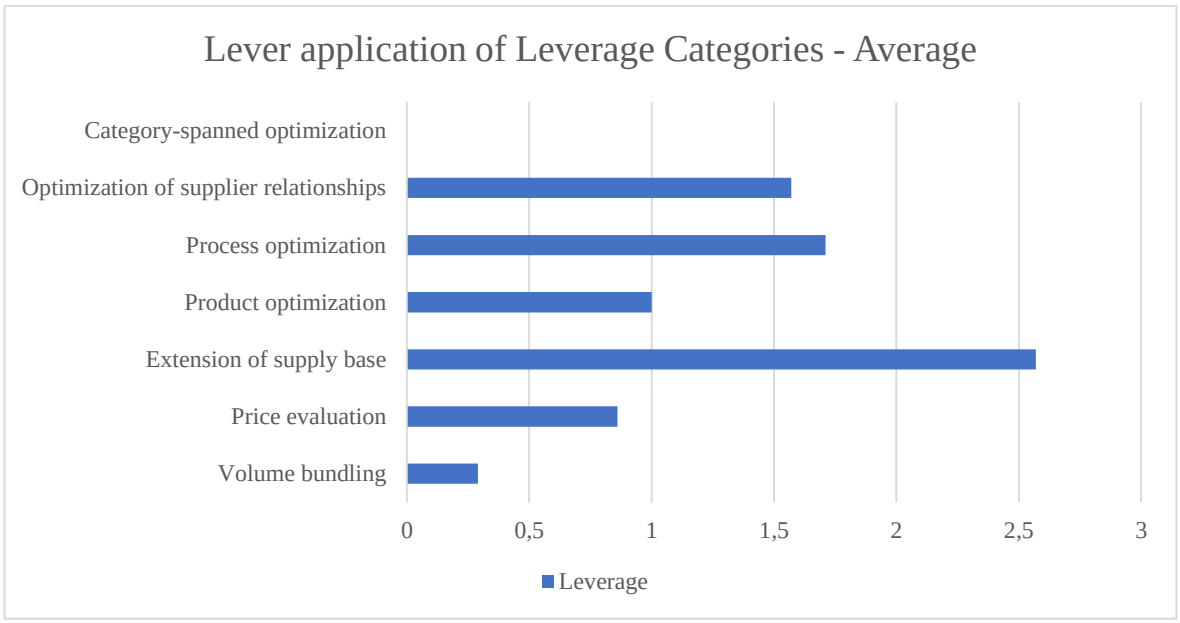

Illustration 9: Lever application of Leverage Categories - Average

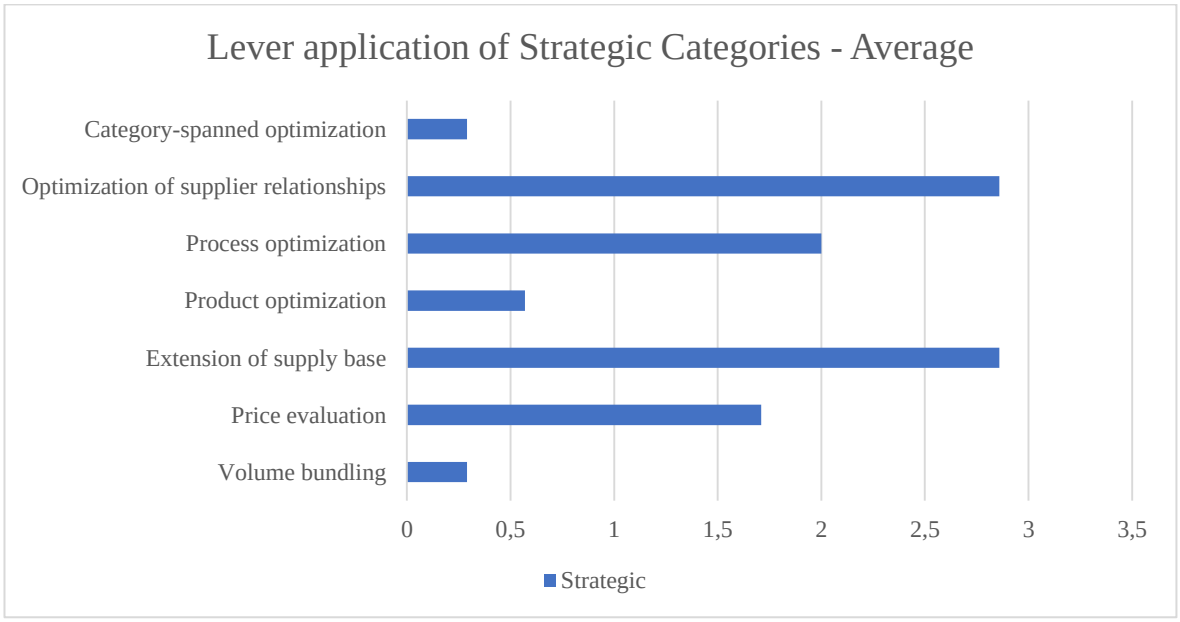

Illustration 10: Lever application of Strategic Categories - Average

A6 Sourcing Lever Usage and significant Differences

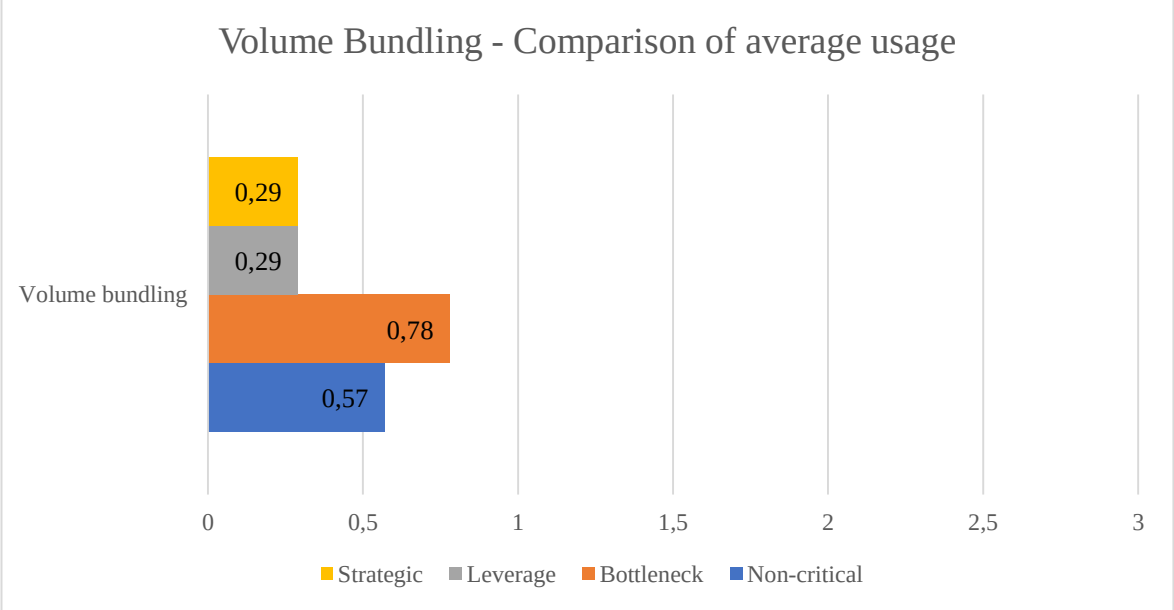

Illustration 11: Volume Bundling - Comparison of average usage

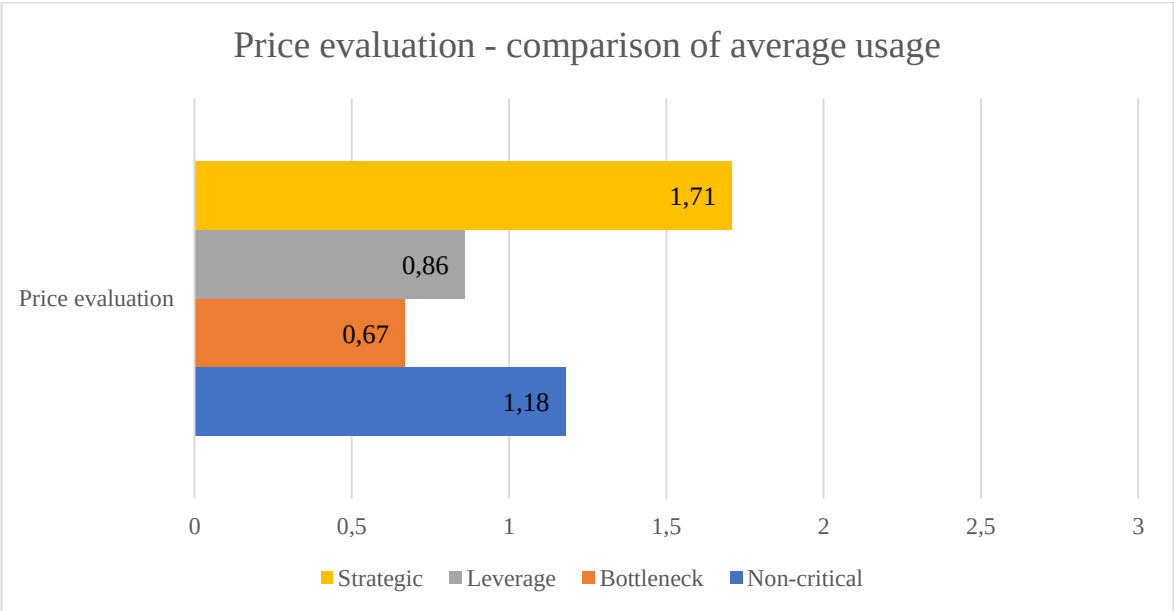

Illustration 12: Price evaluation - comparison of average usage

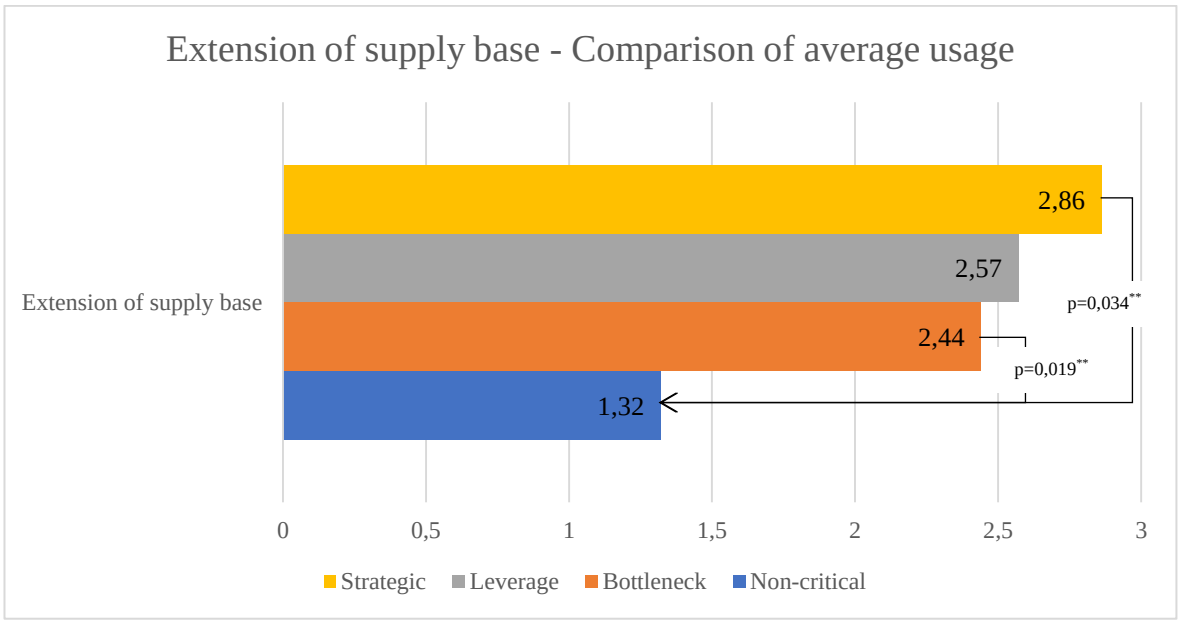

Illustration 13: Extension of supply base - Comparison of average usage

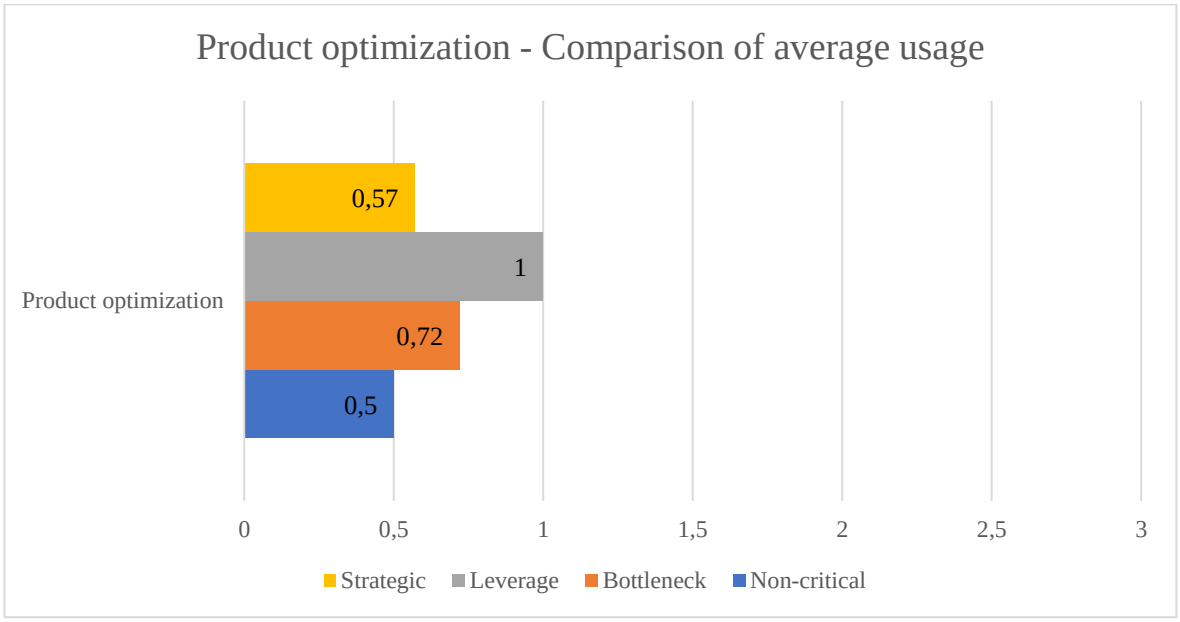

Illustration 14: Product optimization - Comparison of average usage

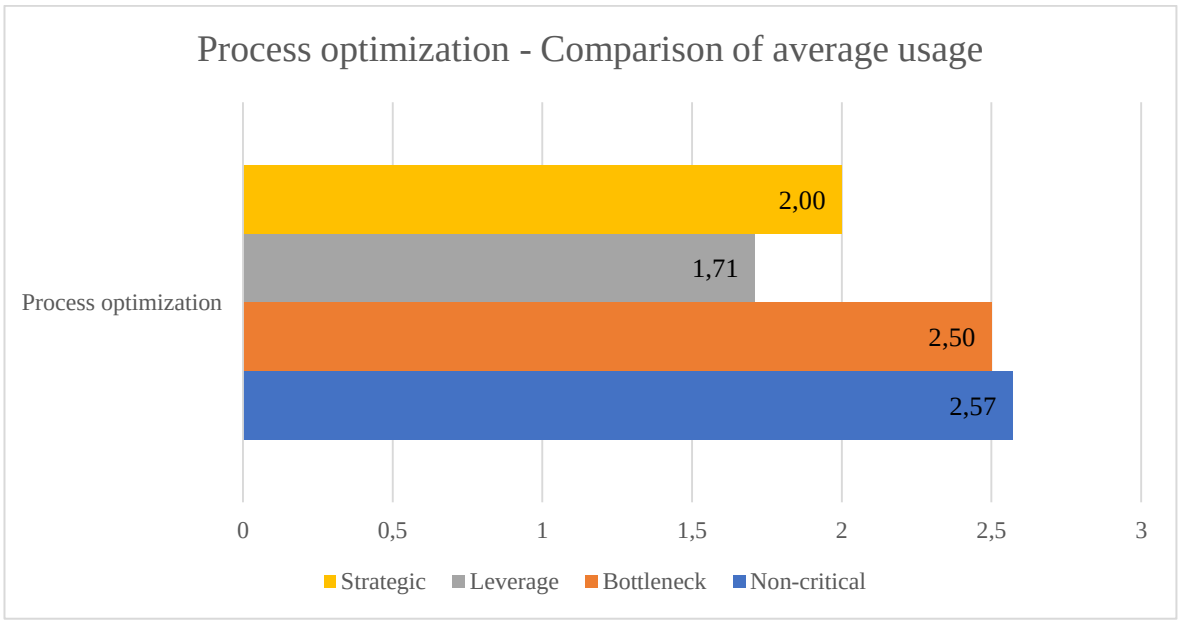

Illustration 15: Process optimization - Comparison of average usage

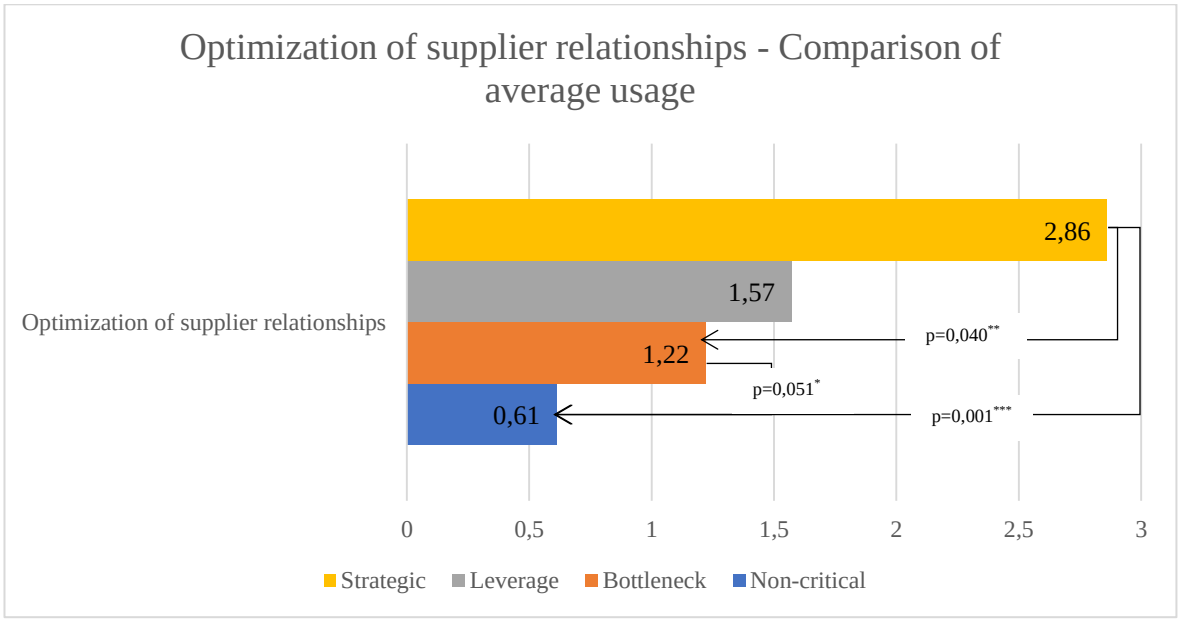

Illustration 16: Optimization of supplier relationships - Comparison of average usage

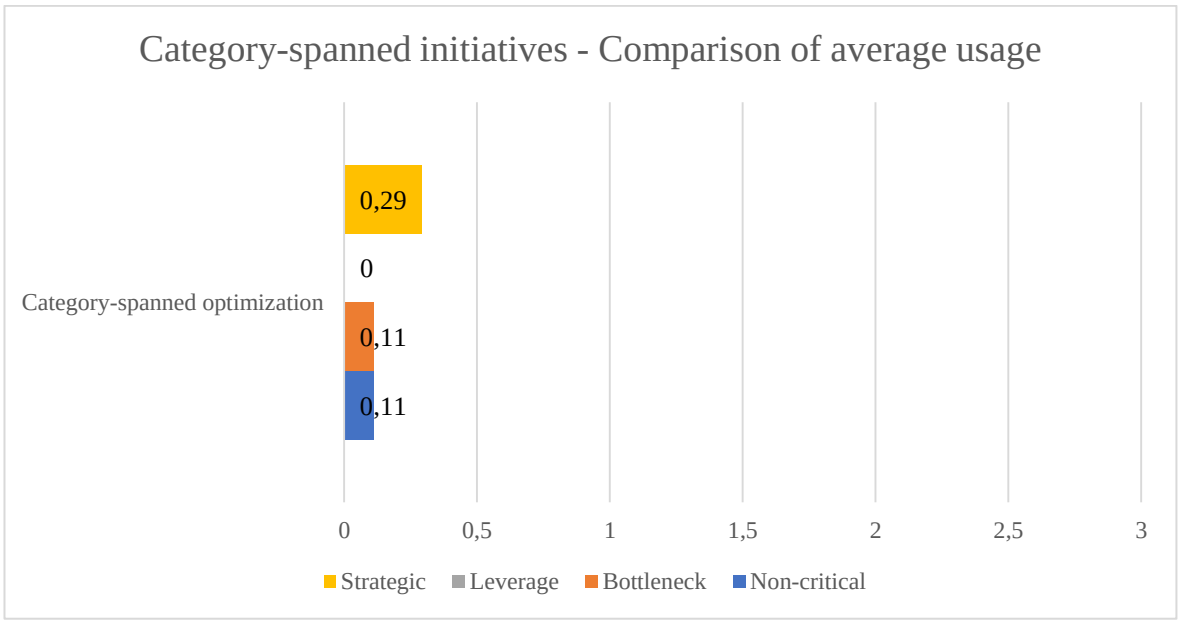

Illustration 17: Category-spanned initiatives - Comparison of average usage

A7 Results of the Analysis

Tactical sourcing lever	ø n = 60				Non-critical n = 28				Bottleneck n = 18				Leverage n = 7				Strategic n = 7			
	pos.	delta ø	mean	std. dev.	pos.	delta ø	mean	std. dev.	pos.	delta ø	mean	std. dev.	pos.	delta ø	mean	std. dev.	pos.	delta ø	mean	std. dev.
Volume bundling	6	-	0,57	0,767	6	0	0,57	0,634	4	0,21	0,78	1,060	6	-0,28	0,29	0,488	5	-0,28	0,29	0,488
Price evaluation	4	-	1,05	1,254	2	0,13	1,18	1,335	6	-0,38	0,67	0,767	5	-0,19	0,86	0,900	3	0,66	1,71	1,976
Extension of supply base	2	-	1,98	1,761	3	-0,66	1,32	1,056	2	0,46	2,44	1,723	1	0,59	2,57	2,936	1	0,88	2,86	2,116
Product optimization	5	-	0,63	0,823	5	-0,13	0,50	0,638	5	0,09	0,72	0,826	4	0,37	1,00	1,414	4	-0,06	0,57	0,787
Process optimization	1	-	2,38	1,648	1	0,19	2,57	1,67	1	0,12	2,50	1,948	2	-0,67	1,71	1,254	2	-0,38	2,00	1,414
Optimization of supplier relationships	3	-	1,17	1,404	4	-0,56	0,61	0,832	3	0,05	1,22	1,114	3	0,4	1,57	2,070	1	1,69	2,86	1,864
Category-spanned optimization	7	-	0,12	0,324	7	-0,01	0,11	0,315	7	-0,01	0,11	0,323	7	-0,12	0,00	0,000	5	0,17	0,29	0,488
Implementation rate	-		0,663	0,28	-	-0,027	0,636	0,266	-	0,002	0,665	0,316	-	-0,070	0,59	0,325	-	0,179	0,842	0,129

Table 9: Comparison of tactical sourcing lever usage across portfolio quadrants

Note: Application of tactical sourcing levers is calculated by adding up all measures that belong to a certain lever per category and shown as averages above

Tactical sourcing lever	Average across all categories		Non-critical and Leverage		Non-critical and Bottleneck		Non-critical and Strategic		Bottleneck and Leverage		Bottleneck and Strategic		Leverage and Strategic	
	delta mean	p-value	delta mean	p-value	delta mean	p-value	delta mean	p-value	delta mean	p-value	delta mean	p-value	delta mean	p-value
Volume bundling	-	0,540	0,28	0,282	-0,21	0,842	0,28	0,282	0,49	0,334	0,49	0,334	0	1,000§§§
Price evaluation	-	0,523	0,32	0,647	0,51	0,196	-0,53	0,698	-0,19	0,622	-1,04	0,242	-0,85	0,547
Extension of supply base	-	0,051*	-1,25	0,305	-1,12	0,019**	-1,54	0,034**	-0,13	0,577	-0,42	0,735	-0,29	0,422
Product optimization	-	0,771	-0,5	0,430	-0,22	0,378	-0,07	0,888	-0,28	0,842	0,15	0,665	0,43	0,624
Process optimization	-	0,586	0,86	0,199	0,07	0,663	0,57	0,413	0,79	0,399	0,5	0,664	-0,29	0,688
Optimization of supplier relationships	-	0,009***	-0,96	0,433	-0,61	0,051*	-2,25	0,001***	-0,35	1,000§§§	-1,64	0,040**	-1,29	0,132
Category-spanned optimization	-	0,416	0,11	0,372	0	0,967§§	-0,18	0,234	0,11	0,368	-0,18	0,295	-0,29	0,141
Implementation rate	-	0,181	0,046	0,754	-0,029	0,64	-0,206	0,023**	0,075	0,83	-0,177	0,157	-0,252	0,07*

Table 10: Portfolio quadrants jointly analysed for differences and similarities

Note: The Kruskal-Wallis H test was applied to all four portfolio quadrants simultaneously; the Mann-Whitney U test was applied to each possible pair of portfolio quadrants; Difference: *** highly significant ($p \leq 0,01$); ** moderately significant ($0,01 < p \leq 0,05$); * slightly significant ($0,5 < p \leq 0,1$); Similarity: §§§ highly significant ($p \geq 0,99$); §§ moderately significant ($0,95 \leq p < 0,99$); § slightly significant ($0,9 \leq p < 0,95$)