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Florian Schupp
Heiko Wöhner *Editors*

The Nature of Purchasing

Insights from Research and Practice

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Purchasing is simple but not easy.
Masafumi Horio

Foreword

This book is written with the ambition to progress the field of purchasing by taking a step back and looking at it from multiple, multidisciplinary angles, thus inspiring important novel thoughts and considerations.

When confronted with the topic of this book as a cognitive zoologist studying the evolution of thought processes in intelligent animals, several thoughts come to my mind. In civilised societies, we have alienated ourselves from nature and sometimes forget that we are products of evolution and natural selection, like all other living vertebrates. The awareness that our brains and minds have been shaped by nature matters greatly, because it enables us to comprehend ourselves better. It may help us to become aware of weaknesses, cognitive biases and undesirable tendencies that form part of our "human nature" while fostering the desirable traits. When we look at human economic behaviour, it is worth keeping this in mind. For example, we may be convinced that we are using our rational thought to arrive at optimal economic decisions, while actually in some of our decision-making we revert to unconscious, genetically pre-wired decision-making processes that allow for quick processing of information and economic weighing-off between options (see works, e.g., by Daniel Kahneman, Gerd Gigerenzer or John-Dylan Haynes).

Some of us may feel uncomfortable with the thought or rather the fact that some of our behaviour is regulated by automated and unconscious processes. But it is important to recognise that these can have an immense survival value because they allow for much faster beneficial reactions (e.g. see study by John W. Payne). Yet, it may also occur that we unwittingly behave suboptimal and irrationally because our ratio is bypassed by other mental processes and psychological inclinations that lay in "our nature". For example, humans tend to fall for what is often referred to as the "sunk cost fallacy", also known as "too-much-invested-to-quit fallacy", their perception of value is influenced by context, the so-called context-depending utility bias, or by physiological need as in "state-dependent-valuation learning" (see works by Alex Kacelnik for summaries). For example, after you once had a type of food in a special situation with a state of physical exhaustion, e.g. eating a certain cheese sandwich after having climbed the peak of a mountain, you are likely to overrate the taste or "value" of that food in the future compared to other similar food types. Sometimes, we might also make irrational choices simply because of impulsivity or a lack of self-control. Undoubtedly, recognising and overcoming such tendencies

would help us to optimise our economic behaviour. Further, it may also be worthwhile examining how natural selection has fine-tuned optimal decision making and economic behaviour in other species, because this may broaden our perspective and allow us to gain further insights relevant for optimising our own behaviour (see chapter by Florian Schupp).

The essence of natural selection is fine-tuning for efficiency, because only the fittest individuals' genes reproduce and survive, i.e. remain in any species' gene pool. Albeit, as a passive process bound to always develop from the current status quo, evolution does not necessarily result in the most efficient strategy ever. Yet, all living creatures strive for maximising their fitness while minimising their time and energy expenditure. For this reason, there are many parallels between natural evolution and economic modelling, such as in game theory. Optimal foraging theory is an ecological application of the optimality model that helps predict how an animal behaves when searching for food and represents a good example in this regard. It has been widely studied by behavioural ecologists in various animal species ranging from wild starlings to bees. It examines how animals develop the most economically beneficial foraging patterns that help them to maximise their net energy intake while minimising their costs given that searching for food can be costly in terms of both time and energy. To illustrate how subtle behaviour can be fine-tuned, foraging starlings serve as a good example. For example, when provisioning their young in the nest, they optimise the load of worms they carry in their beak per trip back to the nest as a function of travel time, because the fuller their beak gets the longer it takes them to pick up further worms. At the same time, studying decision-making in starlings has also revealed that their rational decision-making can be hampered by psychological processes mirroring those found in humans. For example, like humans, they can be tricked into suboptimal choice-making by contextual cues, when having to decide between two simultaneously presented options, because based on their previous experiences they associate the suboptimal option as the beneficial one in that context ("context dependent utility"; see studies by Alex Kacelnik). Therefore, it is sometimes adaptive to ignore contextual information ("less-is-more" effect).

Studying economic behaviour in various species may also help us to identify different algorithms and trade-offs that could be valuable for refining artificial intelligence that may exceed our human capacities and employed as a tool in the future.

Intelligent purchasing forms the basis for any successful industry surviving market competition. The essence of successful purchasing is a combination of strategic planning and timing, resource management, storage place, the right amount and buffer, anticipation of the developments and predicting changes in the consumer behaviour and the market in general among many other skills. To some extent, it could be equated with foraging in animals.

Two take-away messages thus from my perspective: We can learn from nature, and we can gain a lot if we understand "human nature", i.e. to understand ourselves as products of evolution and part of nature. Therefore, I advocate that we should

strive for reconnecting with nature. Even more important, we ought to make sure our children spend sufficient time outside in nature, so they can fully develop their senses as well as their natural curiosity.

This book takes a step back and takes a fresh look at purchasing from different angles. I wish the reader inspiration and an enjoyable lecture when "foraging" in its chapters.

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Auguste von Bayern is a cognitive zoologist who seeks to understand how animals, particularly crows and parrots, "think" and how intelligence evolves. Her research interests comprise flexible reasoning skills and vocal learning abilities of these birds. After completing her PhD at the University of Cambridge, she continued as postdoctoral researcher at the University of Oxford investigating flexible tool-use in crows. Since 2014, she leads the Comparative Cognition Group at the Max-Planck-Institute for Ornithology and runs a research station on Tenerife where her team investigates the cognitive abilities of different parrot species comparatively, collaborating with the Loro Parque Foundation, which keeps the world's largest collection of parrots. Auguste is keenly interested in biodiversity conservation and environmental protection. She chairs the "Förderkreis Biotopia e.V", an initiative for the realization of an international life sciences platform in Munich, Germany, which raises awareness for environmental issues and enthuses people for nature and science.

Acknowledgements

Nature is not only our habitat, it frames and directs our behaviour. Nature, both the biology of humans and the human nature, is the ground for activities that are performed by humans in daily life. Our professional field, purchasing goods and services, is embedded in our nature and therefore might follow natural rules. This book was created in the spirit of following nature to reflect the field of professional purchasing. We have asked ourselves what the core of purchasing would be, the inner structure of it or in other words the natural way. We are curious to learn from nature because nature masters both effectiveness based on immanent laws and efficiency by best results for minimal invest.

We have asked distinguished experts in their field to contribute to this book. All of them have accepted our challenge without hesitation. We want to thank all authors for their incredible contributions.

In addition, we want to thank Thomas Stürzl, Alfons Hörmann, Michael Hartig, Keith Mackey, Matthias Renz and Masafumi Horio. They have established contact to experts and did not hesitate to help us with proof-reading and expertise. Moreover, we thank Auguste von Bayern for taking the effort to reflect this book's approach to enhance purchasing by recognizing its natural way.

We kindly invite you, the reader, to get in touch with us and to establish further dialogue on the nature of purchasing.

Our dedication is only possible with the support, backing and patience of our families. We want to express our gratitude to Alexandra, Liv Grete, Anne-Hélène, Immanuel, Julia, Hinnerk and Hergen.

Florian Schupp
Heiko Wöhner

Introduction

Abstract The target of our book is to present purchasing in its natural flow and to reflect on purchasers' natural behaviour. We refer to nature and see purchasing in a natural way. We strive to overcome the definition of artificial processes that cannot be met in practical reality. Instead, we want to allow you, the reader of this book, to detect and to find additional cognitive glow. In a way we want you to see, to hear and to feel how nature directs the business that you are in and how you can safely and successfully be part of this nature. Feel free to step into the nature of purchasing.

You might wonder what "the nature of purchasing" could be—and so did we some time ago whenever we were asked from students, scientists and professionals of non-purchasing functions to describe the meaning and core of purchasing. The range of answers starts at "buy what is needed" and ends somewhere beyond "the art of negotiation". In fact, "What purchasing is" could have been another promising title for a book, but we choose a less analytic approach because purchasing has got so many aspects that any overview can hardly be complete and discerning at the same time. Therefore, this book shall provide insights to different topics that purchasers are concerned with to allow both a better understanding of exactly those currently important purchasing topics and a grasp of what and how purchasing is on a more abstract level.

The analogy to nature can and shall be interpreted from different angles. Purchasers are humans, and business is done between humans. Therefore, it is interesting to reflect human behaviour and natural processes in the light of purchasing interactions. Florian Schupp elaborates such analogies in his chapter on "Elements of Purchasing in Nature" and offers possible interpretations that shall be challenged and discussed. The chapter draws on research about behaviour of animals, e.g. birds, wolves, fish, chimpanzees—and humans—and proposes implications and applications of these research results in the field of purchasing. As an example, the mating sounds of tropical katydid males have a leader–follower structure where the leader is most attractive to females, but the followers benefit from the group situation by extended acoustic space: Competition increases in a group situation—in the analogy, suppliers in a true competition situation are more attractive than the lonesome single supplier.

There are increasingly smart technological tools to create such situations of supplier competition such as "Auctions as the Most Efficient Form of Negotiations". ZEW—Leibniz Centre for European Economic Research explains how auctions are the breeding ground to shift the negotiation between buyer and supplier towards a competition amongst suppliers. Commitment of the buyer to the auctions' results and an introduction into different forms of auctions are provided.

Despite the technological progress, key element of interactions in purchasing remains the negotiation with a potential supplier. Both parties have a common target—closing a deal to ensure supply, respectively to generate sales volume—but both parties have different opinions about the details of such a deal. The chapter ""En Garde!"—What Business Negotiators Could Learn from an epée Fencing Champion" by Britta Heidemann and Pascal Fournier offers to learn from an Olympic champion how to prepare in the long-run and to perform on stage or at the negotiation table. From mental and physical preparation to tactics during a repartee, from assessing own and opposing capacities to considering appropriate timing for attack or defence: There is a plenty of lessons to learn. We all know feedback is important for improving one's own capabilities, but how often do you invite your trainer, e.g. besides other options your boss, to join your negotiations and to provide feedback on how you act in the real negotiation situation? To improve the results, we must improve the technique.

Like flora and fauna undergo a permanent change by internal and external stimuli, purchasing as a function evolves over time. Thomas Nash and Robert Handfield present "Purchasing's Role as an Influencer of Business Outcomes" and give insights from practical experience why successful purchasers are team players in today's business environment. While operational purchasing of the past followed a command and control approach to tell people what to do and how to do it, today's purchasers need to win individuals' hearts and minds. Purchasers need to adapt their approaches to the nature of different problems and the individuals at hand. Thus, purchasing realises positive change and actively contributes to the development on the organisational, the dyadic and the supply chain level.

Searching, identifying and integrating new ideas, products and opportunities help companies to develop and to stay competitive. "Innovation Scouting: A New Challenge for the Purchasing Function" is such an area of development. In their chapter, Richard Calvi, Matti Pihlajamaa and Romaric Servajean-Hilst present alternative organisational solutions with focus on purchasing's role in innovation scouting. These organisational set-ups integrate the innovation capabilities of the internal organisation with the external environment to allow for an effective gatekeeper role of purchasing to gather information, filter potentially fitting innovations and transmit information in the innovation community.

On the dyadic level, understanding the status and the prospects of the buyer–seller relationship is essential to realise as many benefits as possible over time. Yusoon Kim and Thomas Choi expand the conventional framework of relational posture with the relational intensity in "Reframing Buyer–Supplier Relationships: Deep, Sticky, Transient and Gracious". A cooperative relationship is not synonymous with closely tied partnership, and an adversarial relationship is not equal to

arm's length transaction. To put it differently: Consider your top 10 suppliers, do you have a positive attitude towards all of them? The differences are part of the relationship's nature, and its success can be increased by understanding and leveraging the underlying mechanisms.

Would it not be refreshing if purchasers could work with purchasers instead of salesmen? Opportunities for alignment of purchasers along the supply chain are presented by Lotta Lind and Florian Schupp on the example of the financial flow along the supply chain: "Towards Efficient Financial Supply Chains: How to Leverage Inter-organizational Working Capital by Digitalizing the Financial Flows". The chapter illustrates the potential of financial collaboration by proposing a model for working capital optimisation in the supply chain via payment term adjustments. An analysis of seven scenarios of payment terms along the supply chain shows that significant amounts of working capital could be released by enabling win-win situations with an incentive system.

Like a tree that grew a stable trunk and a wide crown, purchasing embraces a wide range of aspects that nurture each other. The use of artificial intelligence is an example that visualises the technological development. Frank Straube, Anna Lisa Junge and Tu Anh Tran Hoang present "Prospects of Purchasing—An Evaluation Model for Data Mining Approaches for Preventive Quality Assurance". With the availability of big data, future purchasing relies on the ability to use that data with suitable tools and skills. Taking the example of preventive quality assurance as part of purchasing's quality dimension, support vector machines and k-nearest neighbour are presented as most promising data mining methods.

Another view on the quality branch of purchasing considers the measurement of defects and how purchasing can prevent defects. "Zero Shades of Gray—Reaching Zero Defects by Externalization of the Quality Philosophy into the Upstream Supply Chain" by Johanna Ewald and Florian Schupp derives a practically tested five step approach to permanently reduce the number of quality issues. This approach includes analytics, expert involvement as well as management involvement and commitment. Taking this approach with suppliers lifts buyer–supplier relationships on a higher level through transparency, open and consequent failure communication as well as technical co-operation.

Sustainability and the care for ecological and social features are fast-growing purchasing aspects that can be expected to be of increasing importance in environmentally significantly changing times. "Ethical Purchasing—Knowledge- and Person-Related Inhibitors to Consumption of Fair Fashion" by Marlene M. Hohn and Christian F. Durach gives insights why only few consumers buy fair-trade clothing despite many opposing to the unsustainable working conditions in the apparel industry. Such divergence of expectations and behaviour that can be found in other areas of purchasing as well.

In addition to these new purchasing branches, it remains worth to take a closer look at what could be called the evergreens of purchasing: prices and contracts. Taking sourcing decisions remains as difficult as evaluating the contribution of the taken sourcing decisions. Roberta Pellegrino, Barbara Gaudenzi and George A. Zsidisin consider "The "True" Cost of Mitigating Commodity Price Volatility:

Insights from Total Cost of Ownership and Real Options Approach". Many companies approach price volatility in commodity markets by risk mitigation practices to lower the risk of potential losses. However, such practices are often associated with high implementation costs. Therefore, commodity price risk mitigation strategies need to be analysed under the perspective of their costs and performance. Luigi D'Ottavi assesses "The Value of Contracts in a Long-Term Context—An Example Based on the Lateran Treaty and the Concordat of 1984". This view on the Lateran Treaty of 1929, and its revision in 1984 shows that a durable long-term agreement can become a win-win situation. The understanding of the negotiation is by far not limited to the government-to-government sector.

To master today's and future challenges, purchasing and purchasers must drive the change and adapt to changes. Thus, purchasers require a modern set of skills. Yasmin Weiß and Sonja Kamm take a closer view in "Upskilling for "Purchasing 4.0": How European Automotive OEMs Master the Future of Purchasing with the Right Skill Set". A well-rounded qualification profile combines a general knowledge in many areas with deep expert knowledge and profound experience in purchasing. The future hot skills of purchasers combine the purchasing experience with specific digital skills, e.g. advanced analytics.

Nadine Kiratli contributes a view beyond the individual level and emphasises an important part of nature and development, the ability to develop novel and meaningful solutions for new problems: "Creativity in Purchasing—What a Team Can Do" . The understanding of purchaser's and team's behaviour is essential to build purchasing teams in such a way that success flourishes. On the background of an ever, but increasingly faster changing business environment, creativity is a key competence for continued cost savings and value creation. Interestingly, leadership styles should vary during the different stages of the creative process to reach optimal results.

How individual traits make the difference and accounts for group performance present Alessandro Ancarani, Carmela Di Mauro, Giulia Crocco and Florian Schupp in their chapter about the role of confidence in the well-known beer game: "The Importance of Being Confident: Evidence from a Supply Chain Experiment". An empirical test implies that the self-confidence of inventory managers is important in affecting the trade-off between guaranteeing the smooth flow of goods across the supply chain and cost containment. The nature of the purchasers impacts on their order behaviour.

The following chapters combine scientific research results with practical experience in purchasing and supply management, present case studies, analysis and experiments, and hopefully nurture curiosity to further read a selection of the literature references, to get in touch with the authors and editors, as well as to reflect and improve your own purchasing skills.

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About the Editors

Prof. Dr.-Ing. Florian Schupp works as Senior Vice President Purchasing & Supplier Management Automotive OEM at the Schaeffler Group, Germany. He completed his Ph.D. at the Technical University of Berlin in the field of strategy development in purchasing and logistics and has 21 years of purchasing experience in the companies Schaeffler, Continental, Siemens and Sony. He integrates practical purchasing and supply management work with academic research together with the University of Lappeenranta, Finland; the University of Catania, Italy; the Université Savoie Mont Blanc, Chambéry, France; the Technical University Berlin, Germany; and the Jacobs University Bremen, Germany. He teaches purchasing and supply management in Bremen and Berlin. Main research interests are purchasing strategy, behavioural aspects in purchasing, purchasing in nature and supplier innovation. Schupp is member of the Advisory Board of BLG Logistics, Bremen, Germany and the Advisory Board of Xtronic, Böblingen, Germany. Since 2019, he is Adjunct Professor for Logistics at the Jacobs University Bremen, Germany.

Dr. Heiko Wöhner is Director Supply Management Automotive OEM at Schaeffler. He studied industrial economics and management at the University of Bremen, Germany and the Mid Sweden University, Östersund, Sweden. He completed his Ph.D. on supply chain integration at the European Business School, Oestrich-Winkel, Germany and worked as a project manager at the German logistics association BVL. His main research interests are integration along the supply chain and behavioural aspects in buyer–supplier relationships.

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Elements of Purchasing in Nature

Florian Schupp

1 Introduction

Humans are part of nature. Our closest animal ancestors are chimpanzees that developed as well but in a slightly different way than us. Our paths have diverged 7 million years ago, which is why we can learn a lot from each other. Other animals are maybe not as close to us as chimpanzees are, but for different reasons, they also show behaviour that can help us to understand ourselves better. Noë et al. (2001) and Kalenscher and van Wingerden (2011) explain why we should look at animals to study economic decision making. Both researcher groups show that economic and evolutionary theories of human and animal decision have much in common as both focus on profit maximization. The target of this chapter is to reflect on ourselves and to learn about the benefits of self-control. By studying animals and humans in specific situations related to purchasing tasks, this article wants to offer behavioural hints and suggestions for the decisive moments in purchasing. We can read in many pieces of literature on purchasing and supply management and on economics how humans in the ideal case should act. In my experience, this ideal case does not happen very often. Therefore, I asked myself what really drives us in deviation from economics (e.g. as in Stiglitz 1993). These days the most wanted way of studying is to test a hypothesis based on a set of probands or interviewees performing a set task and concluding from this. The last ten IPSERA conferences (see for example IPSERA 2018, 2019) and journals like the Journal of Purchasing and Supply Management have shown this trend. Most of this research is, of course, valuable and some of it is also applicable, but in my view, it does not reflect on the natural behaviour of us humans in the decisive moments, in the moments of truth in purchasing and supply management. Not primarily, the description and analysis of a

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transaction in the past are deciding about the success of the buyer in the future. Rather the role models around us buyers or the natural behaviour of our brain is ruling over our actions. My position is simple. We should know economics theory, research results of purchasing and supply management studies, and in addition to these two, we should try to understand how nature works or better how nature runs. Most likely, trying to master nature is not a good idea. We have seen in numerous pieces of research that this does not work (Grill et al. 2019). But we can learn how to use the natural way for us. I invite you to join this journey by entering into the world of nature, or how Hollywood would probably say it: Welcome to Purchasing Jumanji! You can enter Purchasing Jumanji from the front of this chapter, but it is also possible to dive in at another spot.

2 How Parrots Make Economic Decisions

Krasheninnikova et al. (2018) have tested four parrot species with regard to economic decision making in a so-called token exchange task. Before going into the study itself, the researchers explain the background of economic decision making as being the decision process between different beneficial alternatives in order to get the highest possible return. Such process when looking at the behavioural aspect can require the individual decision maker to overcome his wish for immediate or direct satisfaction. The connected ability to overcome such a desire in a specific situation is challenging from a cognitive viewpoint. It requires to withstand tempting impulses. In the same way, it needs the ability to evaluate expected outcomes of different available alternatives in order to decide if it is worthwhile to sacrifice an immediate option for future returns. In this aspect, economic and evolutionary theories of human and animal decision making have much in common. Both humans and animals go for profit maximization (Noë et al. 2001; Kalenscher and van Wingerden 2011). Kalenscher and van Wingerden (2011) argue that empirically observed decisions many times do not follow the set ideal outcomes of economic or even ecological models and that many according to behaviours can be found in humans as well as in animals. This is why we can and should study economic decision making in animals.

Going deeper into the said study of Krasheninnikova et al. (2018), the researchers introduce the differences of several tasks or tests on how to understand the economic decision making in animals, here in parrots.

First, there is the delay of gratification task, in which subjects have to choose between an immediate reward of lower value and a later reward of higher value (Addessi et al. 2011). The boundary condition in such a delay of gratification task is that once the decision is made, it cannot be reverted. In other words, the subjects have to wait for the whole time of the delay to get their larger reward. Another version of test is to measure how long subjects can wait until they change their mind to shorten or stop the delay. This kind of task is set in so-called delay maintenance tasks where subjects can stop a steady increase of, e.g. food rewards

by simply taking the food (Beran and Evans 2006). But the most commonly used task to test economic decision making is the delay exchange task. In this task, the subjects get an at first low-value item. They can give it up at any time during the delay period, e.g. by consuming it, or they exchange it in return for a higher quality or quantity food or object. Such delay exchange tasks are used to investigate economic decision making as they are of similar nature to economic transactions, e.g. observed in capuchin monkeys (Addessi et al. 2008).

Several studies showed that in exchange and choice tasks, non-human primates can maximize their future returns by delaying immediate benefits. One example is in chimpanzees (Pan troglodytes) who trade small quantities of food for larger amounts (Dufour et al. 2007), while brown capuchin monkeys (Cebus apella) exchange low-value food for high-value food and in another task refrain from taking an immediately available piece of food to get a higher-value food at a later time if the lower value food serves as an exchange token (Drapier et al. 2005; Evans and Westergaard 2006). In a very recent review, Addessi et al. (2020) analyze evidence for human economic behaviours in non-human primates. The researchers show to what extent non-human primates share economic abilities with humans and conclude that it is not a question if, but to what extent non-human primates can decide economically. The difference in specifics seems not to be the cognitive ability as such, but the limits to conclude out of different sources of information (Addessi et al. 2020).

The same ability to optimize pay-off at a later stage as well exists in non-primate species. Here, studies have been made with dogs (Canis familiaris, Leonardi et al. 2012), sea-lions (Zalophus californianus, Genty and Roeder 2006), and as in the present sub-chapter also with large-brained birds such as corvids (Dufour et al. 2011; Hillemann et al. 2014) and parrots (Cacatua coffini, Auersperg et al. 2013; Psittacus erithacus, Vick et al. 2010; Psittacus erithacus, Koepke et al. 2015). The performance of the different species in such delayed exchange tasks is mixed as the tolerance of delay ranges from minutes to seconds (Hillemann et al. 2014; Auersperg et al. 2013; Wascher et al. 2012). A first takeaway for purchasing in this regard is that the tolerance of delay depends on the question if either quantity or quality of return shall be optimized.

Other points have been found when comparing primates with other species. For example, animals that do not have functional hands such as birds or dogs classically have to keep the tradeable food in their mouth. In such cases, it was difficult for them to hold the food in contact with their taste organs making it more difficult to hold the impulse to eat (Leonardi et al. 2012; Wascher et al. 2012). An elegant solution to this problem is possible by implementing tokens as symbolic representation of food that could be traded for reward as a kind of money (Brosnan and de Waal 2004; Addessi et al. 2014; Hackenberg 2009). Substituting real food items indeed supported the subjects' improvements with or in primates (Addessi and Rossi 2010). The task can be played with tokens only and also with tokens and physically present food as a return. Beran and Evans have worked with chimpanzees to choose between a food item and a token that could be exchanged for a

higher-quality food item (Beran and Evans 2006). The chimpanzees tended to select an additional exchange rather than the immediate food return. Similar results were found with capuchin monkeys (Judge and Essler 2013).

However, with or in birds, the token exchange methodology to test economic decision making has not been used before the one of Krasheninnikova et al. (2018). Other than already present exchange tasks in a tool-use context to get to higher-value food, Krasheninnikova et al. (2018) used tokens that could be exchanged for another food reward in the future. They used three different food rewards in low-, medium-, and high-quality food associated with three different tokens. The researchers' tool-related studies are also interesting to be compared with other studies that are presented later in this chapter on tool-use in chimpanzees with respective conclusions on cultural aspects (Whiten et al. 1999; Goodall 1986).

Krasheninnikova et al. (2018) studied whether parrots could learn to associate different tokens with different types of food and if the parrots would select such token for a later food reward before a directly available food with a lower value. The decisive point then was to see if the parrots would behave economically, i.e. they would maximize their profits. In such a case, the researchers could predict the parrots choosing the most profitable option and avoiding unnecessary effort.

Four parrot species were tested. The great green macaws (Ara ambiguus) and the blue-throated macaws (Ara glaucogularis) are feeding specialist, i.e. they heavily rely on specific food such as mountain almond trees and motacu palm fruit. The other two species in the experiment were African grey parrots (Psittacus erithacus) and blue-headed macaws (Primolius couloni) which both are generalist feeders that eat various types of seeds and nuts. The blue-headed macaws live in a nomadic style. Knowing this, we would assume that feeding specialist might have a greater need for optimal decision making than feeding generalists that might behave opportunistically when encountering food options.

The result of the study is manifold. First, the parrots of all four species behaved according to expectation by selecting tokens first that were associated with more preferred food. These findings are in line with previous studies with other primates such as capuchin monkeys (Brosnan and de Waal 2004; Addessi et al. 2007) showing that the parrots indeed gave value to the tokens. Regardless of the value of the immediate gain with low or medium value, all four species of parrots inhibited their impulses and chose a token to exchange for preferred food. In fact, for the low-value food, they performed as good as chimpanzees and better than capuchin monkeys or Goffin cockatoos. This shows the high level of self-control that these four parrot species have. In professional purchasing, this can also be observed as buyers sometimes are offered a lower money payment today compared to a later price reduction on a piece price in the sense of a token exchange. Sellers offer an exclusive one-time payment and ask for giving up price reductions in the future. Most of the buyers that I have worked with chose the token over the immediate payment. The counter-test also worked in parrots, as the birds did not choose a low-value token over immediate higher-value food even when the food was not the preferred one.

However, some blue-throated and blue-headed macaws showed some mistakes in valuing medium-value tokens against low-value food showing that if the difference between the returns was not very differentiated, they had a hard time to decide. Another phenomenon was observed with blue-headed macaws and grey parrots who decided for high-value tokens instead of the most preferred food now. This indicates that some individuals gave the token an intrinsic value. The latter I have already observed in the business-to-business purchasing context when buyers would go, e.g. for a prolongation of payment terms in the future with equal value to today's payment. They gave the token *payment terms* an intrinsic value that can even be higher than the monetary payment today.

I observed the decision prohibition or lack of decision when future token values were not sharply different to today's benefits.

On a group level, great green macaws performed best in all six test conditions, which indicates that amongst parrots we can find species that take better economic decisions than others do. In my view, both points are also the case for or in humans. Some humans are more capable than others to perform economic decision tasks on maximizing profits while all humans have a certain need and experience to do so. Moreover, I can see that group behaviour and individual behaviour can differ. Another result that is also interesting is when blue-throated macaws performed well overall but showed a weaker performance only when the token offered was of fairly low value compared to the immediate reward (see explanation above). The researchers assume a motivation problem here. We can observe this phenomenon also in purchasing or in soccer when sellers are negotiating with less important customers or buyers with supposedly less important suppliers or in soccer when a top team faces a team more present at the lower end of the table. Here, motivation plays are more significant role over the reward mechanism even if the game and the frame conditions are still the same. Of course, the more relevant problem case is the assumed go along with smaller purchasing volume suppliers, where the negotiation cake has an absolutely lower value than the one with bigger suppliers. Relatively, the game is the same, but it contains motivation problems here. In such cases, we can also learn from blue-throated macaws that overall good performance does not prevent from motivational issues in specific situations.

One reference to the African grey parrots again, as they failed to optimize their choice when the token had the exact same value than the food. Sometimes, they chose the token which represented an unnecessary effort. I observed this behaviour also with buyers. The buyers could have simply taken the immediate money instead of trading it in for a later reward. With some parrot species, this behaviour is explained by strong tendencies to engage in object play (Auersperg et al. 2015). Like suggested by the researchers also, I would like to test whether increasing the costliness of the token exchange, e.g. by prolonging the waiting time for the return, would change the behaviour of the players. Concretely, I observe that sometimes buyers negotiate just for the sake of negotiation, in other words for the play and not for the result. By changing the values of later reward or by explaining the cost of the token more explicitly by a discounting calculation process to be set as a rule, this

problem can be avoided in the purchasing environment. Of course, same can be true for sellers from their perspective.

Finally, I would like to look at the performance of the parrots regarding Condition 6 in the test where high-value tokens were offered versus high-value food today. Here, the feeding specialists, the great green macaws and the blue-throated macaws, perform best and significantly better than the feeding generalists as being the blue-headed macaws and the African grey parrots. One explanation could be that the feeding specialists know their specific need over general food and therefore act more economically. Researchers do not know the exact cognitive demands of the species' feeding ecologies, but for the first time, such a difference was observed in a clear way. It means that feeding specialists act more economically than feeding generalists in the test. Seen in the business-to-business environment, some purchasers might be prone to a more specific food compared to other more generalist purchasers. I refer to the statement of 'money is money' as a question. Sometimes, purchasers are confronted with the question to get a bonus payment for past business versus a price reduction of same value for the same goods going forward. In such cases, money might not be money. Specifically, some buying companies are feeding specialists based on aggressive prices for the products going forward. Others prefer bonus payments in a more general way. Within this aspect, there might also be differences between non-purchasing professionals and purchasing professionals in a buying company or in a selling company vice versa. In my observation, especially the longer negotiations go on, the faster non-purchasing players give in and accept the earlier and potentially lower reward in the sense of a delay exchange.

This of course can as well happen to buyers, but maybe less to purchasing specialists as they might rather carry the role of feeding specialists. When referring to feeding ecology, some purchasing specialist can be seen as feeding specialist that clearly can decide better for high-value food now over a high-value token later.

Both behaviours can be observed in business-to-business purchasing environments. On the one hand, generalists and opportunistic buyers may decide less economically as they take any kind of monetary food represented by a high-value token later. On the other hand, they might decisively take the immediate reward with high value before an equally valuable token reward at a later stage, e.g. in form of prolongated payment terms or an investment of the supplier in a new machine. The latter is especially the case for buyers that are being measured on year-on-year savings only. Those buyers are specialized on competitive purchase prices and therefore might act more economically than buyers that also are allowed to accept savings as one-time bonus payments for a good business in the past, but without price reduction in the next period.

In any case, in animals, a clear correlation between economic decision making and feeding ecology should be considered with precaution until more data is becoming available. However, the cited study with four parrot species shows discussed correlation.

All parrots in the study of Krasheninnikova et al. (2018) were able to inhibit their impulse reactions if it led to an increased return. Particularly, the two larger macaws were even equally good or better than the performance of primates in comparable conditions. In critical control questions, they even optimized their behaviour and consequently decided economically.

If you reached this point of the present chapter of this book, you have got a first understanding of what I mean with elements of purchasing in nature. For the next paragraphs, I will stay with birds, starting with zebra finches.

3 Behaviour Compatibility Results in a Positive Biological Effect

Ihle et al. (2015) brought zebra finches together who live in monogamous, lifelong partnerships. Their research question was if sympathy or affection has a biological effect on the zebra finches. Ihle et al. (2015) clarify that in the zoological context, the term behavioural compatibility is used to describe the fit of partners. Zebra finches select their partners by their behavioural fit and not that much by their singing abilities or their colour. The scientists have set up a dating scenario with the zebra finches, where alike many other bird types the males sing, and the females choose (Bodderas 2015). Ihle et al. (2015) have brought 20 males and 20 females together to let them sing and choose. For females, to choose from 20 is a low number in zebra finch nature. Normally, they select out of several hundreds. In Ihle et al.'s test, it took some birds weeks to select, while others were ready after two days. The record found was partner choice in 2 h. But, half of the observed marriages ended in divorce. In the next step, the researchers continued their experiment and brought divorced zebra finches together for second marriages. Most of these partnerships also broke apart, others lasted.

Then the researchers compared the number of eggs in the nest of both groups, lasting partnerships and new partnerships, after having been divorced in the first period. In the latter, many eggs have not been fertilized and more chicks died early after birth.

The result is unambiguously clear. Zebra finches that found the partner for life get more descendants. This seems especially true in monogamous contexts. The birds in partnerships have to adjust their behaviour by motivating each other, by coordinating tasks, and by sharing tasks. After 1700 h of observation, the researchers did not find the reason or triggering element for attraction, but when the birds found each other, their level of harmony was remarkable. They sit next to each other, they clean each other, and they move in a synchronous way.

For purchasing, many aspects can be transferred and learned from this experiment. During supplier selection, many dates have to be made to finally select the supplier partner for a specific component or specific good. The selection phase takes place with geographical context and under the assumption of time constraints. For new categories to be purchased and also for components that are already bought

for a long time, usually many suppliers have to be analyzed. According to my experience in new categories, greater than 40 supplying companies are analyzed before the real supplier selection takes place. If a component is already bought for a long period of time and this in a larger amount of similar but not same items, many times more than 100 suppliers of the same component or category group are selected over time, which suggests that also buying organizations search for the right partner to stay with under the boundary condition of relevant transfer cost between one and the other suppliers. Beyond this, also in organizational interaction with a buying and supplying context, those organizational relationships that are based on similar behaviour patterns and on similarity create attraction between buying firm and supplying firm leading to longer lasting relationships. If the number of descendants of such long lasting relationships is comparably larger than of shorter relationships remains to be open in the purchasing context. However, if a certain harmony can be observed between buying and selling organization, my observation clearly points into the direction of more common developments on product and process level.

As Ihle et al. (2015) did not study attraction as such, I would like to draw your attention to the following species, the white-crowned sparrow.

4 Choose Your Songs

Birds sing at minimum for two reasons. Most of the times, males sing in order to attract females and to keep rivals out of their territory (Catchpole and Slater 2008). This means that singing is a permanent change between attraction and aggression (Riechelmann 2016). More complicated to understand is the question if birds always sing the same songs or if they change their songs with the new year. For nightingales, this question has been researched well (Catchpole and Slater 2008). The nightingale males do only merely change their songs over lifetime. They mostly keep the songs that they learn in the first year and only add or change small elements over time. The conclusion is that when they die after 6–7 years, also their individual songs die. This is different for canaries, as every winter they regress those brain areas that are responsible for song learning and memorizing them (Catchpole and Slater 2008). In each spring season, the respective brain area grows again, which means that the birds have to learn their songs over again. This is also one proof that nerve death and nerve growth are present which means that nerve cells can be renewed within an individual life and that they do it in the context and presence of learning. Purchasers sometimes are said to sing the same songs every year again. Savings, and more savings, or for a special market situation, the buying company asks for a special contribution of the suppliers to the bottom-line of the buyers. This song might scare off suppliers more than attracting them. Therefore, and in order to attract suppliers, buyers should change their songs from time to time, maybe even every spring season. The buyers could select another business area to create attraction and to motivate potential suppliers to quote for available business.

On the other hand, singing a known song might only attract known suppliers and might at the same time scare off suppliers that could add value if being attracted. Partially, good news in the context of birds, here with white-crowned sparrows (Zonotrichia leucophrys), has been found by Derryberry. She identified that both male and female white-crowned sparrows respond more strongly to current than to historical songs, 'indicating that historical songs are less effective as signals in the current contexts of both mate choice and male–male competition' (Derryberry 2007). This suggests that signal evolution within specific populations, that includes geographical specifics, may contribute to the formation of behavioural barriers between populations (Derryberry 2007). For us in purchasing this means that very old songs are potentially not remembered and can be used, but on the other hand, the songs that are used have to fit to the current context of the partners that you work with. Otherwise, your messages will not be received well.

One way or the other, I clearly recommend revisiting the songs that you sing.

Extending the learnings from birds, the following paragraph targets to learn from crows in a direct comparison with humans.

5 Crows Show Individual Preferences When Using Tools

In their study, Danel et al. (2017) investigate the tool usage of distantly related habitually tool-using vertebrate species, specifically the New Caledonian crow (Corvus moneduloides), with respect to using tools depending on their necessity (Danel et al. 2017). A comparison is done with adult humans and in addition to children aged from three to five years.

The set task was to choose between a body part and a tool in order to get a reward out of a box. Crows were confronted to use their beak or a tool. Humans had to choose between their hand and a tool. For both species, the tool was a wooden stick that could be fetched to move the reward out of the box by inserting the tool into a hole and sliding the reward to the side. Alternatively, the subjects had to open two windows successively in order to take the reward out of the box by beak or by hand. The very interesting result of the test was that adult humans could accurately weigh up between the two options regarding cost and benefit in terms of time and effort and therefore decided for the less costly and more beneficial offer irrespective of involved tool usage or not. By the way, it is proven in other studies that adult humans may have the tendency to overestimate the benefits out of tool usage in general (Osiurak et al. 2014). This aspect might be relevant for professional purchasing in these days, as according to my observation many buying companies tend to overestimate the benefits of production tools with suppliers, especially when the purchaser wants to buy a technically challenging product.

Other than humans, the crows, however, did not show any preference for using the beak tor the tool. They also did not appear to behave economically neither at the group nor at the individual level. Of course, the authors explain this finding by cognitive skills that might lack to make economic decisions in the context of using

tools. One prerequisite to economic decisions is to be able to assess the amount of time and effort linked to each opportunity and weighing up between them. Secondly, the task also requires some inhibitory control or motor self-control to avoid silent stimuli of food leading to impulsive reactions of the animals like presented in the first case of this chapter when looking at parrots. Both phenomena, however, can be treated with a low likelihood in their presence, as in other tests New Caledonian crows showed remarkable cognitive skills allowing them to plan action sequences involving several steps to reach their goal (Taylor et al. 2007). Crows are also good at inhibiting impulsive motor actions (Kabadayi et al. 2016), and related corvids show to be capable of weighing up between different options at different points of time (Hillemann et al. 2014).

However, when looking at the individual performance of the crows, the researchers found significant preference for either usage of tool or beak that they tested and confirmed additionally.

The explanation for this behaviour could be done through neophobic responses coming out of their natural environment and leading to shy behaviour when touching the unknown tools or vice versa through an individual difference in the propensity of the use of tools within a defined population leading to a preference for tools. This might be a reason for the overestimated benefits of tool usage by humans and will, related to animals, be further discussed in the cultural contexts regarding characteristic behaviour of populations in the following paragraph of this article.

Coming back to humans, researchers also investigated the behaviour development of 3–5-year-old humans. Here the 3–4-year-old group did not behave economically nor was it showing any bias for using tools. In fact, most of them chose randomly. However, the pattern of the adult humans could be found at five-year-old humans as well. This means that a development towards economic decision making, goal-directing actions, and the effective employment of tools is developed at humans at the age of five.

Looking at purchasing practice, these findings can be discussed as well. Undoubtedly, the ability for economic decision making is present with purchasers. But very often, purchasers are deciding by using their body in form of their mouth or sometimes even their handshake in preference over a contractual agreement or the usage of a tool when negotiating with a supplier and when taking supplier decisions, the so-called sourcing decisions. Such a tool could be an IT-based sourcing platform or more traditionally it could be a written contract. My observation in this field is that not all purchasers see the economic benefit of manifesting the negotiation result in a contractual agreement right after or with the end of the negotiation, as the negative consequence out of not having a contract could come with a significant time lag only. In that sense, the purchasers either show the limits of their ability for economic decision making or the usage of the mouth or handshake instead of a tool as being the preferred instrument maybe even on a cultural bias. The other way around, a fully professional and sound purchasing organization has to ensure the transparency of an over a long period discounted economic decision. Purchasing has the target to allow a tool-supported economic decision making over the simple usage of a mouth or handshake in the negotiation field. We

should also consider that instruments like email might be a cultural trait that could either support the tool usage economics or be counterproductive as not all emails would hold for a contractual agreement in the long run.

Staying with young members of a species, the following paragraph focuses again on corvids and parrots.

6 Juveniles Explore More Than Adults, Faster Approaching Individuals Explore Earlier

In a recent study, a group of researchers has observed four corvid and five parrot species when performing the so-called touch screen discrimination task (O'Hara et al. 2017). In the task, the birds were confronted with a touch screen computer presenting rewarded and unrewarded stimuli to them. The unrewarded stimuli were replaced by novel ones in colour and shape in two of 16 trials in each session, performed over 16 sessions. The behavioural responses of birds were tested when confronted with new situations, while the responses in birds are usually determined by fundamental predispositions (Greenberg and Mettke-Hofmann 2001). One of those is the propensity for exploration that is defined as an activity that allows to gain information but at the same time does not satisfy a current physiological need (Winkler and Leisler 1999). Where exploration is motivated by novelty, the researches talk about neophilia (Tebbich et al. 2002); when another predisposition leads to the avoidance of novel stimuli, they talk about neophobia (Barnett 1958). Exploration is controlled by feeding ecology and habitat complexity as key factors that determine levels of exploration, and neophobia is impacted by riskiness of foraging and interspecific competition (Greenberg and Mettke-Hofmann 2001). Thus, individual experience can impact upon functional expression of exploration and neotic style resulting in differences between individuals within a species (Guillette et al. 2009, 2014). Individual rank within dominance hierarchies has been shown to influence approaches to novelty, but depending on the species higher ranking individuals or subordinates may be less neophobic to novel food (Chiarati et al. 2012; Boogert et al. 2006). Individuals raised in enriched environments showed lower levels of neophobia in later life (Fox and Millam 2004; DePasquale et al. 2016).

The results of the study show that a neotic style does not impact upon the amount of exploration but rather effects the time at which it takes place. Very fast approaching individuals exhibited most novelty responses in the early trials, but individuals with increased latencies exhibited an exploration peak at the later stages of the task. This means that neophobic individuals do not necessarily explore less, but only so once they have habituated to a situation. The study shows that individuals that are comparably fast in their approach can potentially influence group data of a species. A clear difference in exploration over time can only be observed in juvenile crows. These findings suggest that age rather than species supports this effect.

This means that the researchers found evidence for a shift in pattern of exploration depending on neotic style. Faster approaching individuals in neotic style explore earlier. Age rather than species might have influenced the amount of total exploration, while young animals explore more than adults. Neotic style seemed to be an individual trait rather than a purely species' specific component.

Looking at purchasing tasks, there is a considerable amount of studies that look at the necessity to introduce new suppliers and supplier induced innovation to the buying firm, especially when the markets are getting more turbulent or changed by introduction of new products. In such cases, the buying firm has to look for new solutions; in other words, it should go out to find novel solutions or better offerings. Here, it seems viable to say that younger individuals that are fast approaching the problem in their nature should be the forerunners in such a search. High propensity to be attracted by new things or neophilia is very helpful. Neophobe individuals might not even reach a low level of exploration. So, if innovation is a time-critical component, which it normally is, young and neophile buyers could be asked to go out and explore novel things. Young buyers who are rather neophobe might not be the best choice for time-critical new purchasing fields. Neotic style in the study varied only for one species and seems to be a strong individual component.

When trying to understand birds better and comparing them with humans, you might have asked yourself how the human brain is structured in general. Of course, I do not want to extend on anatomic lectures, but the aspect of cognition seems to be interesting for our questions.

7 The Human Brain

Davies et al. (2018) explain the difference between a conventional computer chip and the human brain (Martin-Jung 2018). The first main difference is the pattern of connections. An electric circuit can perform about ten connections; a nerve cell in the human brain can enter 10,000 connections. A common processor has less than 10 billion transistors, while the human brain has more than 80 billion neurons, which translate into more than 1 quadrillion synaptic connections (Markham 2019; Davies 2019). Secondly, information in the human brain can be stored bound to time. Most of the times, the brain though is in idle mode, but once it is needed the brain is creating activity peaks while using its complex connection patterns. In that sense, time represents a dimension of computational work or, in other words, time is an endogenously active dimension. Therefore, timing is an active dimension of work. Thirdly, the brain works with a significantly higher inaccuracy than computer chips. Maybe some information will be transmitted, but some information will not. Despite these factors, the result of the brain work luckily is good. Fourth, the brain is distinguished by its mutability or ability to change. Connections are being established in real time just in the way and when they are needed. For purchasers, this ability to create on the spot is particularly valuable as many situations that

occur in professional purchasing cannot be predicted. Another important aspect is the time dimension and the timing itself. Connections are subject to timing which means that if the necessary information is available, but not at the right point in time, it might be lost. Inaccuracy is immanent; therefore, trying to be over-precise might not be brain natural.

Beyond these already thrilling basic aspects of our brains, the following paragraph targets to expand on information flexibility of our brain, brain cognition, and the extension of cognition into our bodies.

8 Neuroplasticity and Embodied Cognition

'Humans are impressionable, footballs are not', states Kranz (2016). He explains that even the most talented soccer player will not be able to impress a football. He can hit it or press it, but after this, the ball will inflate again and will go back to its original shape. The football in that sense is the contrary to plastic. Rather the ball is elastic and will be somehow constant in its form.

The human brain instead of in a scientific view is discussed and characterized by its plasticity. One of the metaphors in use is the paradigm of 'the trace in the snow' (Spitzer 2003).

Spitzer's example is a Christmas market in wintertime. From a bird's view on a Christmas market, you can observe a first visitor who is making his way through the snow to the tea sales booth and then to the Christmas tree sales place. A next visitor is coming and uses the same pathway via the tea sales booth but will only go to the Christmas tree sales booth without a visit at the tea sales booth. This visitor, therefore, takes a detour, as the existing pathway through the snow is already well paved. Other visitors use new paths or use old existing ones even when they have to take a little longer way to get to their target. What we can take away from this picture is that frequently used pathways in the event of new snow falling are still visible for a while, whereas only seldomly used routes will disappear. In our brain, this phenomenon is known as 'If you do not use it, you will lose it' (Sun 2007). The other way around also works that in case the winter days are getting warm and the snow disappears at least for some days, new paths can be created easily after another snow. The same picture of the Christmas market in snow gives explanation to the so-called small-world-efficiency construct of our brain in which the efficiency of information transfer in our brain is related to the processing of information according to the minimal linkage costs. We know that the brain is not only a hard disc but also can be compared better with the World Wide Web. In the World Wide Web, the importance of a webpage depends on the use case and the frequency it is used at. Against this background, Kranz (2016) points out that computers themselves are not producing the webpages, just like the brain alone does not produce our thoughts. In order to further understand this point, I would like to refer to Levi-Montalcini's and Angeletti's (Levi-Montalcini and Angeletti 1968; Aloe

2004) discovery. She found nerve growth factors in adults and observed that nerve ends can be sprouted, nerve links can be conserved, and the repair of links can be supported. It can also be shown that the magnitude of such nerve growth factors depends and can be influenced by the behaviour of a human. Other studies show (Pal et al. 2014; Emanuele et al. 2006) that yoga and the state of being in love will increase the nerve growth factors as well. Beyond this, Gage et al. (1995) discovered cell division even in adult brains. But this seems limited to specific brain regions such as the gyrus dentatus in the hippocampus and the subventricular zone of the lateral wall of the side ventriculum. Also, this form of vitality is supported by the behaviour. Increased cell division can be improved by learning and external, physical movement. Contrary to this, the cell division is reduced by stress, depression, sleeplessness, and ageing (Kempermann et al. 2002; Lepousez et al. 2015). We find plasticity cases on all kinds of levels of the cerebral system, such as the number of synapses, the size and the strength of relations, and even up to the change in brain landscapes. This leads to the overarching thought that we constantly change our brain at the moment when we use it. Or in other words: 'We never use the same brain twice' (Kranz 2016).

For our topic purchasing, this means that we should always keep moving and never stop learning in order to better understand suppliers, products, and technologies. The human brain will continue to learn and create new links and relations, and by doing so, we will find new solutions to known or unknown problems. Or in other words, if a negotiation cannot be finalized today, maybe it can be finalized tomorrow. Supplier's that we do not understand right now, we might understand better the day after tomorrow. This time in-between could allow purchasers to increase their options regarding competition, optimization, or for new sourcings.

I would also like to encourage all of us to travel to suppliers or in the other direction to our customers. This will as well drive our learning supported by external movement.

The 'I-sphere' allows us an additional thought: The brain alone cannot be responsible for the memory and remembrance functions. Not limited to this, the complete metabolism–limb system interaction plays a role in cognitive performance in the sense of multi-sensory integration. The findings suggest that a cerebral-centric memory concept should be questioned in its pure conceptual approach. Instead, the so-called embodied cognition or embodiment is more and more researched and discussed. For professional purchasers, this might mean that they should not only travel to their suppliers and customers, but should also touch the parts that they buy, analyze failures of delivered products, visit factories, smell the products, hear the sounds of the purchased products, and test the services that they buy.

This will allow buyers to improve and optimize brainpower and at the same time makes use of the entire body to feel the supplier and its performance by embodied cognition.

Embodied cognition is a form of memory.

9 Contagious Memories

Memories seem to be unalterable as they would be chiselled in stone. The contrary is the case: Memories live.

They change when we share them with others (Rajaram and Pereira-Pasarin 2010; Rajaram 2011; Barber et al. 2014). Rajaram et al. even found that memories can disappear when the one, who shares them with someone other, leaves (Rajaram 2011).

Rajaram discovered the mechanism of contagious memory at a couple. One of the partners suffered from dementia, and consequently, also the other partner lost his memories of common items. When a partner or counterpart cannot confirm common memories, both will lose the past. Rajaram is, therefore, studying the social side of memories. She specializes on common memories and studies how groups learn and remember thing. According to Rajaram, many people think that co-working or working together would help the memory. But this is not always the case. The joint work can also harm the memory. Of course, working groups together can memorize more things than an individual can, but at the same time, specific memories of individuals can as well be destroyed, because different humans have different strategies for memorizing. In addition, others would blend own memories from time to time with mistakes which then would enter into the collective memory. This aspect is truly independent from a co-worker if it is based on words or on emotional events. As well, the effect is independent from friendship, partnership, or the age of the humans that work together.

But, of course, at the same time, others can refresh own memory items, they can correct mistakes and add details that oneself has not been able to memorize. To prevent ourselves from loosing or blending memory, especially when like in purchasing a group of buyers is negotiating with a group of sellers, I recommend to write down meeting minutes that are shared with all participants. If the meeting minutes are well written and reflect what has been discussed and agreed, memories can be refreshed and will not be subject to inevitable loss when one of the two sides will disappear.

In this context, it is also interesting and important in which way the information is written down.

10 Writing by Hand Helps with Memorizing

Writing by hand is a kind of precision work that is most likely even influencing the mind.

According to Velay and Longcamp (2012), this aspect is already true in the period when the alphabet is being learned. In their study, Velay and Longcamp (2012) found that children can recognize and distinguish letters better when they write down sequences of letters of the alphabet by hand instead of typing them on a

keyboard. This seems to be a prove that handwritten pieces are saved in a pluri-modal way which means that the human brain connects the learned letters with movements of the hand and feelings of how the pen is sliding on the paper. By this, the learning is linked with physical experiences, a kind of physical pony (see also Longcamp et al. 2016; Longcamp et al. 2005).

Medwell and Wray (Medwell and Wray 2017; see also Medwell and Wray 2014) argue in the same direction that physical movements that are resulting out of handwriting are part of the thought process. James and Engelhardt (2012) report in addition that brain areas that are activated during handwriting are not activated when typing.

In the business context, I frequently observe people who write down notes in their small books. Those people will be able to memorize better over people who took notes via their keyboard.

Another situation that many of you might have experienced is that in a meeting, someone goes to a whiteboard to take notes or even to lead the discussion by writing down words and numbers. This person will memorize best what has been said in the meeting. One more incentive to lead a meeting from the whiteboard position.

It requires only a small step from memory and memorizing to the span of attention.

11 Mobile Phones Reduce the Span of Attention

A very interesting study analyzing the span of attention is called 'Jugend (youth), Information, (Multi-) Media'. This study was published in the year 2017 for the twentieth time. The study shows that the usage of media has increased again compared to previous years and corresponding effects are more stress, lower conflict capability, and deficits in social behaviour. As one example, in Germany, 95% of the teenagers aged from 12 to 19 regularly use 'WhatsApp'. Lembke (2016, 2019) argues that digital communication creates an overflow of stimuli. It forces the users towards multi-tasking. One result of that is the reduction of the attention span, which was found to be reduced from the year 2000 to the year 2013 by one-third. In addition, according to Lembke (2016) and Feierabend et al. (2017), digital communication represses social communication more and more. The effect is a rather narcissistic and egoistic communication and a lack of compassionate behaviour and conflict capability (Rother 2016). Teenagers receive more than 3000 messages per month (Feierabend et al. 2017).

If we project these learnings into the modern purchasing world, we can assume that also here the broad usage of smartphones and messaging is present and predominant. When it comes to negotiations, project discussions or sourcing decisions, which are the decisive moments in purchasing, buyers therefore might want to increase their attention span and leave the mobile phones out of the negotiation room. A lack of compassionate behaviour might also harm the understanding for the supplier and result in a lower conflict capability finally leading to harder

decisions. On the other hand, a buyer might be able to use a low span of attention of the supplier for his interests. But, in the long run, such a win could also come back as a loss when it was identified as problematic by the supplier.

So, please leave modern communication out of the negotiation room.

12 Incomplete Tasks are the Ones We Remember the Best

The topic of incomplete tasks goes back to a for me highly relevant work and publication by Zeigarnik in (1927). I was confronted with the work by a small article in the Business Live Journal of British Airways excerpting a book of Martin et al. (2016, 2014), who is mentioning Zeigarnik. The work of Zeigarnik is about memorizing completed and in-completed tasks. Zeigarnik's attention to the topic was taken during a restaurant visit together with research fellows including her mentor Kurt Lewin. The reported story is that a waiter was extremely good in memorizing orders from a large number of dining customers. The waiter was so impressive that he did not make mistakes neither for food nor for drink orders without noting them down. Zeigarnik and fellows tested the waiter by covering their plates and glasses with napkins after the waiter's delivery and asked him to recall what they have ordered. The result was that he was not able to remember the food or drink orders.

The explaining effect was later tested by Zeigarnik and entered social psychology literature as the 'Zeigarnik effect'.

According to Zeigarnik (1927), in-completed tasks are being memorized better than completed ones, concretely even almost twice as good as completed tasks. In her and her research fellows' tests, the decisive element was not found in the feeling about or the intensity of the task, nor in the shock effect in the moment of in-completion of the task, but in existence of a *quasi need* that was created by pursuing or during execution of the task. When the test persons were asked about the tasks, this quasi need is revisited. Such quasi need equals to a tension that is pointing in the same direction as the target of the task or the intended direction for the completion of the task and also exists during reproduction of the task.

The directional element by the way is founded in the field theory of Lewin developed during the 1920s (Lewin 1931; Lück 1996), elaborating on the transfer from the Aristotelic to the Galileic thinking when explaining biology and psychology. Here, especially relevant is the treatment of dynamic problems to be seen as developing situations that are influenced and impacted by the overall scenario in which the problem is embedded at a certain point in time. Influencing actions or elements are described by vectors and mathematical means and can pull or push a task in different directions within a given framework.

In my view, their work is relevant for negotiation tasks in purchasing as those are as well scenario-, context-, and moment-dependent.

Coming back to Zeigarnik, the quasi need coming to the surface when reproducing the task depends on the intensity and the structure of the tension, as well as on the strength and type of will for reproduction that develops in the moment of revisiting.

Whereas the will for reproduction can be stronger than the quasi need itself, while pointing in the same direction. This is the case when a test person is treating the mental revisiting of the task as a separate memorizing task. It is not the case, when a test person only reports or talks about the tasks.

Decisive about the continuation of the quasi need is not the externally visible completion or in-completion of the task, but it is the internal or inner in-completion of the task. Completed tasks, in which the test person was not satisfied with its own performance or tasks that had different possibilities for a solution, could also be memorized well. The same is true for interesting tasks in the perception of the test person. Similar to in-completed tasks, externally not-completed actions, of which the feeling for need of completion is gone, are not well memorized.

In cases where behind the quasi need expressive and real needs are present when the central I-sphere of the human is touched, the need-like tensions are stronger. For ambitious people, the in-completed tasks that are strongly touching the persons ambitions are memorized well.

The difference between completed and interrupted tasks is greater for end-point-oriented tasks than for continuous tasks. This is related to what extent those task structures lead to the development of independent tension systems.

If the single actions do not have their own identity, the whole test is seen as one-single tension system. For example, if test persons were informed at the beginning of the test about all elements of the tasks or if the tasks were seen as minor actions, then no outweighing of in-completed tasks was present.

For the development of tension systems, a sufficient strength of the surrounding dynamic field is necessary. If the psychical field gets too liquid, e.g. during getting tired, or when big pressure changes occur, e.g. during excitement or nervousness, the creation of tensions will not happen. Already existing tension systems can be dissolved by changes in situation, e.g. through jogging or by entering into different situations. A similar aspect is explained by Britta Heidemann in her interview in this book.

The strength in which such need-related tensions are created or maintained seems to be individually different and for each individual in a high-degree constant.

The more the needs of the respective human are unbroken, the less it can renounce the satisfaction of the need; the more childish, naïve, and natural the person is during the action, the stronger is the overweighing of the in-completed tasks.

For purchasing, the Zeigarnik effect is particularly interesting. As already mentioned a few times, in my opinion, one of the most important purchasing tasks is the negotiation. Now, if a negotiation is kicked-off, has a repeatedly mentioned target, and is embedded in an overarching tension, the negotiation can be continued until the target is reached. The suppliers and of course also the buyers will remember the incomplete task, and depending on the will for reproduction, the task

can be revisited many times. On the other hand, a completed negotiation will be forgotten in content and result. So, it might not be a fault of the customer that he cannot remember negotiation results. Forgetting them rather means that their target was reached. In cases where buyers remember negotiation results, the negotiations most likely have not reached the buyer's targets and will come back on the negotiation table. Taking into consideration the positive effects of tension and a tension system, it might be as well beneficial to limit negotiations to a specific and ending period of time in the year. This allows to forget when the tension system is gone and gives room for other important tasks of purchasing which is the supply management aspect including strategy, performance refinement, and innovation.

A striking way of pure task orientation including a very visible symbol of target completion or tension system relief was found with the Amazonian tribe of the Amondawa.

13 Task Orientation to Avoid Meeting Minutes at All

The Amazonian tribe Amondawa lives without calendar and time (Braun 2011). Time does not play a significant role in their daily life. The Amondawa does not even have a word for time nor do they have one for week, month, or year. Consequently, they cannot tell you their own age in years. The life of the Amondawa takes place in a solitary region of the rain forest in Brazil and is oriented at the way of the sun (Braun 2011). The sun determines the daily rhythm and also splits the year in half as scientists around (Sinha 2011) from Portsmouth University found out. When the sun is shining, for the Amondawa, the dry season is meant, in their language 'Kuaripe' or 'in the sun'. When it rains and for some months it is the rainy season, they call it 'Amana', their word for rain. Their day is split into two halves as well. During daytime, it is 'Ara' or sunshine. There is no concept of morning or afternoon. No meeting time or punctuality is conceptualized, only tasks have to be completed. The male members of the tribe have to work on the fields for grain or manioc. What the Amondawa harvests, they eat or sell on the market. The concept of storing is not present. Their life is lived now and here. There is no planning for the future, not even the seeds for the next year are stored.

Once the work is done, the sunsets and for the Amondawa starts the night, or the black (Braun 2011).

The scientists discovered that there is no abstract concept of time present in that culture. Even numbers do not seem to exist in a complex way. The numbers one 'pèi' and two 'monkoi' can be combined to 3 and 4. Age can therefore not be fully expressed in years. Instead, Amondawa gets new names. When a member gets a new task, he or she gets a new name.

Maybe a recommendation with a smile on my face could be to avoid meeting minutes at all, to complete the purchasing and supply management tasks, and once we have finished our specific tasks, we get a new name. Of course, a less philosophic hint could be to take a more stringent task orientation in purchasing and

supply management not to be constantly overwhelmed by many open items. I observe especially in purchasing departments that are tasked with purchasing work in a broader sense including negotiation and sourcing, supplier quality management, supply management, and technological supplier development that many open items might bring the individual buyer to a quantity limit of bearable tasks. For this reason, it might be beneficial to split the year into seasons with specific task focus in each season, such as strategy development in wintertime or annual negotiations in autumn. This way would allow a natural structure and higher task orientation. Within this approach, Steve Jobs (Isaacson 2011) recommended to limit parallel tasks to maximum of three or four in order to ensure efficiency and consistent task orientation throughout the whole organization. In my experience, this approach can create commitment and reduce distraction from targets.

After having focused on human behaviour and human cultures, I want to go back to animals for further understanding and analysis.

14 How the Wolf Hunts

In my view, a very interesting animal is the wolf. The wolf is intelligent and unfortunately more and more endangered. In this regard, I would like to point out on wolf research or conservation centres that do not only try to better understand the wolf but also want to protect the species. One of those research centres is the Wolf Conservation Centre in South Salem, New York, founded by Grimaud (2013). I recommend at least for a visit on the Internet.

A few researchers investigate the wolf's life. Ahne (2017) has brought together a few of the findings of Mech (1999) and Zimen (2003), selected and explained many of the wolf's traits of which I would like to focus on a few.

By supervision from the air, the hunting behaviour of the wolf can be analyzed. Regarding this hunting behaviour, researchers found always the same pattern: First the search, then the pursuit, the encounter with the prey, and lastly the hunt itself. When the wolves have detected their prey by a highly developed sense of smelling and hearing, they try to get closer to the prey without being discovered. At a certain point, the prey realizes its haunters. The prey either starts to run or it does not. The latter interestingly increases its chances for survival. Ungulates, the most frequent prey of wolves, are well prepared for an attack. If the animal stands still with the intention to defend itself instead of running away, the wolves start to calculate a quick cost–benefit analysis: A successful attack will provide food for several days. On the other hand, to get hit by a foot of a defending moose would mean severe injuries.

Contrary to his reputation, the wolf is not a merciless hunter but a clever tactician. Most of the hunts are being stopped.

The one who runs is vulnerable. Therefore, the pack tries to make the prey run. If the wolves are successful in this regard, usually a relatively short sprint is taking place, in which the wolves use their only real physical weapon: Their teeth. Their

teeth and their jaw withstand enormous weights, e.g. when a wolf bites in the foot of a moose and is being dragged along for several metres.

Other than lions or tigers, wolves do not kill their prey with one precise bite. Instead the prey dies as a consequence of several wounds that are mainly caused by the wolves' fangs. This is particularly the case when the prey is big.

Of course, it is maybe difficult to compare the hunt of the wolves with typical situations in purchasing. But minimum a negotiation can carry elements of a hunt. Many buyers know that if the potential suppliers do not move at all, they are less vulnerable towards price reductions or other concessions to the buyer. In such cases, buyers start a quick cost–benefit analysis and decide about the potential return of a dangerous negotiation. However, when the buyer can make the supplier run, usually as an effect of competition, prices drop and the position of the buyer to reach his targets improves. Like in the wolf, the buyer only has limited real influencing possibilities, but once he is on the supplier, the supplier might have a difficult time. So, think about taking the effort to invest in competition and allow suppliers to move.

In my time as a buyer, I have also experienced, and this in both ways that a supplier can be attacked by many buyers for a supposed weakness and as indicated also the other way around. Supposedly, good suppliers have been approached by many buyers of the same organization and of different organizations ending up with too many projects at the same time struggling for survival. This aspect brings me directly to the question if buyers should negotiate together or alone.

15 The Young Wolf

Looking at the wolf in this regard, we can observe that the wolf hunts in groups. Why wolves hunt together seemed to be clear for a long time: More hunters, more prey, so was the believe. But this perception is actually wrong (Zimen 2003). Also, a single lonesome wolf is able to kill a moose or a deer. And, a wolf couple does not kill less prey than a wolf pack. In fact, the larger the size of the pack, the lesser food remains for each individual wolf.

Consequently, a widely discussed question in science about the wolf is what is the reason that a young wolf does not simply leave the pack after seven to twelve months when he or she is grown up. Instead, the young wolf stays two, three, or even four years with its family (Zimen 2003).

The reason for this behaviour according to Ahne (2017) is a family political decision. In cases where big prey is present, which is the preferred food of the wolf, there is also enough food for the offspring. The food that would normally rest for scavengers is given to young wolves. The fact that there is a correlation between availability of food and the size of the pack is shown in regions where food is a scarce resource for wolves. In Italy during the 1970s for example, where there were only a few games such as red dear present, or in Israel where wolves ate small

animals and litter, packs frequently consisted of only one couple and the young wolves left their parents early (Ahne 2017; Zimen 2003).

Instead, the probability that the invest in the next generations pays off increases when the young wolves participate in joint hunt and get their food out of it, respectively. For the young wolves, this way is beneficial as well, as staying with their parents protects them until the time when the mating instinct and the rather risky search for an own partner and territory will lead them away from their parents. An extended family will take care of the young wolves via uncles and aunts to protect the next generation (Zimen 2003).

This group aspect might explain why young buyers stay with groups of buyers and learn from and with the elder ones how to negotiate and how to buy. If the available food is big enough, the young buyers stay with the pack, but at a certain time, they leave and try to create their own family and life. I have seen many young buyers leaving. And, some even came back, when their new venture did not give them enough to eat and the old pack offered bigger chances for bigger negotiations. But most of the young buyers who have left the pack, I did not see coming back.

You cannot and should not try to stop them from leaving. It is a natural process same as when children once they are grown up leave the house of their parents.

The young buyers go out to create their own adventure and step further into the business-to-business jungle.

16 An Empty Stomach Influences the Behaviour

Going deeper into Purchasing Jumanji, I want to look at the aspect of being hungry. In this regard, zebrafish are very interesting as their larvae when they are hungry pursue larger prey, that they normally would not hunt for. Filosa et al. (2016) created computer-animated circles that passed through the field of sight of zebrafish larvae. Fed larvae did only follow small circles as potential prey, while dropping large circles. This is due to the fact that the larger circles could also represent an enemy that could be dangerous for themselves. Zebrafish larvae with an empty stomach however took a higher risk and followed larger circles. On top of the direct findings, Filosa et al. (2016) assume that hungry larvae can also see potential prey better as compared to fed ones. This is induced by the finding that the brain areas that are responsible for seeing have been more active with hungry animals than with saturated ones.

I clearly observed such behaviour in professional purchasing as well. When a buying organization really is hungry for savings or urgently needs a new or even unknown technology or good, this buying organization is trying to work with too big suppliers. At the end of the day, the buying organization cannot digest the bigger supplier, either as it is too inflexible or too clever for the buyer. If the zebrafish larvae finally can digest, too large prey is not exactly reported in the research of Filosa et al. (2016), but the change from escape to approach in that case suggests a certain success rate (Filosa et al. 2016; Bednekoff 2007). In nature, the

big dots in the test are predators and thus potentially dangerous for the zebrafish larvae, but they seem to have a threshold value in size, whereas too big dots seem to be too large to potentially represent food (Semmelhack et al. 2014).

We can already see that our brain is playing games with us and our behaviour might be somehow irrational. To further complicate the topic, I want to introduce the influence of language.

17 Framing

Clearly, modern neuro- or cognitive research is challenging classic reasoning. I guess you might have felt this already when having read the first paragraphs of this article.

According to the work of Elisabeth Wehling (2016), the basis for our decisions is not facts, but the cognitive interpretive framework that we have. In science, this interpretive area is called a frame. Frames are activated in our brain by language and these frames decide about how we understand facts that are communicated to us.

An interesting encounter in this context would be if Immanuel Kant and Elisabeth Wehling could meet. Kant in his 'Critik der reinen Vernunft' (Kant 1787) would argue that sense or sensuality and reason or comprehension are the only and equally important and from each other independent sources for the development of realization, new knowledge, or cognition. Wehling (2016) would argue that frames activated by specific language and experience define cognitive boundaries in which the decisions are being made. The discussion would probably go deeper into the question to what extend sensuality is misled by language and frames. But the consequence of the phenomenon as such might not be in dispute. For those of you who are interested in Kant and his 'Epistemology' (Erkenntnistheorie) might also want to have a look into Reiniger (1923), who develops Kant and his work out of the context of previous and contradicting philosophies to Kant. Reininger also explains Kant's philosophy of nature, ethics, and the question of what is an art. This aspect adds to the discussion of Britta Heidemann when comparing fencing with the art of surgery and business negotiations.

According to Kant natural beauty is set as the highest point. While beautiful nature looks like it would be beautiful art, so should beautiful art give the impression as it would be beautiful nature. This means that it must not relieve the intentional aspect of its creation. Despite being itself a piece of freedom, a product of fine art must be free of the constraint of arbitrary rules, just like it was produced by nature itself. And, this will particularly be the case when the artist carries the rule that he uses to create inside himself.

Let us look closer into framing. Frames are activated by language and decide in which direction we think. One example is the word 'tax' or 'taxes'. In this context, we sometimes speak about the burden of taxes which already open the frame that something is pushing on our shoulders (Wehling 2016). By nature, this feeling is

inconvenient for us humans and leads to a counter-action. Trapped inside this frame we start to fight against the one who is pushing us on our shoulders. We also think in *our* language that opens other kinds of frames. One example would be that in German we say in a literal translation 'You cannot carry someone to the hunt'. The corresponding English expression would be 'You can bring the horse to the pond, but you cannot make it drink'. Both expressions are supposed to mean the same thing, but they open different frames in our brains. The German expression creates a frame of aggressiveness or offence—the situation of hunting an animal. The English expression is more peaceful or goes into the direction of stubbornness.

Using those expressions in negotiations can lead to different roads of thinking in the brain of the respective negotiator. Humans are rational creatures. They can decide by rationality or faculty of reason. If you put relevant facts on the table (another frame), humans can objectively weigh them against each other and decide for the best solution. This is the way we have learned to think about ourselves, but neuro- and cognitive science show that not the facts for themselves are decisive, but also our conceptual or mental frame of interpretation, in brief the frame.

Frames are the elements that give the facts a meaning and this in a way that they sort and file information relative to our physical experience and to our memorized knowledge about the world. This knowledge by the way can already be a result of other frames. Frames are always selective. They emphasize specific facts or realities and let others 'drop under the table' (another German frame). Therefore, frames are evaluating and interpreting. And once they are activated in our brain by the means of language, frames guide our thinking and action or behaviour. And, this *without* us realizing or knowing that this happens by frames. One frame that Luther has created is 'It is more blessed to give than to receive'. (Luther 1545). This old frame guides us to give the customer what he needs and at the same time puts the buyer into a perspective of robbing or stealing that by the way does not fit to the exact same expression. This means depending on one's experience, a sentence can open up different frames. Kant would love this discussion.

By the way, for those of you who have kids, kids create *artificial* frames all the time. And adults follow directions or dead ends within or out of frames.

Having understood this concept (avoiding the framing word construct, that is often misleading scientists), Wehling steps ahead towards embodied cognition (see also Barsalou 2008, 2009; or Wehlings research fellow Lakoff in Lakoff and Johnson 1999; Niedenthal et al. 2005). This aspect has already been touched upon while explaining about our brain structure earlier in this article. If you read the word 'hammer' and you are asked, 'What do you think now?', you would probably have several associations such as tools, hammering, hitting the nail on the head or if you have recently visited the Oktoberfest in Munich, Germany, you might think about the popular game 'Hau den Lukas' which is the attraction where you hit a knob by a large hammer and try to catapult a small weight up a scale. The stronger you are, … Or, you imagine a blue thumb.

Having set this frame, Rueschemeyer et al. (2010) show that our brain is automatically planning a body movement when hearing the word hammer. The premotor cortex centre of our brain is designing and also preparing the movements.

This simulation of movement is also set in context with our experience with corresponding objects. In other words, our brain wants to train over and over again until it reaches the targeted movement to be the future context when activated. Understanding this aspect, the sentence 'Uwe kicks the ball' already activates your leg or 'John bits in the apple' already creates movement of our jaws. We therefore understand the meaning of an activity word by simulation of connected actions in our brain (Hauk and Pulvermüller 2004; Tettamanti et al. 2005; Desai et al. 2010). Similar to movements, our brain also simulates saved or memorized knowledge like feelings, haptic experience, tactile sense, odours, or flavours. If you read the word salt, the brain activates those body areas that are responsible for sensing flavours (Barros-Loscertales et al. 2012). And consequently, also the cognitive understanding of noises is simulated by a tong movement that would go along with the production of such noise. In other words, we understand what someone says by ourselves going through the motions (Fadiga et al. 2002), always in the context of our previous experiences. Cognitive simulation can be problematic when it is contradictory to, e.g. its real movement. For example, Wehling states, 'would you read the word "pull" on a door, but you needed to push to open it, your brain would prepare the pull movement, but would get immediately trapped in a motoric decision conflict only because of the linguistic coupling to our senses wishing to pull and on the other hand having to push to get through the door'.

Giving is better than taking. If you ask your supplier to give, he will already prepare himself in his premotor cortex to give.

Beyond the embodied cognition itself lies the simulation of language as such. This process is automatically happening when we compile language. For example, where we look at when we read or hear sentences that describe loci. An experiment analyzed a situation when a test person was to hear two different sentences while looking out of the window to a high multistory building.

The test person heard 'The man in the fifth story is ironing his shirts' and then 'The man in the ground floor is ironing his shirts'. While nobody who in fact is ironing was visible, the test person automatically looked at the fifth floor while hearing the first sentence and to the ground floor when the second sentence was played. Why? In order to understand the words, our brain simulates the implicit location (Spivey and Geng 2001). This means that experienced buyers locate the source of cost improvements *in the production plant* of the supplier and by this expression explicitly point the suppliers to an implicit location.

Thirdly, when we try to understand sentences that contain visual information, our brain does not simulate the movement, but pictures and perspectives in our visual cortex.

Wehling (2016) suggests reading the following two sentences:

'The bird is in the sky'.
'The bird is on the ground'.

Both sentences do not contain words that indicate movement as ‘is’ is has static meaning. Instead, our brain develops visual scenes in which the subject takes a supervisory role. The brain calculates what it would mean to see a bird in the sky or on the ground. The brain simulates as if the supervisor would in fact be in the real situation and observing from the respective perspective. This process gives the sense to the words that we hear.

Now, if Wehling would have shown us two pictures while listening to the first sentence, one picture with a bird flying in the sky with the wings widespread and one picture with the bird sitting on the ground and wings attached, we would have recognized the bird on the first picture much quicker than on the second one. The test is equally valid for the second sentence (Zwaan et al. 2002; Zwaan and Pecher 2012). In this example, we understand again that we simulate linguistic information to be able to understand it, and in addition to that, simulation has also an effect on our perception or speed of cognition.

Not limited to the above, we do not only simulate single concepts, but also several concepts when we read or hear words. This means that behind each word or sentence, there is more meaning hidden immanently than we think. The reason for this evermore presence of a greater meaning of single words or sentences is the content and structure of the frames that are opened. This so-called frame semantics is derived from our individual experiences in the world. Included here are physical experiences such as movements, space, time, and emotions, but also experiences with language and culture.

We can understand this in the bird example as well. When we heard the sentence ‘The bird is in the sky’, we did not read the bird with its wings widespread in the sky. Still, we identified the bird with the wings spread faster. This is the case because, in our natural experience, we connect birds that have the ability to fly with wings because they need and have wings to fly. Birds with wings attached in that sense are not birds, because we expect birds to fly. All this information has not been transported by the words in the sentence that you read, but through the frames that you opened up in your brain.

By the way, this can lead to the impression that humans sometimes think or even swear that they have heard or read ideas related to one specific word, while not explicitly having heard or read the ideas. They only have been triggered by frames embedded in experiences by words.

Matlock (2004) has shown that the simulation of slowness and speed has a direct influence of how quickly test persons understood a sentence that contained a fictive movement. For buyers, this can also be an important aspect. If a buyer can simulate how easy one can move through a defined terrain, either by a movie about Formula-E cars or by listening to sentences that describe easy and effective navigation across an island by car through a city by e-bike, the respective supplier will understand quicker when a fictive movement is presented to him, such as catching up to the speed of the customer. This means frames have an influence on the language processing speed.

Frames also have an influence on our perception of the world.

Aarts and Dijksterhuis (2002) asked probands to read a text that contained the words turtle or cheetah. Afterwards, they were asked to estimate the walking speed of a man on a picture. The people who read about the turtle have estimated the speed of the man as much slower than the cheetah group. Nota bene, the words slow or fast have not been in the text, i.e. the persons associated a certain speed with each animal and transferred this knowledge into the man.

Frames therefore lead to the phenomenon that single words can activate a single concept that changes our perception of the world. Srull and Wyer (1979) have made a highly relevant study also for purchasers or suppliers in this context. They asked test persons to read a list of words that belong to the field of sensitivity or considerate behaviour and others read about asperity or brusqueness. Afterwards, each group had to estimate the social behaviour of test persons on pictures shown to them. The pictures were of course the same, but probands that have read about considerate behaviour estimated the persons on the pictures as being gentle, generous, and friendly. The other group estimated the people being unfriendly, rude. As the visible or external characteristics of the people on the pictures were the same, it was the frame that was activated by language beforehand that lead to the evaluation of the persons on the pictures.

This is especially relevant for supplier reputation in both directions. By language, the research and development function, the purchasing function inside the customer, the management group of the supplier, the supplier as a whole, the customer as a whole can be changed in perception based on previously used language, such as modern, innovative, technology-oriented, future-oriented, speedy, aggressive, cost killing, consistent, rule-based, reactive, fast, smart, clever, etc. Please, try to combine a few departments of your organization with different attributes, repeat them in front of others, and test the directional (re-)orientation in the perception of your target group when working with the selected departments.

And now the most important aspect of framing: When frames are already activated in our heads, then the dictate with which simplicity and easiness information is absorbed by us. Indeed, it is true that the brain can calculate facts best when those facts fit into frames that are already activated by language. Another way around, if a specific interpretive frame is already activated and when we are confronted with information that does not fit into this frame, then our brain reacts in a stubborn way. It rejects to accept diverting information as being part of reality.

An interesting test in this regard and especially also for the context of purchasing and good or bad suppliers is the study by Yaxley and Zwaan (2007). Participants were asked to read ‘The skier did barely see the elk through his blurred goggles’. The other group had to read ‘The skier saw the elk clearly through his clean goggles’. Afterwards, a picture of an elk was shown to the participants, whereas one elk was only fuzzily visible, and on another picture, the elk was clearly visible. Objectively, the human should be able to recognize the clearly visible elk in a better way. But, as you can already guess, those participants who previously read about the blurry goggles did realize the only fuzzily visible elk significantly faster than the others. The ones with the clean goggles saw the clearly visible elk faster. What has happened?

The prereading of the text leads to the stimulus of good or bad sight. In their brain, an interpretive frame was activated that would integrate the then following facts. When fact and frame matched, the information quickly made sense. Was there a contradiction between fact and frame, the understanding of the information was lagging and this independently which one of the information was objectively easier available.

Many of us purchasers know this problem. Independently of objective criteria and facts: If the wrong frame is activated, the corresponding information is absorbed, the other one is not. Historically bad quality suppliers, that are performing well in the recent past or current period, can be seen as bad today, especially also if they only make one mistake even after a long period of no mistakes. Vice versa, suppliers that are supposed to be clearly good, honest, effective, and efficient, but objectively are not, might quickly be seen as positive after one good move.

Frames decide with which easiness we understand facts and information, independent how objectively good or bad the facts are available or accessible.

The bad supplier can be clearly seen behind the blur. A good supplier cannot be seen in a clear picture.

In reality, there are no objectively easier accessible facts as soon as frames come into play. There are only such facts that fit well into a frame and others that do not fit well or do not fit at all into a frame.

Beyond what was already said, another phenomenon is that when the concept of slowness is activated in our brain, we also move our body slower (Bargh et al. 1996).

Just to remember, our brain is learning frames by experience in a way that phenomena either correlate with the real world or that different aspects are being set into context by culture or language.

Two studies were analyzing the effect of using the expression to look into the future or to look back, while experiencing in life that moving forward and time usually point in the same direction. People sometimes walk backwards and time advances, but most of the time people advance while time also advances. So, the frames ‘the future lies in front of us’ and ‘the past lies behind us’ directly impact our actions. Miles et al. (2010) found that when we talk about the past, physically we lean back, when we talk about tomorrow, we tend to lean forward.

Language directly influences how we act in the world and how we interact with other people. Again, two groups were given a task. The first one was reading a text stating words like respect, sensitive, and polite. Others read aggressive, unfriendly, and impolite. After reading the text, the probands had to shortly discuss a small topic with research leader. This research leader purposely was talking to someone else in that moment. So, the probands had to wait or act by interruption. The result of the test was that the second group entered in a rude way into the talk of the researcher with his discussion partner. The members of this group interrupted the talk and tried to get the attention of the research leader. The members of the first group however were passive and waited for a longer time until they politely asked for interruption (Bargh et al. 1996).

In a nutshell, we can see that we all think and act according to words. The language that we hear or read activates frames in our head. A part of these frames is always also the cognitive simulation of things that we normally do not associate

with language, such as emotions, movements, smells, sounds, pictures, and so on. Because each and every word activates frames, with every word we are communicating a multitude of ideas that are connected with our experience in the world around this word. Frames take influence on our cognition and can heavily influence the easiness how we realize facts and information. Only when a fact fits into an activated frame, this fact will enter without problems in our consciousness. And, language takes direct influence in our actions by activated frames.

One small example could be a negotiation. In a negotiation, the buyer could think about avoiding the expression cost savings in favour of cost reductions. Savings could trigger the frame to bring money to the own bank account and to save. With this frame being activated, a supplier would most likely not give money to the buying company, but to try to save money instead. Also, the word cost might be interpreted as a burden by the supplier and lead him to a path of suppression and not to concession. Price instead might have a positive connotation as the frame 'value for price' could be opened at the supplier. So, price reductions would potentially be the better expression in favour of the buyer when discussing to get a lower price in the next period for a good that was purchased before.

Leaving humans for a moment, we want to go back to animals.

18 The Farming Fish

The one who wants to harvest a lot of crop has to take care of his land. This is also true, when the respective claim is located under water. How this works can be studied with some farming damselfish (Parma alboscapularis) that one could also call farming fish. These animals nourish themselves by harvesting and eating algae surfaces on riffs. But the fish do not eat somewhere unspecific; they concentrate on their geographic claim. They care for their claim and clean it from undesired plants, defend their claim against intruders, and fertilize their claim with own excreta. The scientists around Ferreira (Ferreira et al. 2018) from the University of South Australia in Adelaide have even reported that the fish adjust their efforts and work following the CO_2 concentration of the water. The higher the CO_2 concentration, the faster the algae will grow and the more intensive the fish care about the cleaning of the weed. Because in such circumstances, there is more food available, and the animals get along with a smaller claim. By this, the population can grow with higher CO_2 content.

I report about this fish, as I truly believe a buying company cannot harvest price reductions or in a broader view the fruits of competitiveness when they do not take care about their suppliers. Buyers have to work with suppliers, seed, fertilize, clean and defend intruders before they can harvest good crop. The better the outer circumstances, the easier it is to work with lesser number of suppliers.

This aspect brings us directly to the question of competition in nature.

19 Local Competition in Nature

Recently, I have read the new book of Gerd Ganteför (Ganteför 2018), who analyzes collective phenomena in nature and discusses potential consequences for communication and human behaviour in a herd. In this instance, I came across many interesting phenomena, but one of them caught my specific attention. Already for a long time, I am surprised why purchasers are buying 'around the church clock tower of their village', how I usually tell it to my colleagues. My observation is that many companies primarily buy regionally or even locally. This not by strategy, but by chance or better: By nature. Ganteför found a few annotations for this behaviour in the competitive world of animals.

In this context, I would like to introduce two animals to you, the firefly (here Pteroptyx malaccae, as well Photinus carolinus, Macrolampis palaciosi) and the bush cricket or katydid (here the Mecopoda elongate). Both of them emit light or sound to attract conspecific mates and to keep away predators at the same time. Like in most of the species, the male is flashing or singing, and the female is being attracted and chooses.

A well-cited publication in this context analyzes the rhythm of male Pteroptyx malaccae fireflies, congregated in trees, flashing in rhythmic synchrony with a period of about 560 ± 6 ms. The study analyzes if the rhythm of the flies is inherent to each animal or if the flashes are a reaction to the others. The result is that the synchrony is regulated by central nervous feedback from preceding activity cycles as also seen in the human sense of rhythm as well (Buck and Buck 1968). At the same time, the range of flash coincidence is of the order of ± 20 ms. This means that there is a certain time delta between the flashes of each individual, but also a fair amount of synchrony (Buck and Buck 1978; Moiseff and Copeland 2010).

Based on this knowledge, in fact that the sound or light to attract mates is produced intrinsically, and in competition with each other, we can look at the following study of Mecopoda elongate.

Hartbauer and Römer (2016) give an overview on studies that research chorus synchrony in this tropical katydid *Mecopoda elongata*. They do not analyze the flash light, but the mating sound produced by katydids. A special focus is given to the question why some males persistently signal as followers although this reduces their mating success.

If we assume that finding the right supplier for a specific good that the buyer needs also represents a form of mating, I wanted to look at the results of the above research.

The results are extremely interesting for purchasers. First, in the observation of Hartbauer and Römer (2016), females prefer males that signal at a period of 2 s. This is the conspecific requirement of Mecopoda elongata and individual to each species. It forces the males to get as close as possible to such rhythm, otherwise female will not be attracted. Females also prefer leading signals in fact they prefer the leaders, which is why males in a group compete for the leader role (Hartbauer et al. 2014). Chorus synchrony is a by-product of this behaviour. The synchrony is not perfect

and also interesting is that the leader–follower roles remain stable for a long time. One explanation for remaining a follower is also that those katydids who follow have less chance to become a victim to parasitoid flies, as those seem to focus first on the leaders. At the same time of course, the followers go into a disadvantage of reproduction success. On the other hand, it is also beneficial for the followers to establish a group and following the leader in a group, because such a group can 'extend the acoustic space'. Herein, consistent leader males increase their signal rate in choruses by 4% on average compared to when they sing in isolation. This means that competition increases in a group situation. This, the so-called beacon effect on top of it, attracts more female, as females prefer group situations where the can choose from instead of following a lone single male who is comparably quieter. By grouping, males increase their own mating chances and the mating chances of the group. Consequently, simulations have shown that the per capita chance to meet a date mate increases if the katydids sing in a chorus. Therefore, sexual selection favours group displays, and follower roles are evolutionary stabilized out of this emerging positive group effect and the negative natural selection.

For the professional purchasers, this can mean many things. One very important aspect is to bring suppliers into a true competition situation which results in an increased signal rate of the leading supplier and an increased competition out of the beacon effect. At the same time, natural selection is happening as not all suppliers are good enough to follow the leader and to really enter the group.

The result is an enhanced level of competition. This can be achieved and used best in an auction which is described in one chapter of this book by ZEW—Leibniz Centre for European Economic Research. As one argument that purchasers could use to bring suppliers into an auction, the aspect could hold that those suppliers who rightfully enter the auction are fitter than the ones that do not. Beginning a little bit earlier in the process, in my experience, the buyers sometimes do not ask loud enough for a bid. Or putting it in another way, the buyer does not actively go out to search for mates. Buyers think that the chorus should come to them. This is obviously not happening for the complete chorus. So, the buying company represented by the buyer has to work on its attractiveness to signal that a partner is wanted. Once this is done, the suppliers should be brought in a chorus situation. Coming back to the phenomenon of buying around the church in your own village. Mate dating seems to be relatively regional. Suppliers in the specific area compete for their customers. But it can happen that the mates available in the area are not best for a successful reproduction. Therefore, it can make sense for buyers to move to other geographies and to try to find better partners. For sellers, it can also make sense to leave, either to find better customers or to become a leader in case they have been followers for a long time with no chance to overtake the leader. Also, the question of the right rhythm is important. For example, if we compare the automotive industry with the agriculture industry, the rhythm of both industries might be different. If this is the case, automotive buyers should try to find only automotive rhythm suppliers. If this such condition not given, meaning the offset of sound or light emitted by the suppliers is too big and therefore not conspecifically suitable, the buyer should not try to make a transaction. Evolutionary interesting is that humans most of the time

have moved completely to another region when the food in their home region was scarce (see for example the German emigration to the USA after the crop failures in 1846 and 1847). This can lead to a complete drying out of the left region or it can lead to an establishment of a new centre elsewhere. In this context, I would like to mention the work of Krugman, who described the centre periphery model as a function of transportation costs. If the transportation cost is sufficiently low, goods between centre and periphery can be easily exchanged. Therefore, the centre will represent and concentrate the core of the economy and the periphery will supply the agricultural goods to the centre. If the transportation costs are high, the economy displays a symmetric regional pattern of production. Beware of centrifugal and centripetal forces that can influence the centres in positive or negative ways (Krugman 1991).

Returning to the findings of Ganteför (2018) in his new book, it is worth mentioning the Brazil nuts effect. In this effect, granular convection is observed in selections of different nuts or muesli, e.g. when the nuts are transported from production to the shop. After transportation, the bigger Brazil nuts usually are located on top of the muesli or nut mix bag (Rosato et al. 1987; Rietz and Stannarius 2008). This effect occurs when the nuts or the muesli are being shaken during transportation. When shaken small spaces under or next to the nuts are temporarily being created. Those spaces are filled easiest with smaller granular elements. As a consequence, the larger size elements are being transported to the top of the bag. The Brazil nuts are comparably big in a nut mix. Therefore, they end up at the top. In my view, a similar effect can also happen when a buyer's supplier portfolio is being shaken a lot. The bigger suppliers in the portfolio might come up quicker in times of strong competition even without showing a high level of own activity, while the smaller suppliers fill-in the small gaps by quickly getting smaller niche businesses. So, buyers please continue to maximize competition, but beware of the Brazil nuts effect. Therefore, the ones at the top might not be the ones that can quickly fill the gaps.

The Brazil nut effect is of course real but might feel like an illusion. To clarify the question of what is real as such, I would like to draw your attention to the next paragraph.

20 Understanding the Supplier Requires Observation, Communication *and* Information

Just recently, I have read a quote from Garfield, who said 'if it not a cat, it must be a dog'.

In Latin, this would be called 'tertium non datur': A third solution is not possible (Urban 2011 according to the logic of Aristoteles).

To better understand the question, I would like to refer to Heisenberg (1927). Heisenberg wrote about the trajectory of an electron in a way that such trajectory only starts to exist by our observation. The observation is the primary source of the image or better imagination that we get when studying nature. This statement was

challenged by Watzlawick et al. (1967) who observed that the *truth* might be the result of communication. Zeilinger (2001, 2003) concludes out of the both that it does not make sense to talk about a *reality* without the relevant information to it.

This means that the real world might be different to the observed or communicated world. For purchasing, this is a highly relevant discussion item as many of us judge a situation, or specific suppliers in their current state or 'current' market situation, without own observation nor with underlying, related and relevant information. Therefore, we consider situations that are communicated to us as reality.

This might not always be true, which is why I recommend visiting suppliers and to make own analyses. Only then, you can get a better picture about reality.

Interesting in addition to this is that especially creative humans, who build new links by associations, are especially receptive for seeing correlations where those correlations in reality do not exist (Brugger 2001). Brugger concludes that out of an above average characteristic to see patterns, the good and wanted form of creativity also comes with the side effect of believing in nonsense. 'Believing in nonsense is the price of creativity' (Brugger 2001; Urban 2011). This point iterates as well that information gathering, and testing is required after developing a creative thought. This aspect of supporting a thought by data will be picked up later in this article when discussing advancements in science, or the science of science as such. What I mean is that it is not enough to visit suppliers only; it is also required to test and to check by data ideally on site.

In favour of and fairness to all creative people, such supporting tests or proof of information might come into consciousness only many years after the creative thought has happened. We can see this with Einstein's theory of special relativity, which was confirmed only 26 years after his discovery in 1905 (Einstein and Infeld 1938; Wickert 1972). In 1906, the thought could not be confirmed by observation or data yet.

21 The Art of Seduction

This paragraph at the first glance might be looking at a very small detail only, but in the real purchasing world the topic in my view it is relevant. I am talking about the point in time when a supplier is selected. The moment of truth after a buyer has decided for a new supplier is always the actual delivery of the contracted goods. On the one hand, this is a very naked moment and reveals the true content or features of the purchased good. On the other hand, the transaction is somehow also hidden behind curtains as the good itself is most of the time not uncovered by purchasing but by logistics or production or the end customer, especially when a buying company is large and works based on a process separation scheme. The transaction itself and also the trade as such therefore is a hidden process not visible to the outside of a company and even inside a company not completely transparent (Kaube 2014). This phenomenon in the context of love is called *hidden sociality*

(Kuchler and Beher 2014). In the context of business-to-business or also business-to-consumer transactions, this hidden sociality could even be seen as embedded in a *hidden society* (Aubert 1965). A business requires closed rooms for discussions and negotiations, non-disclosure agreements, limits the number of actors to a defined circle, and describes itself even sometimes as a mystery. If it is really the case that purchasing in a business-to-business scenario is somehow hidden, the question of seduction in conclusion is an important one. In other words, how is the decision process for a supplier or vice versa for a customer exactly done? According to Aubert (1965), the preceding process of the hidden sociality is the seduction, or even the art of seduction. While the nature of seduction is characterized by an asymmetry of knowledge and the absence of a common planning, the seduction rests on the fact that it is not spoken out what just happens. Seduction therefore realizes learning by being surprised or by being tricked. In the context of purchasing, this phenomenon is widely known as the buyer is seduced by the supplier and the supplier is seduced by the buyer. Both parties do not know who the other side really is or what the other side will do. The target of both parties is to uncover the personality of the other. By that the value of seclusion, as, e.g. in love, might be partially lost, but such transparency for sure helps to understand the other party. Bottom-line the supplier selection process remains a process preceded by the art of seduction and proceeded by hidden sociality. And this most of the times even takes place in a hidden society. Assuming such context, the buyers are recommended to test their suppliers after supplier selection by transactional trial periods. In addition to this in the time of seduction and minimum after the first transaction, the supplier's character and performance should be measured. Two sets of numbers might help to narrow the topic down. In a recent CAPS survey (CAPS 2019), it was found that 94% of the asked companies find their new suppliers through the procurement function itself. 46% are recommended by internal business partners, 42% are filtered out of requests for quotations and requests for information by pure competition, 24% are recommended or directed by externals especially by customers, and even 2% are found by crowd sourcing. The companies were asked in this survey to select the top three preferred sources to find new suppliers. Coming back to the sociology of love (Kuchler and Beher 2014), two-thirds of the marriages worldwide are not the result of seduction but are based on the initiative of the related families. Even in the so-called bourgeoisie, marriages are often related to business rational and heritage (Kuchler and Beher 2014). In the world of purchasing, I have a clear opinion. No customer–supplier relationship is sustainable without the preceding process of seduction and following selection always under the risk of partition when the transaction, the relationship, or the traded good itself was not meeting the expectation.

To further understand the background for staying together or in other words sustainable buyer–supplier relationships, I want to briefly jump back into the animal world before having a closer look at relationships in humans.

22 Lasting Pair Bonds

In socially monogamous prairie voles (Microtus ochrogaster), mating induces enduring or lasting pair bonds that are initiated by partner preference formation and regulated by several neurotransmitters resulting out of a chemical process that leads to an epigenetic change in their DNA. The trigger for this change is the first mating that the prairie voles have (Wang et al. 2013; Blawat 2013). As a result, the prairie voles remain to be loyal to each other. This happens by the epigenetic change of their chromosomes, which means that the spatial structure of the DNA changes in some areas, while the sequence of the DNA remains unchanged. The prairie voles remain the same personalities as before, but they feel closer to each other (than before). The mating releases a cascade of processes that result in the activation of genes that have been on mute before. Those genes then control the payout of oxytocin, vasopressin, and dopamine which stimulate the nucleus accumbens, the centre for happiness, here in the brain of the prairie voles (Wang et al. 2013). Mating in the direct sense is not present in buyer–supplier relationships. Therefore, we cannot say that initial buying induces enduring of pair bonds. On the other hand, we will see the positive effect of oxytocin on bonding in the following paragraphs. So, the partner preference formation might not come out of the buying itself, but if the partners do not meet at all, the regulating neurotransmitters either do not show up at all or are triggered by other impulses.

In the purchasing world where buyers mainly use business-to-business platforms for sourcing and maybe even platform supported scouting before the sourcing (CAPS 2019), the pair bonding in the original, natural sense does not happen. For me, this is a sign that buyers should go to their potential suppliers to see and meet. Also, eating together allows proximity in order to understand better if a lasting partner preference can be formed.

23 Couples and also Singles Over-Rationalize Their Relationship Status as Being Ideal

The stronger the feeling of humans that their life as single or as a couple will not change in the near future, the more actively they will try to find reasons to explain why the live as they live (Herrmann 2013). In two tests, Laurin et al. (2013) found that the stability of the current relationship status is the decisive factor for this rationalization. In this context, stability according to Laurin et al. (2013) did not mean happiness. More so, stability in the above context can be explained by hopelessness. What does not change is treated as good, as Gilbert and Ebert or Killingsworth and Gilbert (Gilbert and Ebert 2002; Killingsworth and Gilbert 2010) have found. The people that cannot change a decision any more are happier with it. In personal relationships, Laurin et al. (2013) found that couples that think their happiness is defined by being together tend to not meet with happily single singles and vice versa.

For us in the field of purchasing, this point is particularly interesting, as it could mean that once a relationship between a buying company and a specific supplier has been established, it might be seen as a good decision that should not be changed. This might explain why in many cases it takes a long time to change the supplier as a lot of convincing by the buyer is needed internally inside the buying firm in order to explain facts, but also to work against over-rationalization of the relationship status. On the other hand, some suppliers might think that they never are able to work with a specific customer as this customer lives in a happy relationship with another supplier. Going back to the previous paragraph, it probably makes sense to always stay on the market and to try to find better suppliers or better customers. In contrast to the private life, the business environment allows to do the one and the other.

24 The Interaction of Buyer and Supplier Depends on Trust

A sensitive topic in purchasing is the required and desired level of understanding between the buying group and the selling group. As well it is important to understand how buying groups and selling groups effectively work together to achieve their targets in the best way.

In this context, it is worthwhile to understand the 'click-effect', which was described by Brafman and Brafman (2010). Brafman and Brafman claim that the interaction between two people works much more efficiently and effectively if a feeling of trust is present between the two. This status requires that a common language is found, personal characteristics are understood, and emotional connections are built. In many cases, such process takes time, but in other cases, the process can be accelerated a lot. This is the case when it clicks. First, this click-effect can create a unique or magic soul state, and secondly, it can change the basic nature of the relationship in a sustainable way. In the context of love, scientists have researched the biological background of such an effect and came up with the result that based on trust, dopamine is produced in a large extent which helps to stimulate the brain areas of desire and creates an increased positive attitude of life. So far, so good. But, is there a secret trigger that allows the click-effect to happen or can the occurrence of the click-effect be supported or stimulated? Brafman and Brafman (2010) found that the click-effect is not always a result of pure chance, but it can be influenced by several accelerators.

The first accelerator is vulnerability. Many people believe that vulnerability puts themselves in a weak or inferior position (Brafman and Brafman 2013). When people show their inner fears or weaknesses, they believe they automatically give power and influence over themselves to others.

In human interaction, however, vulnerability and self-openness are clear signs of strength.

When we show our vulnerability, others start to trust us, just because we take a risk emotionally, psychologically, and even sometimes physically. The reaction of our counterpart is usually that this person also opens up in a similar way. The protective wall is down; a closer personal connection can start to exist. This aspect is especially interesting for work environments where verbal interaction is predominant allowing the transactions between the parties.

Another aspect is proximity (Brafman and Brafman 2013). In a more and more digitalized world, it probable that we want to follow the efficient way of communication by smart IT tools. But this will keep us from the possibility to personally interact with the people that we want to work with.

Several studies show that people who are located in a certain proximity to each other, e.g. on the same floor, will collaborate twice as much as people that are located on different floors. Even interaction between people of different departments is increasing when the departments are located on the same floor. One explanatory background here is the *spontaneous communication*. It is described by the coincidental communication of humans, because they simply find each other at the same location at the same time.

The third aspect is the presence that somebody shows to and shares with another person (Brafman and Brafman 2013). If someone is fully or transformatively present in a specific situation, this person shows elements of care by active participation. Intensive listening, attentiveness are key attributes here.

Similarity is another important accelerator for the click-effect (Brafman and Brafman 2013). Similarity leads to sympathy and attraction. In case we find felt similarities, we create an in-group effect that allows building a community. In-group members are likely to be seen more positively, the likelihood for likeability increases.

If humans jointly experienced hard times and difficult situations have been successfully overcome together, the self-protective barriers are lowered, and a feeling of solidarity is created.

The result is more trust. In such an environment, your counterpart will emotionally support yourself which allows ground for debate and positive conflict. In effect, persons and teams that have experienced the click-effect can be more productive and more successful (Murnighan and Conlon 1991). For buyers, this click-effect might be important as its consequence allows to create and manage the relationship between buyer and supplier. In this way, a true buyer–supplier relationship can be established and the frequently mentioned supplier management as a main element of purchasing can be performed. The risk of clicking-in is of course that the buyers develop too much understanding for the buyer. This problem by the way also works vice versa in the same way. This is why I suggest and follow the first rule of purchasing: ‘Always ensure competition before collaboration’.

A very specific aspect in a competitive and in a collaborative relationship is the question of which hierarchy should talk to whom? Here, the following paragraph provides the first insight.

A much deeper look into buyer–supplier relationship is offered by Kim and Choi within this book.

25 Humans React Most Intensely on Other Humans of the Same Rank

The own social status decides significantly about how strong humans react to people that are on the same or on a different level in the social hierarchy (Ly et al. 2011; Zink et al. 2008). Ly et al. (2011) confirmed this by measuring the ventricle striatum activity through functional magnetic resonance tomography (fMRT) in the valuation system of the brain.

This brain structure is more active when someone gives another person a stronger or higher social importance. In the test of Ly et al. (2011), the test persons were confronted with text statements indicating different social status while looking at photographs of people. Hearing statements like 'This person was several times fired' or 'This person went to an elite university', the test persons did not automatically give more importance or interest to the person of higher social rank. This finding was against the hypothesis of the research team. Adversely, the interest of the test persons was decided by the self-valuation of their own social rank.

Only in those test persons that estimated the own social rank as high when they have been confronted with a photograph of people indicated with a higher social rank, the ventricle striatum was very active. In test persons with subjectively self-rated lower social rank, the interest was only focused on people with lower status.

For the researchers around Ly and Zink (Ly et al. 2011; Zink et al. 2008), the results were not surprising, as similar studies with monkeys on rank dependency are known. But, between those and Ly's study, there was one difference found. In monkey studies, the lower-ranked non-human primates also valued the dominant leading monkey. This aspect was not found in Ly et al. (2011). As a side comment, not clarified by the researchers yet is if humans have been emancipating themselves over this phenomenon.

For us in the field of purchasing, the findings of Ly et al. (2011) can be confirmed. Quite often I find that higher-ranked individuals in the own organization and people how have a self-perception of higher rank like to talk to higher rank people at the suppliers. Vice versa, sales representatives at suppliers or business leaders being owners or executive directors want to talk to higher-ranked persons in the organization of the buying company. Unfortunately, for purchasing, sometimes the business leaders of suppliers want to talk to the business leaders of the buying companies and not to the purchasing leaders of the buying company. The complementary finding of Ly et al. (2011) is also present in purchasing. Many buyers who have a self-perception of their own lower rank do not want to talk or negotiate with higher-ranked individuals of the supplier. This is particularly problematic as the suppliers' true decision makers are usually found in higher ranks. For purchasing leaders, this aspect leads to the so-called escalations, when lower-ranked buyers find they cannot solve a particular problem with the supplier by their own, they escalate to the purchasing leader avoiding to find a solution directly with the higher rank decision maker at the supplier. On the positive side, we should keep in

mind that this higher-ranked individual at the supplier most likely wants to talk to his own perceived rank at the buying company.

These interesting findings lead me to another related field which is the reaction patterns when an unplanned event in the supply chain occurs. In such a case, e.g. when a quality problem at the supplier potentially causes a massive supply interruption at the buying company, purchasers need help.

26 Crying for Help is Heard by Partners

A research group around Liévin-Bazin (Liévin-Bazin et al. 2018) has studied emotional responses to distress calls in cockatiels (Nymphicus hollandicus). These parrots were confronted with a conspecific distress call and their reaction patterns were scored. In the animal world, vocal communication is used to transmit information from emitter to receiver whereas information can be size, age, sex, dominance status, *and* also emotional status. The transmission of such emotional status is called emotional contagion and represents the first level of empathy.

In the test with the cockatiels, three types of audio stimuli were transmitted to the receiving birds. A partner's distress call, a non-partner's distress call, and a control sound. Distress calls in this case were sound emitted like when a bird was caught or forcibly restrained. The calls were taken from familiar birds or from birds with a high level of affiliation. The latter are called partners; the familiar birds are called non-partners. As a first result, in all cases, the birds were more attentive and active when confronted with the distress calls rather than with the control sound. But when the distress calls came from a partner, the birds were significantly more attentive and active than when the call came from a non-partner.

This could mean that distress calls not only function as stimulus triggering automatic reaction, but also transmit emotions. And, affiliation enhanced the emotional reactions in case of receiving distress calls from the same species.

Of course, this is completely untested in the context of purchasing, but quite often purchasers are called to help from production leaders, from general management or from other groups in the company, even from other purchasers. My observation here is that if the caller is affiliated and not only known or even unknown, the willingness of the receiver to help is much higher with the affiliate partner usually followed by active support. Across the negotiation table, so to say, meaning between buyer and supplier this might also be the case. When buyers are calling suppliers for help, the level of reactivity partially also depends on the relationship status of individuals. Affiliation also is valued higher than familiarity. This might even be influenced by the type of business that the business partners are mainly active in. If the business culture of both is similar, the level of affiliation might be higher. If the business culture differs, the level of personal affiliation might be even more decisive.

27 Super-Tasters for Bitterness Help to Stay Healthy

We know that it is important to meet up with suppliers in order to get to know them better. As described in the chapter of this book on the zero shades of grey, we also see that it is good to analyze the supplier product as such regarding failure or defect form, type, structure, and nature. What we have not discussed yet is which individual out of the purchasing team should meet up with the supplier or who should *get in contact* with the supplier's products. In this regard, I want to direct your attention to the topic of bitterness (Zittlau 2016). Most of us know the taste of grapefruit, dark chocolate, or chicorée salad. The bitter taste of those products is registered by receptors on our tong, whereas we have 25 types of receptors for different forms of bitterness and by the way only one for each sweet and sour. The reason is that things that taste bitter are potentially poisonous. Because of this aspect, it is important to already identify potentially poisonous products in the mouth before they enter the body (Zittlau 2016). But, beyond the mouth bitter receptors also exist further inside the body. Lee and Cohen, who are molecular biologists, research cells that are and work as bitter receptors inside the body, in this case inside the nose and the lung (Lee and Cohen 2016). Lee and Cohen found that people with a strong reaction to bitter taste get less infections of the respiratory tract. Bitter receptors are located on the tong, in the nose, in the bronchia, in the heart, and in other parts of the body. Each fifth European reacts very sensitively to bitter products. Around 30% of the Europeans, however, do not react to bitterness. The remainder reacts normal. The taste sensitivity of humans is defined by their genes. While super-tasters are getting slightly less infections of the respiratory tract than others, super-tasters are much more immune against less frequent infections, caused by bacteria, e.g. such as pseudomonades that can cause pneumonia while pseudomonades are sometimes resistant to antibiotics. When getting in contact with the bitter items, the receptors start a mechanism of defence. The cilia are set in movement in order to cough out bacteria, then antibacterial substances such as nitric oxide are emitted, and finally, immune cells are called for help. Potentially, to induce this effect, bitter receptors can be stimulated purposely with medical plants or herbs. For one of those plants, the artemisia abrotanum, such an effect was already proven. The bitter taste of the medicine therefore is a part of the effect. Looking at the topic from the other perspective, medicine often tastes sweet (Zittlau 2016). Especially, children medicine tastes sweet. Bitter stimuli trigger the immune system; sweet stimuli can even slow the immune system down. This is the case because the brain wrongly assumes and believes that the body is saved. The immune system retracts and the blood sugar rises. Bacteria need sugar and now can benefit from a higher sugar level.

Of course, this phenomenon is purely related to body physiology, but maybe the effect also plays a role in the business-to-business context. If a buying firm has no one in his purchasing team who can taste bitterness, bacteria can enter unhindered in the organism by purchased products. On the other hand, if an organization or organism has the ability to taste bitterness, it might be able to protect itself from

dangerous diseases. Suppliers might know this effect as well and could try to make their products taste sweet, e.g. by a good price. But, in reality, the product that is traded might have a bad quality without being identified by the receptors on the tong, represented by the purchasing employees. The brain might be tricked as well by nice savings and no substantially good product on the buyside. This means that most probably each buying organization should hire super-tasters and should beware of sweet tastes. On the sales side, by the way, customers can taste very sweet by promising a lot of volume and potential sales revenue, but maybe also here a good portion of bitterness tasting capability is positive for the focal firm. Maybe buyers and sellers should train their taste and eat less sugar, but medicinal herbs or dark chocolate from time to stimulate the bitterness receptors. The topic of food will be given a much closer look in the following paragraph. After having read it, you might want to buy your supplier a breakfast.

28 Invite Your Supplier for Breakfast

This paragraph deals with another aspect of human physiology. Whereas many studies about humans look at neuromodulation by inducing supraphysiological effects, e.g. by pharmaceuticals, I want to look at the natural way of life, namely I want to look at the buyer's and especially at the supplier's *breakfast*. And here, I do not want to limit our thoughts on manipulating blood glucose concentrations by, e.g. drinks that contain glucose. In contrast, I would like to focus on the normal breakfast itself assuming that buyers and suppliers eat breakfast. Strang et al. (2017) have performed two studies and repeated both studies a few times concluding the following. Food intake not only secures energy levels but also influences biochemical processes depending on different macronutrient compositions. These biochemical processes influence brain processes, including higher-level cognition, especially social decision making. Therefore, it is not only about whether or when we eat (Kahneman 2011), but also about what we eat. When talking about social decisions, researchers mean helping, trusting, or actions of social punishment. The latter can be assessed by the ultimatum game. In this game, actor 1 receives a good g from which he has to select a share s to offer this share s to an actor 2. If actor 2 accepts, both actors 1 and 2 get their share of the good, i.e. for actor 1 g minus s and for actor 2 s. If actor 2 rejects, both actors get nothing. Different studies show that receivers, actors 2, usually reject unfair offers, which is interpreted as a form of social punishment (Strang et al. 2017). The target of an ultimatum game is that actor 1 maximizes his return, by giving only a minimum share to actor 2. Already, with one payment unit greater than zero, the game has a return-oriented, rational solution. In practice, however, most of the offers that are lower than 15% are rejected, and on average, 30% is left for actor 2. If reputation is considered in the game, according to research by Nowak et al. (2000), even a level of 30% is rejected by actor 2, whereas reputation is defined as information about the behaviour of an actor 1 in the past.

Coming back to the research of Strang et al. (2017), social decisions are responsive to influences from hormonal and neurotransmitter states. In order to analyze the impact of macronutrient composition of a typical Western-style breakfast on social decision making, Strang et al. first tested whether the composition of a *breakfast* has an influence on the social decision-making behaviour. In a second study, the researchers manipulated the macronutrient composition of the breakfast as such and the timing of the followingly played ultimatum game in order to monitor metabolic parameters while assessing social decisions.

In the first study, eighty-seven subjects were asked to submit a detailed description of all food items that they consumed before 11 a.m. to 1 p.m. of the test day. The ratio of carbohydrates and proteins as a percentage of total energy intakes was calculated followed by a one-shot ultimatum game that each individual had to take. One interesting side result was that out of the 87 people, only 76 had breakfast. The remaining 11 were excluded from the following analysis. Another interesting result is that the following conclusions have been independent from age, body mass index, gender, or total energy intake. Based on a median split, two groups were formed, one with a high-carb/protein ratio and another group with a low-carb/protein ratio. When comparing the rejection rates of the ultimatum game, in which the subjects could punish a norm violator who had made an unfair offer, which means in the role of actor 2, in the low-carb/protein group 24% of the subjects decided to reject unfair offers. In contrast, 53% of the high-carb/protein group decided to reject unfair offers. This means that subjects who had relatively more cheese, yoghurt, milk, and relatively less bread for breakfast rejected unfair offers at a much lower rate. Now, if a buyer who eats breakfast and negotiates with a supplier in the morning of the negotiation day, a low-carb/protein ratio breakfast will lead him to lower rejection rates of unfair offers from his supplier. Decisive of course is, who is actor 1 and who is actor 2. If the buyer is actor 1 and has something to offer, e.g. a new business, and in return, he wants to get savings on running business or an improvement of business terms, the buyer might want to first find out about the breakfast of the negotiating supplier representative. If the supplier representative had a low-carb/protein ratio breakfast, the level of aggressiveness of the buyer's offer can increase. If the offer of the buyer is too aggressive, the supplier may find the buyer's offer unfair and rejects it. In such a case, the deal would not come into play at all.

The second test of Strang et al. made use of the results of study 1 and designed a breakfast as a controlled meal to study the causal relation between the macronutrient composition and rejection rates. So, the target was to induce physiological fluctuations resulting out of a breakfast to assess the respective impact of a controlled low-carb/protein-breakfast with a 50/25% ratio and a high-carb/protein-breakfast with an 80/10% ratio composed out of in real-life available goods. Concretely, breakfast 1 was prepared with 88 g. wholegrain bread, 20 g ham, 5 g cream cheese, 30 g strawberry marmalade, 130 ml milk, 200 ml apple juice, 110 ml water, 225 g banana, and 225 g apple. The low-carb/protein ratio breakfast was prepared with 70 g sunflower seed bread, 70 g wholegrain bread, 40 g ham, 30 g cream cheese, 40 g Camembert, 240 ml milk, 200 ml water,

250 ml yoghurt, and 120 g banana. In study 2, the macronutrient composition of the breakfast significantly modulated rejection rates in response to unfair offers. Rejection rates were again significantly higher with high-carb/protein ratios, about 15% in the mean. But, the main target of study 2 was to identify the mechanism behind the decision-making process. The result shows a lower tyrosine level, higher tryptophan levels, and a steeper decline in postprandial blood glucose with taking a high-carb/protein ratio breakfast. The researchers also found that only changes in tyrosine levels significantly predicted changes in rejection rates while the tyrosine levels in both types of breakfast significantly differed as such. In previous studies when the overall energy content, glucose, declined below optimal levels, changes in behaviour happened followed by decreasing self-control (Gailliot et al. 2007; Masicampo and Baumeister 2008). But despite the fact that a steeper decline of glucose was also found in study 2 comparing high-carb/protein ratio with low-carb/protein ratio, glucose was not predicting the rejection decisions of the probands. On the other hand, previous studies have already shown that brain tyrosine and its neurotransmitter product dopamine both are involved in social decisions. While dopamine neurons indicate reward prediction errors, meaning differences between prediction and experience of the reward, different tyrosine levels might increase rejection rates of the ultimatum game via an influence on dopamine. One constraint of study 2 is that only male subjects were analyzed as previous studies have shown gender differences most likely due to the metabolism differences. However, study 1 indicates that similar results can be expected with females. In any case, Strang et al. (2017) found that a modulation in the dopamine precursor, tyrosine, is the underlying mechanism influencing our social decision through macronutrient composition of our food, which means that the food intake based on its composition and content has an influence on antisocial behaviour. For those of you who are interested in knowing more about tyrosine might find it interesting that Justus von Liebig in 1846 first time has characterized L-tyrosine as protein component of cheese as it is present in large quantities in casein (Von Liebig and Poggendorf 1858). If you combine this knowledge with a recent article of Hawks (2019) who comments that enjoying dairy in adulthood is a genetic privilege that emerged only recently in our evolutionary history, you might want to ask yourself what you are having for breakfast. In my case, I like to eat yoghurt with muesli or a piece of wholegrain bread with two slices of cheese.

29 To Feel Disconnection as a Pain Is a High Motivation to Stay with a Partner

Coming back to prairie voles (Microtus ochrogaster), I want to study why partners stay together. Here, Oliver Bosch and Tobias Pohl from the University of Regensburg and Larry Young from Emory University School of Medicine in Atlanta, GA, have contributed significantly to the role and mediation of oxytocin in social relationships. Social relationships are important for the well-being of

humans. Basically, there are two different types of relationships. One is the parent–child relationship and the other one is a relationship established between individuals and family, friends, co-workers, and of course partners. In both cases, the neuropeptide oxytocin plays an important role as it, when released within the brain, facilitates the formation of pair bonds and friendship as well as the positive effects resulting from those. Also, in the opposite way, oxytocin plays a role, as bond disruption or a loss of bond severely impacts the oxytocin system by a disfunction. This disfunction results in harmful physiological and psychological effects. As the ability to study the underlying mechanisms of social relationships is limited in humans, researchers like Bosch research comparable animal models that include pair bonding of partners and friends and biparental care of their offspring (Bosch and Young 2017). In that context, the behavioural and neuroendocrine factors associated with social bonding in male and female prairie voles have been extensively studied in the past decades (Pohl et al. 2018). The first study in this area was presented by Thomas and Birney in 1979 (Thomas and Birney 1979) describing the prairie vole as a monogamous species characterizing the mating system in a laboratory setting. Social structures of wild prairie voles were studied and male–female pairs were followed in nature over a longer period of time. Because prairie voles are affiliative and co-operative, and form enduring social bonds between both sexes male and female and provide the care for children by both parents, they are a valuable model organism to study social monogamy and neuronal pathways when forming partner preference also in humans. In this regard, I want to mention that in purchasing and supply management, I have experienced the formation of a lot of buyer–supplier relationships. In other words, it was always easier to create a new relationship with a new supplier than ending a relationship with an existing supplier. Usually, in practice, it is almost impossible to completely end a relationship with a supplier, only the magnitude, level or intensity of co-operation changes. I am also observing that many buyers, but more so members of non-purchasing departments in the buying company, fear to end relationships with suppliers. Only experienced and therefore trained buyers and the suppression of emotions in individuals can allow ending a relationship. Ambivalent in my observation are exposed leaders of suppliers that most of the times do not want to end a relationship with a customer, while others are ‘colder’ and do not fear ending a relationship. Having said that and coming back to prairie voles, Grippo et al. (2007, 2011) and Bosch et al. (2009) have studied physiological and psychological consequences of pair bond disruption in adult prairie voles. Here, it can be said that social isolation from same-sex individuals evokes gender-specific responses. In female voles, separation from another female causes depressive-like symptoms, whereas males do not react with such emotional consequence. In contrast to same-sex isolation, the sudden disruption of opposite-sex pair bonds provokes an increase in behaviours on a psychological distress level. Both, male and female, show a depressive behaviour which even is increasing when exposed to mild stress. On a physiological level, the cardiovascular system becomes dysregulated. By hormonal and corticosterone reactions, the stress level is chronically activated and elevated. From the opposite point of view, blocking the corticotropin-releasing factor

normalizes the emotionality of separated males and by the way also separated lactating mothers from their children. This corticotropin-releasing factor is expressed when male and female are separated, but not when male is separated from male. Surprisingly, the corticotropin-releasing factor is also high when male is together with the female partner, but the corticotropin-releasing factor does not have to be activated yet. Bosch and Young (2017) hypothesize that this constellation can guarantee the immediate activation if needed in case of separation. Or seen from the opposite side, while knowing that the corticotropin-releasing factor can be immediately activated, the maintenance of the pair bond encourages the partners to actively seek the presence of each other in order to reduce a separation-induced stress reaction. In summary, to feel disconnection as a pain keeps the prairie voles together. This has the consequence that the partners stay together, and by that, they secure the survival of their offspring.

Of course, in the context of buyer–supplier relationships, we not only find personal relationships but a larger number of personal relationships forming a business-to-business or company-to-company relationship. It will probably take a while to study and analyze human relationships on the physiological level comparable to prairie voles research, and beyond this, it might take another while to research organizational relationships. But, for sure we can say that each organizational relationship consists of human, individual relationships that are subject to mediation by the oxytocin system influenced by corticotropin release.

Therefore, I suggest keeping in mind that sometimes staying with a supplier or staying with a buyer might be driven by the fear to experience pain out of a potential bond disruption. The development of a good relationship is important for the business success and depends on trust and other items. But, on the other hand, disrupting a relationship might be necessary in times to allow a new orientation following a strategy to reach the next goal.

At any time though, let us keep in mind that we are humans, one way or the other.

30 The Culture of the Negotiation Partner Influences the Result

Culture in our mind or according to our common understanding might be defined by theatre visits, symphonic concerts, or discussions amongst intellectuals. But culture also means typically present rituals or ways of doing things in a quotidian way. This could contain eating rituals, stories that are told within specific countries, specific music styles in a country, or ways of celebrating or discussing within a family. Generally, culture means the ability, custody, or information that members of a group pass along to other members of their group in a lasting way (Blawat 2016).

Like as in humans, culture in animals can be particularly useful, e.g. when following specific hunting techniques as in orcas (Orcinus orca; Laland and Janik 2006). The result of the very effective and unfortunately also efficient hunting culture recently was observed by my family in Tromsø, Norway, where the orcas supported by climate change excessively hunt for narwhales (Monodon monoceros) who as a consequence are more and more endangered with a drastic negative effect on the local ecosystem.

In the context of culture evolution and development, scientist speaks of social learning or social or even cultural cognition (Whiten and Watson 2018). In general, it can be said that the capacity for social learning is shared by humans, other primates, but also with fish, birds, and even with insects (Leadbeater and Chittka 2007). Whiten and van Schaik (2007) have proposed an evolutionary progression from simple social learning which is widespread in animals to cumulative culture as in humans. Based on this logic, an eight-stage model regarding the evolution of culture and cultural cognition was provided by Haidle et al. (2015) to lead to contemporary human cultures.

When socially transmitted information diffuses to become a group-wide knowledge or behaviour in a species, scientists speak of traditions (Whiten and Watson 2018). Culture would then be a collection of traditions. While some researchers link the following ability of cumulative cultures, i.e. to constantly add up cultural learning, to humans (Tennie et al. 2009), Whiten et al. (2011) show that also in other species limited forms of capacity for cumulative culture exist. This means that the species learn genetically but also culturally by a 'second inheritance system' (Whiten 2005), while both systems are complementary and interactive. As chimpanzees are our sister species as being humans, I want to have a short look at the first dimension of social learning as described by Whiten (2017).

Andrew Whiten has authored and co-authored more than 240 research publications in the field of social cognition in chimpanzees (Whiten 2011) and specifically on social learning, tradition, and the evolution of culture amongst others (Rae 2010). In his studies, Whiten observed a lot of cultural richesse with chimpanzees, and in specific, he has found 39 behavioural traits in chimpanzee groups that could not be fully explained by genetical influences nor environmental conditions.

The findings can be embedded in this framework for 'comparing cultural cognition across species' (Whiten and Watson 2018) which divides social learning into three dimensions: population-level patterning of traditions, social learning processes, and cultural content.

Elaborating only on the first dimension, the population-level patterning of traditions, I want to draw your attention to the research on wild chimpanzees. Starting with Jane Goodall, scientists began to collect long-term observational information on behaviour of chimpanzees from multiple field sites. Doing this, it became apparent that the chimpanzees living at the different sites also differed in their behaviour (Goodall 1986; McGrew 1992; Boesch and Tomasello 1998). Without apparent ecological explanation, some behaviours were absent in some sites while being present in others, summing up to above mentioned 39 different traits.

One example is the cracking of nuts with the help of hammer and anvil performed by chimpanzees in the Tai National Park of Cote d'Ivoire. Compared with the chimpanzees living at the Gombe Stream in Tanzania, which is the famous research area of Jane Goodall, the Gombe Stream apes did not look at nuts at all if they needed tools to open them.

Not limited to tool-use, the differences in traditions compel foraging techniques to find food, communication, social, and even sexual behaviour [Whiten and Watson 2018, see here also the recent book of Bagusche 2019, who amongst other examples discusses the mating tradition of sea otters (Enhydra lutris)]. Whiten (2011) remarks in addition that a substantial and at the same time diverse portion of chimpanzee behavioural repertoire is culturally inherited and therefore as indicated above common to us humans, which according to Whiten is likely to characterizing our shared ancestry. While not wanting to extend the discussion on the distributional proliferation of cultures in other animals, multiple traditions of our common ancestors date back minimum of 14–15 million years (Whiten and Watson 2018).

Transferring this aspect of population-level patterning of traditions, I want to tell a short story. Some two years ago, I was invited for a speech in the Conservatoire National Arts et Métiers in Paris, France. When finished with my speech, I was asked where I would go next from there. I answered I will go to a supplier in Bretagne, France, to discuss business problems. My French hosts were very surprised and did not understand at all, why a senior vice president purchasing would go to a supplier instead of the supplier *coming* to the office of the buyer. I identified this as a tradition being present in that cultural frame. Some traditions might not be present in different populations.

Discussing the second dimension of the social learning framework, Whiten and Watson (2018) look at how the *process* of social learning is in fact happening. Here, the researchers split into biases and mechanisms. Social learning biases influence us when we utilize social information, meaning which behaviours and from whom we should learn them. Social mechanisms reflect and describe the way how and in which precision information is transmitted from the demonstrator to the observer.

This processual aspect of social learning is also present in the purchasing and supply management context. For example, a supplier *a* might be biased from a past experience when a buying company has bought from the supplier's competitor, but after a change in strategy, this competitor might not be as interesting any more for the buyer as before. The supplier *a* might still think that the buyer is not interested and therefore could be biased towards other potential customers resulting in lost chances. Another example that I have experienced myself is a supplier that delivered with bad quality for years, but after an intensive quality development programme, the same supplier objectively has improved. Decision makers in the buying company, however, still believe that the respective supplier is bad in quality, just because this was the case in the rather distant past. The buying company, therefore, might be biased. Another aspect is the person who transmits information. Here, my experience is that the functional origin of a person can be decisive for social learning. Concretely, the engineering head of a supplier or as recently self-experienced, the head of business operations of a supplier, who has an

engineering background, both listen more carefully and consequently are more receptive to information that is coming from a high-level engineer of the buying company instead of the head of purchasing of the buying company as this person might be more perceived to be connected to the money side of things. The information observer in this example becomes a receiver biased by his engineering background. Such cultural aspects can of course be used by purchasing for its respective interests. When we look at learning mechanisms, we can also find interesting examples. One often discussed and not always understood example is the Japanese mechanism of learning. In this culture in my experience, the information of the content demonstrator is only received when a whole group with all related stakeholders at the supplier has understood and confirmed the information. The mechanism therefore works in a collective way of absorption. Other cultures might rather work in a way that once the highest management member has received an information and agreed to it, the rest of the organization executes accordingly without further challenge of the content that is therefore given or socially learned. Both ways can contain pitfalls out of biases of learners when to deploy social learning and whom to learn from (Giraldeau et al. 2002; Laland 2004).

The third dimension of social learning is the cultural content. A key prerequisite for cumulative culture is to forego a highly inefficient behaviour to adopt a highly efficient alternative (Davis et al. 2016). This process of adopting in order to cumulate is reliably found in humans over chimpanzees (Dean et al. 2012), whereas chimpanzees sometimes even get stuck on first-learned behaviour (Marshall-Pescini and Whiten 2008). The capacity for cumulative culture at humans is unique (Tennie et al. 2009; Heinrich 2015). Nevertheless, the rapid cumulation of culture happened only fairly recently in human development (Semaw et al. 2003; Harmand et al. 2015; Stout 2011). If we translate the idea of cumulative culture into purchasing and supply management, my suggestion is to focus on the cumulative culture of your very business. In my case, as a buyer, I have experienced the telecom industry, the gaming industry, the machine-building industry, project business for energy production, and the automotive industry. All of those industries according to my observation have an own culture which has been created by adoption of efficient behaviours and by cumulation. To be able to succeed with your suppliers, therefore I suggest checking if your suppliers really understand and accept the cumulative culture of your business. Because, if this is not the case, either you, or your supplier, or both of you will either fail or have to adapt.

After having developed a general understanding on the development of social learning and cultures, in the following paragraph, I would like to look at a specifically stable culture.

31 Stable Cultures

We know from the studies of Whiten et al. and Goodall (Whiten et al. 1999; Goodall 1986) that cultures are defined by behaviour patterns. In consequence, the following research is setting an interesting frame for purchasing, in specific for the available negotiation stake and more important for the framing values and potential way of negotiation. Regarding the frame of negotiations in the sense of Wehling (2016), the cultural frame that includes language can determine or in a way limit the negotiation cake beyond the expected value out of game theoretical thoughts. With particular focus in this regard, I want to look at the development of human culture over time. Here, Baek, Minnhagen, and Kim (Baek et al. 2011a) presented thrilling results when analyzing family names of people living in Korea (Weber 2011). The researchers used ten historical family books that document the respective family trees in the Confucian tradition more than 500 years back. By means of random group formation (RGF), the researchers showed a mathematical correlation between the size of the population and the prevalence of the family name, Kim (Baek et al. 2011b; Kiet et al. 2008), which means the share of people with last name Kim out of the total number of Koreans was always the same. This was not the case for other last names that also increased or decreased over time. Baek, Minnhagen, and Kim (Baek et al. 2011a) are physicians and used a method out of theoretical physics to determine that out of 50,000 Koreans that lived in Korea in the year 500 AD, 10,000 carried the name Kim. It was the dominating name over 1500 years and this in a name context where in the early Korean time about 150 other last names were in use. The reasoning behind this fact is not fully confirmed, but the researchers speculate that the explanation to this state is stability. Most likely, the Korean culture remained stable over 1500 years, even when the population drastically increased in the same time frame and the territory of living has increased as well. The Korean culture simply swallowed other influences and kept theirs.

For us in purchasing this means at first that cultural frames are relevant and second that cultural frames can define or narrow down the negotiation cake. If it is the culture to treat the customer as being king, this might be a necessity to be respected by the supplier. On the other hand, negotiation results have to be sustainable, i.e. the share of actor 2 in the ultimatum game might likely be relatively high and stable. If someone intends to break the 'Kim'-culture, he or she needs good arguments, or a high leverage and potentially a lot of time. In my experience, taking the outside perspective might also be challenging. If purchasers outside of Korea do buy and import from Korea, the cultural fit is also relevant. Growth and cultural expansion might always be part of the negotiation and a supra-trade target. One supporting experience I can share adding to the findings above is a supplier day that I attended in South Korea. Most of the present suppliers were South Korean companies, by the way, dominated by the name Kim. The day began with singing the national anthem of South Korea in front of the national flag. This could support the argument of Baek et al. (2011a) that the Korean culture is particularly stable and sets a frame for the negotiation. By the way, in the early Middle Ages in Germany,

people only had first names and no last names at all. Only when the population density grew, people had a second name mostly defining their profession or corporal attributes. In Germany, the negotiation frame therefore might be set by other cultural elements, maybe not the sustainability or stability in the narrow sense, but maybe set by professional values or natural frames.

After having references to cultures as such as a potentially guiding element for negotiations or business-to-business trade, the following paragraph will touch upon the 'we'-feeling of cultures.

32 Cultures Have Their Self-Esteem

If cultures try to expand their reach, they have to adapt, or they have to make others adapt, or they simply trade goods and services with minimal or gradual adaptation. If sub-cultures, cultures, or nations in the sense of cumulative culture with geographic boundaries estimate their own capabilities as exceptional by collective self-esteem, psychologist speaks of collective narcissism (Herrmann 2018). A positive way of putting this phenomenon could be to speak of a 'we'-feeling. The problem is that a strong 'we'-feeling can also lead to a way of hybris or importance overestimation of the own group. In such a situation, the idea creation or ideation process in a group might even be limited. Based on this thought, Zaromb et al. (2018) have asked test persons in 35 countries to quantify the share of their nation in world history. The historical achievements of a nation of course cannot be qualified in detail by such means, and the researchers did not target this aspect in the first place. They wanted to measure to which extent the people of a nation give an overestimated importance to their own cumulative culture. The result of the study showed the two highest scores in Russia with 61% and in Great Britain with 55%. Germany had 33% and the USA 29%. The test persons were informed before answering the test questions that a maximum cumulative score of 100% is allowed. But the total value of answers resulted in 1156%, which in itself represents a collective self-overestimation. By the way, inside the USA, the highest-scoring states were the founding states, e.g. Virginia. The lowest score was with Iowa. If we want to transfer this into purchasing, buyers might get one of the best price-to-cost and cost-to-sustainability ratios in Iowa. On an individual level, by the way, everybody always knows what he himself was able to achieve in the past. But of course, it is much more difficult to know what others have done. Because story telling refers to historical achievements, a great self-esteem can also lead to the feeling of being offended by others. If a buyer–supplier relationship finds itself in the overestimation-offence trap, measuring the relationships performance in real time and not looking at the past might be a good idea.

When we study cultural behaviour and possible implications on buyer–supplier relationships, performance measurement, or the negotiation cake itself, the influence of genes is a natural question. This aspect might relate to a 'first inheritance system' as the genetic counterpart of the 'second inheritance system' (see above and Whiten and Watson 2018) meaning culture as consequence of tradition and social learning processes.

After this intensive look at the development of cultures and their influence on our field, I would like to come back to the interaction between buyer and supplier.

First looking at an example out of the animal world and then followed by what we should or should not wish for.

33 Make Sure that You Have the Right Speed for Your Supplier

Johannes Larsch and Herwig Baier from the Max-Planck-Institute of Neurobiology in Munich found the way how zebrafish follow each other. Zebrafish are small and obviously grouping together increases their probability for survival (Larsch and Baier 2018).

Larsch and Baier found that the grouping mechanism of this fish is based on the adjustment of speed of movement. The fish exclusively check the way of movement of their neighbour zebrafish. Based on their required characteristic behaviour, the fish prefer a speed of 2–6 mm per second. If this speed is present, the zebrafish feel attracted by the other fish. Consequentially, they group and move along together.

Such behaviour is also given when the other fish is not even a zebrafish. The adjustment of speed therefore is the nucleus of swarm building. Other characteristics, however, e.g. such as the look or the smell of the other fish, are not decisive for the zebrafish.

Also, it is not important for the leading zebrafish how the newly following zebrafish is behaving. This means that the communication of the swarm is not a dialogue, it is a one-way street. I found this example in the animal world very interesting for purchasing and supply management. Especially in business-to-business, but also in consumer-to-business purchasing, the speed of the customer is decisive for the business success. If the buying company is too fast or too slow for the supplier, the supplier will not be able to follow with the required distance. As a result, we will see either extensive excess inventory or supply interruptions. In rather extreme cases, the buying company and the supplying company do not fit together at all as the immanent speed of their own species might not fit at all to the speed of their business partner.

In such cases, it is best to stop the relationship and to regroup. In my experience, those cases are not even rare but can be found rather often. It is up to you, to judge your own cases.

34 Buyers to Think About Which Business They Offer to Suppliers

Gino, Adams, and Flynn have conducted a series of studies that analyze gift giving (Flynn and Adams 2009; Gino and Flynn 2011). Gino and Flynn from Harvard and from Stanford University invited some participants to their study to create an online wish list and others to select from this list (Gino and Flynn 2011). The wish list group had to select an item from the list; the surprise group could see the list but had to pick something else of equivalent value. Of course, people were happier with items taken from their own wish-list. But surprisingly, people have rated those choices as thoughtful and personal. People somehow suppress the knowledge that the item was picked from a list and the same people think that the person who is giving really understands the receiver. The same researchers found similar results in weddings. Invitees to the wedding were to pick from a wedding present list and the wedding couples were comparably more delighted to receive something from the list instead of being surprised. In another study, Gino and Flynn (2011) asked people to reflect on what they have received. When people give away purely on their own thought, they think they were well-chosen and probably appreciated. When people receive those, they see them often as a waste of time and money. People should also not try to compensate by spending more. The recipients do not care. Adams and Flynn found in their study about wedding rings that the women did not care about the price the ring had cost. Both researchers found a similar result when they asked people to think about birthday presents, they had been given or that they received. The recipients were just as happy with inexpensive gifts, while givers expected otherwise. As a conclusion, it can be said that givers and receivers see things differently. The giver imagines that the ideal item is costly and is hand-picked. The receiver does not care about a high value, but he does appreciate being bought a present that they had already selected. Therefore, we should ask more questions before to give and we can even spend less (Harford 2016).

In the context of purchasing and supply management, both sides buyers and suppliers are givers and receivers. And, just for making this clear, this chapter is not targeting corporate compliance research, it is looking at business-to-business projects and at negotiations. In cases, when buyers offer business to suppliers, the suppliers might not be happy about receiving the specific business. One reason could be that it does not fit to their capabilities or needs. If a supplier does not indicate which business is on his wish list, he could be unhappy in the end. From a buyer's perspective, something similar might be the case. Suppliers might want to give price down offers to the buyers, but the buyers would be happier about a prolongation of payment terms to protect their working capital. Here as well it makes sense to indicate preferences. Thus, cultural frames are again the ones that might keep supplier or buyer away from signalling their preferences. And, by the way, when having a quick look at the corporate compliance research, the findings of Gino and Flynn (2011) can drastically reduce corporate compliance risk as a

by-product as the transparent signalling between buying and selling company leads to higher explicitness in the trade exchange.

In any case, it makes sense to calculate what is offered. Please, keep in mind the Weber–Fechner law in this regard.

35 Do not Give in Without Calculating

In negotiations, sometimes purchasers give in supposedly small amounts of money when big numbers are being discussed. One reason might lay in the Weber–Fechner law.

The background is that in our brain, numbers are not lined up or memorized in a linear, but in a logarithmic way (Dambeck 2016). More precisely, our brain's scale is logarithmic, i.e. the distance between the number 1 and the number 10 is felt as being similar compared to the distance between 10 and 100 or 100 and 1000. This distortion is called Weber–Fechner law.

When comparing two numbers, our brain does not use a saved table in which it is written that, e.g. the 6 is bigger than the 5. To explain the phenomenon, Izard and Dehaene (2008) introduced the imagination of a number line in our brain by the multiply used tape measure of a tailor. If you imagine the tape measure of a tailor in your mind, to be able to decide if a 9 is greater than a 1, a quick look or glance at the tape measure is enough. But, to differentiate between a 5 and a 6, sometimes you have to look twice in order to understand which number is located more to the right of the other number, especially when the tape measure frequently has been in use and is not fully readable any more. Ditz and Nieder (2016) state that a logarithmic scale seems to be the best way to mentally picture numbers. In this context, Wehling (2016) explains and shows that humans think in images or, in other words, remember by imagining pictures. Nieder and Dehaene say, small numbers are memorized and pictured very precisely, big numbers relatively vaguely (Nieder and Dehaene 2009).

Experiments show that the number line in the brain is also compressed logarithmically even with crows. Ditz and Nieder (2016) and their team trained carrion crows (Corvus corone) to compare numbers between 1 and 30. The crows had to decide on a touch screen if a point cloud after repetitive display on the screen would be same or different to the one before. The crows made mistakes, but numbers like 1 and 2 or 2 and 4 got mixed-up much less often than numbers between 20 and 30. Similar experiments were performed with humans who showed the same distortion.

One advantage of this way of imaging could be to better estimate small and medium versus large quantities of food or to judge a number of predators approaching to us.

Objects and numbers that occur in quantities between 1 and 4, humans and animals such as apes and crows can understand with one look. But, if the numbers increase above 4, we do not focus on the total number of objects but look for amounts. As an example, humans can understand the difference between 10 and 15

green apples quicker than to get the delta between 30 and 35 objects, despite the fact that the calculated difference is the same.

In other words, the numbers 30 and 35 are located closer to each other in our brain than the 10 and the 15 while using a logarithmic scale.

In our field, purchasing and supply management, this might mean that when asking for savings in per cent, the above effect should also be taken into account. Year-on-year savings or price comparisons from 1 to 4% can be understood immediately. Starting from 5% of buyers and sellers might not easily be able to differentiate from other values such as 6 or 7%.

Another aspect to be taken into account could be linked to the Weber–Fechner law.

When Kahneman (2011) talks about cognitive dissonance when humans try to get a better deal for sports shoes for a price delta win of 5 Euros by running from shop to shop and leaving out on a price delta win of 5 Euros when buying a new TV-set with a price of 1005 Euros by staying in one shop, this phenomenon could also be related to the logarithmic scale in our brain.

And by the way, animals cannot count. And humans without mathematical training intuitively use a logarithmic imaging. This holds true for Amazonas tribes or pre-school children. The logarithmical scale is only being linearized during mathematics class in school, mostly in year 2 or 3 in elementary school according to Ditz and Nieder (2016). But, if we have to decide quickly also as adults, our nonlinear scale is coming to play again, e.g. when estimating quantities. This phenomenon might be analogously present during the guessing of the exact quantity of a jar full of beans or how many balls would fit into a swimming pool. Many people drastically are wrong in guessing the correct number. In the purchasing world, quantity estimations and confirmations by purchasers according to my experience are many times lacking foundation and control calculations. Therefore, such estimations sometimes might be subject to the Weber–Fechner law as well. In order to really perform in mathematics, a symbolic understanding of numbers is needed. This cannot be found with animals. In other words, humans can count, animals cannot.

Coming back to the potentially 'right' number of requested savings in per cent: Here it might be a good idea to ask for 7%. Why? Bellos (2010) has asked 30,000 people about their favourite number. Almost half of all interviewees have replied with a number between 1 and 10. 6.7% liked the number 8 best, 7.5% the number 3, and 9.7% favoured the number 7. The 7 is a prime, and according to Bellos, it is invisibly present in our daily life. The week has 7 days; there are 7 continents, 7 seas, and 7 planets at the sky during the antiquity (Poundstone 2015). Another explanation by Bellos is that we can count from 1 to 10 with our fingers, which might explain the preference for the numbers 1–10 amongst all others. Within this frame, according to the study of Kubovy and Psotka (1976) from the University of Yale, probands had to think about a number between 1 and 10. 1 and 10 basically have not been mentioned by the subjects of the study as they mark the endpoints of this frame. 5 is exactly in the middle and does not feel random enough. 2, 4, 6, and 8 are even numbers and therefore are too sorted or organized. According to the

researchers, our brain calculates this way. Remain the numbers 3, 7, and 9, whereas the 9 can be composed of 3 times 3. The number that feels random and unique at the same time is number 7 and was predominantly mentioned by 28.4% of the 558 persons participating in the study.

Kubovy and Psotka (1976) performed another test to choose a number from 0 to 9, whereas to use only whole numbers such as the number 7. This mentioning in the question leads to a reduction of interest on 7 to a percentage a little higher than 16% and the numbers 3 and 5 also being of similar interest to the test persons. As a result, we can say that the number 7 is still very interesting, but the responses to Kubovys' and Psotkas' questions depend on complying with the request for a spontaneous response. In other words, the 7 is a unique number, but it always depends on how you put the question if the 7 gets a very high or a reasonably high interest. Therefore, other numbers, such as the 3, should also be in your scope.

Of course, buyers will continue to ask for price reductions according to the price differences offered by several suppliers in competition with each other. But, for year-on-year productivity negotiations or dedicated project negotiations, a second thought about the suitable number requested by you might make sense.

In the above explanation, we already saw that we are not perfect in validating price differences of different goods when comparing the number deltas themselves. Beyond this aspect, another phenomenon is of interest as well. We are also misled by differences in status perception of the goods that we compare.

36 Testosterone Helps to Increase the Demand for Status Symbols

Nave et al. (2018) have tested the influence of testosterone on purchasing decision for goods with similar quality on the one hand but with a difference in perception of a promised related status. One example in this regard is clothing. According to the test of Nave et al. (2018), men with a measured high testosterone level, in the moment of decision making, decided significantly more frequently for products that supposedly promise a higher status to them compared to products that suggested a lower status (Bartens 2018). In a second test, luxury products, such as watches, pairs of sunglasses, or fountain pens, were linked with different attributes such as either long lifetime and superior quality or high status. Here as well, the probands decided against quality and efficiency and in favour of status. The scientists therefore concluded that the consumption behaviour is partially biologically motivated. Plassmann (2018) saw a similarity in this regard with behaviour by animals with a proven correlation between testosterone and status behaviour (Plassmann 2018). This is because a higher status gives advantages that allow a better access to resources, more influence, and more possibilities for partner choice.

Keeping this in mind, the researchers also know that the testosterone level of males increases, when the males compete or when attractive females are around. Nave et al. (2018) assume that in those situations, males are more receptive to status

symbols and related discussions. For us in purchasing and supply management, this can mean that we should not allow competing males to negotiate together or in order to safeguard the result to apply strict sourcing rules that are fact-based including, e.g. quality data and price history. As well it might impact the negotiation result, when an attractive female buyer or an attractive female seller is in the room, when the negotiation leaders decide for potentially status influencing goods. This could lead to less focus on quality or price and more focus on status. Beyond the individual level, Nave et al. have identified also a cultural difference in behaviour especially when markets develop very quickly, such as in China. The tendency towards luxury could be directly related to the testosterone of males, whereas the consumption behaviour could be explained by different social pressure, population density, and the supply of potential partners. In the field of purchasing and supply management, status in my opinion could also be expressed by the *method* of buying and not by the purchased good itself. Some buyers might want to negotiate in a very hard or explicitly discussed way to obtain status rewards from their peers when reporting about a negotiation result with a supposed success. From a sales perspective, the negotiation partners should not be aware of testosterone influences or vice versa. If competition in one way or the other is present on the same side of the table, the trade might neglect measurable attributes besides status.

Having discussed the influence of perceived status impact of the purchased goods, the age of negotiators might also play a role.

37 High-Patience Young Adults Go for Money, Not for Time and Money

A very specific, at the same time highly amount and effort sensitive, and time-consuming task in purchasing and supply management is the so-called claim negotiation. Origin of such negotiation is either a quality claim or a logistic claim from a buyer towards a supplier before which the supplier delivered a faulty or defect product that consequentially created a source of loss or cost at the buying company. Such negotiations are non-productive, but cathartic, and are in scope of purchasing. To get closer to a better understanding of the processes in such a negotiation, I came across the work of Amasino et al. (2019). Amasino and colleagues from Duke University in Durham, North Carolina, researched intertemporal choices in a complex experiment involving trade-offs between the value of a reward and the delay before those rewards were experienced. The subjects had to chose between options containing a monetary reward in absolute dollar amounts and a time component in days until payout of same for always two options one short-term option with low return and this on the same day, and a longer-term option with a higher reward and a longer waiting period of up to one year. The first result of the study was that the processing of amount of information and time information had un-correlated contributions to the choice process. This means that the probands did use both sources of information for their decision, but not in a correlated way.

A second result was the finding that high-patience individuals were showing more bias towards amount information. Rather than using a slow and analytic comparison process that took into account all available information, those high-patience individuals tended to follow a heuristic strategy basically directly comparing amounts and choosing the higher amount. Low-patience individuals examined both amount and time information and chose by combining both. In addition, the results in the test revealed a strong bias towards an attribute-wise comparison process, rather than an integration of attributes within a choice option. The authors are convinced that their findings can contribute to an improved understanding of the mechanisms of intertemporal choice, which could help to reduce negative real-world outcomes (Story et al. 2014; Lempert and Phelps 2015; Bickel et al. 2014; Bulley and Pepper 2017; Meier and Sprenger 2012; Bruderer Enzler et al. 2014; Chapman 1996; Tsukayama and Duckworth 2010; Hardisty and Weber 2009; Jimura et al. 2011).

In our field purchasing and supply management, the results suggest that high-patience individuals should negotiate claims that potentially take a lot of time until finalization and include high insecurity regarding amount information. These individuals tend to mainly include amount information in their decision process, and they decide by heuristics, i.e. by previous experiences. In other words, it is better to let experienced high-patience individuals negotiate complicated cases. The alternative would be to compromise on amount for time, i.e. an earlier return, which would be more accepted by low-patience individuals.

The target of this chapter is to give you input on how to effectively and efficiently improve your purchasing behaviour and results. Taking a bird's perspective for a moment I ask myself, on how we learn or in other words, how fast does science bring up new knowledge, and how fast are we able to incorporate those aspects into active learnings. The following paragraph will give you insights on this aspect.

38 The Contextual Cognitive Frame Grows in a Linear Way

The science of science is a comparably young branch of science (Fortunato et al. 2018). It tries to understand the structure and development of science as such in order to create tools and strategies to improve and speed up scientific knowledge creation (Anderl 2018). Scisci, the science of science, is data-based and benefits from digitalized scientific publications. One of the Scisci targets is to identify patterns in said publications. The father of Scisci is Derek de Solla Price, a physicist and science historian, who quantitatively analyzed scientific publications in the early 1960s (Anderl 2018). His basic finding was that scientific journals and publications grow exponentially. De Solla Price published a book called 'Little science, big science' (1963) outlining his thoughts and findings in this regard. Sola Price asked 'Why shouldn't we use the tools of science to analyze and understand science itself? Why not measuring, generalizing, defining hypotheses and concluding?' But, for this target, De Solla Price at the time had to go back to

laboriously collected data by other scientists such as, e.g. the mathematician Muir who between 1906 and 1930 created an extensive list of mathematical publications from the eighteenth and nineteenth century related to his research field (Maritz 2005). What De Solla Price did not have back then in the 1960s is text analysis capabilities leveraging a large scale of publications, as he could not use computer analysis. He could not conclude from one database to another by crosslinks nor could he retrieve metadata by simple counting or text recognition. By the way, a similar type of effort as at Muir but of course at a different magnitude and encountering the same problems as De Solla Price I found in a publication by one of my ancestors. Schupp (1964), later court chaplain in Fürstenberg, has collected all peoples' names living in the city of Pfullendorf in Germany and linked this information up with where they lived in the city, what they did for living, who they married, how many children they had, and where they came from before living in Pfullendorf. With the help of computers, this effort would have been comparably minor. At the time, it was a great effort. Following De Solla Price and other researchers from the middle of the last century, Milojevic (2015) analyzed several characteristic terms in the field of physics, astronomy, and biomedicine out of 20 million publications. Milojevic's analysis then with the help of computers has shown in addition to De Solla Price that different to the growth of the number of publications, the terminological or cognitive frame of the publications grew slower, actually in a linear way. Others, such as Vincenot (2018), have researched the content creation behind different terminologies but related to the same methodology in different fields of science and the penetration of same in the respective other fields of science. A similar question is currently very present, when the number of citations of research publications is measured, with the problem that the number of mentions does not at all refer to the content development itself. This aspect was already identified by De Solla Price with two phenomena pointing in opposite directions. Frequently cited publications get more importance and sleeping beauties are not being discovered despite their content relevance. Other studies point out that the combination of so far non-combined ideas and results, that invalidate expectations, create a special effect. Publications of a group of scientists are cited more frequently than articles of single researchers. This can also mean that innovation is being slowed down or inequality is enforced. Clauset et al. (2017) therefore recommended to add controlled experiments to data-based methods in order to identify causal mechanisms.

The present chapter on 'Elements of Purchasing in Nature' therefore targets to identify interesting findings that relate to or could relate to purchasing in practice. It is meant to link aspects and findings that potentially have not been linked before. Findings in different fields of science from a content and abstract contextual point of view can be highly relevant for the field of purchasing and supply management. Although the findings in other fields might not have been tested in purchasing and supply management, they might be very relevant and true. In order to verify or falsify those, I recommend following Clauset et al. (2017) and to perform controlled experiments in an action research approach. This way requires more pracademics or team work between academics and practitioners to bridge the gap between

methodology, pure thinking, and learning from each other. In this regard, another highly relevant paper by Flexner (1939) might give food for thought on 'the usefulness of' potentially 'useless knowledge'. In parallel to this, I want to recommend keeping in mind the findings of Milojevic and De Solla Price that the content of each research field, and here in specific the field of purchasing and supply management, does not primarily depend on the number of publications, but might be as well subject to a linear development of content and cognitive frame.

This content development and cognitive frame however might not be only the result of pure thinking, but as well might be influenced by the social context of the time of creation. To point out to this aspect, the following paragraph will discuss the influence of social context on the linguistic frame and consequential bias.

39 Matching of Social Context and Linguistic Frame

Price is derived from demand and supply!? This economic truth might be, amongst others, biased by frames as already having been discussed in the paragraph about framing. Language hereby influences the behaviour of people. Against this background, the findings of Acerbi et al. (2013) are very interesting for us in the field of purchasing and supply management. Acerbi et al. (2013) analyzed English literature of the twentieth century in order to identify if social feeling and political situation are reflected in the usage of words. The researchers found a trend that based on five million books that have been digitally analyzed out of the Google Ngram-data set, the identified quantity of the words happiness and anger has decreased, whereas emotions that are transported by words related to fear have increased. The researchers looked at six different mood categories being anger, aversion, fear, happiness, surprise, and sorrow. According to the findings of the researchers, the frequency of occurrence of emotionally positive or negative terms in books varied depending on the phase of social carelessness or of severe events. Thus, terms and expressions related to happiness occurred significantly more in the 20s and 60s than in other phases of the century. Tristesse or sorrow came up frequently in books written during the Second World War. In other words, the language of a certain period in time is biased by the corresponding social mood or economic situation.

If we now look at this phenomenon from an opposite direction, it could mean that if a buying company finds itself in an own economic crisis or the buying company might operate in a specific market under crisis while most of the other markets in an economic zone are doing fine, a supplier might not understand the language of the specific focal company in crisis. This might especially be the case when the supplier delivers into several different industries and markets. Only, when the language in the above example is being adapted to crisis at buyer and supplier, also the supplier might be willing to undergo crisis behaviour. In strategy literature, this aspect is explained by common or shared vision (Schupp 2004). Only, if both, buyer and supplier, share the same vision, they will act towards the same goal.

Under-researched in this regard is the twilight-zone between buyer and supplier when one of the two is still in a downturn and the other one is already experiencing a market picking up or vice versa as explained above.

As a conclusion, you should always double-check the matching of your own and your supplier's social context and the corresponding linguistic frame.

Related to this phenomenon, the following paragraph adds an individual perspective to the general social context that you might yourself find in.

40 The General Search for Happiness Can Increase Negative Feelings

Following the above, a general strive for happiness can create enforced negative feelings at the level of individuals (Herrmann 2015). Bastian et al. (2015) demonstrated in this regard that people who experience depressive periods or simply a bad day at the same time feel isolated and lonesome. The reason behind this lies in the feeling to violate social norms. This especially can be the case, when societies give a high value to individual well-being and happiness, while negative emotions adversely are seen as unwanted. The stronger the probands in the researchers' tests believed that their social environment disapproved their fear or sorrow, the more they felt lonesome or isolated. Western societies put an increasingly high value on well-being and good feelings. Constantly, individuals are asked to be or to think positive, to enjoy or to be optimistic. If you want it, you can achieve everything, the so-called can-do attitude. This permanent pressure to live a positive life can create bad mood at the level of the individual. Bastian et al. (2015, 2011) prove in their study that the stronger the felt expectation of having a positive basic preposition or attitude the worse the mood of the individual got. An additional study shows that this can create specific feelings of isolation. As a conclusion, good mood cannot be enacted and vice versa, the feeling of defeat cannot be controlled from the outside. Both feelings have to develop intrinsically or inside-out.

For the field of purchasing and supply management, this aspect has a certain relevance in situations where, e.g. a specific supplier has a bad feeling or feels lonesome with its situation. All of the environment is positive and expects positive mood from the specific supplier. But, in contrary to the expectation, this supplier acts against the good feeling supposedly obstructed with negative moves. Especially critical in this regard are suppliers that are mid-sized and lead by an individual that has more or less the sole power over the supplying company. If such individual feels suppressed by positive expectation, the reaction can be counterproductive for both parties. From the other point of view, a selling company might not be able to transport the positive growth attitude to a customer when the customer has a bad phase. In both scenarios, the best solution might be to leave customer or supplier alone for a period of time to bring own positions and personal feelings in harmony.

Harmony or balance is the keyword that brought me to the overarching question of the next two paragraphs on the power of music and the power of lavender. Both in my view have an influence on us and our field.

41 The Power of Music

Rentfrow and Gosling postulate that the music preference of a person is the key to his or her personality (Rentfrow and Gosling 2003; Gesundheit 2018). In this regard, heavy metal or rock music-loving people are possibly eager to learn and are risk-loving and physically active. People that like to listen to classical music, blues, or jazz are rather intellectual. Pop song and slow song preferences are characterizing sociable and friendly people (Rentfrow and Gosling 2003, Gesundheit 2018). Music is an accompanying element of humans, minimum for the last 35,000 years when flutes made out of bird bones and mammoth ivory were used to entertain. Even before music playing, singing developed coming from the Stone Age time parallel to language development. And, singing or more precisely the volume of the voice indicated health status and power and therefore is suitable to impress potential mating partners. If we see this development or evolvement and compare it with the research of Ihle et al. (2015) on the mating behaviour of zebra finches, we might see relevant parallels. Staying a little bit with Ihle, the two music researchers Altenmüller and Kopiez (2005) have shown that music is mediating mate choice in humans, but in a more complex way. The main influencing factors are experienced with the musical genre, in other words early exposure, touching moments related to music and emotional memories. This means that music has an influence on human partner choice but by ways of exclusion criteria such as described also by Sunnafrank (1992) in the context of attraction. But independent of individual preferences, music has an enormous power and impact (Altenmüller and Kopiez 2012). Music can reduce tensions and stress, can wake up memories, brighten the mood, and music can even reduce prejudice. Common music playing or singing beyond the above, fosters co-operation and supportiveness, creates group effects and trains our ability to anticipate. This aspect is particularly helpful when communication by language is lacking, e.g. with disabled people, or kids that have cancer or refugees that do not speak the language of the host country. In the business world, this aspect is more and more relating to data communication and social media communication without being social. Here, music might be a solution to create proximity (Tüpker 2005). Melodies even allow to enter into unconscious processing and to create experiences that words cannot achieve (Tüpker 2005).

This aspect is particularly interesting for us in the discussed field of purchasing and supply management. If we can set the tone, the melody, the rhythm of the play, we can enter into unconscious processing according to the set cultural rules of the markets that we operate in. Here, I can report a new buyer that I met recently. The buyer was trained in the food industry and is now operating in the automotive

industry. The suppliers and peers are thrilled by the clarity and directness of the buyer's negotiation style and claim sustainability or long-term orientation instead of short-sightedness or short ranging impacting decisions. Food can easily get rotten, automotive parts normally cannot. The cultural background or rhythm of the play in the two industries might be different. The tone though in both industries is tough. This element created common ground in the specific example, opening unconsciously the supplier's mind towards the request of the buyer.

Going even beyond the ability to create group effects, acoustic signals can work like a kind of social bonding. According to Koelsch (2010, 2012), the general musicality of humans most likely had a great importance for the development of language and has the social function to experience community and the co-ordination of co-operative actions. In purchasing and supply management, this means that if we want to create a good relationship with customer or supplier, you have to sense the music in the language of your business partner and best would be to listen or even play music together. If this allows to happen, the co-ordination of complex tasks will be more successful. Modern brain imaging technologies show that when listening to music, human adults do not only show reactions to the music in an isolated brain area, but several areas of our brains are reacting. Amongst others, also the nucleus accumbens comes to play, which is the reward centre of our brain that for example is also activated when we eat chocolate (Blood and Zatorre 2001). Convenient sounds influence the activity of the amygdala in the prefrontal cortex and suppress fear and nervousness.

Before you enter into difficult negotiations, therefore I suggest that you listen to agreeable music. This will suppress your fear and the result of your negotiation most likely will be better.

Besides the neural structures, the neurotransmitters are also being activated when we listen to music. In this context dopamine, serotonin and endorphins are emitted and create a feeling of happiness and easiness. If you go to the extreme and sing together with your customer or supplier, on top of the previously said, your oxytocin level will rise creating bonds and trust

I once attended a supplier day in South Korea, and the beginning was impressive in the above regard. Almost all participants together sang the national anthem of South Korea. There is no better way to glue people together and then subsequently ask for savings. The other way around could work as well. If a buyer or a seller is depressed after a negotiation, the display of music can help to treat the depression and to turn the mood of the business partner into a good one.

So, please make sure that in your reception and farewell area, chill-out music is played.

Going further, melodies activate the neuroplasticity. In the long run, synapses, nerve cells, and even complete brain areas can be changed by listening to good music (Altenmüller and Kopiez 2005).

The corresponding effect is that the musical memory has a close link to the biographical memory. All parents know this when their kids memorize text by singing them. In the business-to-business environment, therefore it could be beneficial to let the business partner listen to your wanted message in form of a song. If you can manage, that your business partner sings your song, she will not forget your message. By this, you might be able to overcome Zeigarnik (1927). At the same time, the findings of Wehling (2016) remain to be true.

42 The Balancing Effect of Lavender

What is the picture that you have in mind when you dream about Southern France in summertime? Most of us have long fields of aligned lavender plants in front of their inner eye. Peace and calm come into our body. Blue-violet colour and a reminder of Southern flair are helping our muscles to relax (Sip 2014). Breckwoldt and von Luckner (2012) have published a whole book on lavender and its effects. In the Middle Ages, lavender was already used as herb, kitchen spice, bathing additive, fragrance, or as an element in aromatherapy. In antiquity, even the clothes were washed with lavender in order to get a good and calming smell while wearing the clothes. In the Middle Ages, lavender grew in the herb gardens of most of the farms in Europe to be used as protection against vermin and as nerve agent to improve the healing of wounds, to alleviate pain and to ease tension. The latter is targeted also in today's use of lavender as the odour of the plant has a balancing effect and reduces stress. The reason for this is the etheric oil that constantly is set free.

In purchasing, buyers very often have to negotiate. A negotiation is a situation that is subject to stress and while buyers normally are stress-resistant, important negotiations might put pressure on the individual. In such a situation, like to chose for the right breakfast, a cup of lavender tea the evening before the negotiation might be the right thing to drink in order to have a relaxed and good preparatory sleep. In the morning by the way, a cup of lavender tea has the opposite effect, which is alike peppermint a stimulating and inspiring effect. If you drink a cup of lavender tea in the morning, you therefore will be more receptive for new things.

If the negotiation contrary to your expectations does not run well, even after the negotiation the embrocation of lavender oil, e.g. on the forehead, can reduce headache and inflammation. A fast recreation from hard negotiations is of course good, because after the negotiation is before the negotiation.

The last topic in this chapter that I would like to think about is who we think that we negotiate with. It is of course important to know which character is in front of us with which history, experience, and frame. I think to understand this topic better, it might be best to talk to Picasso, who is one of the most famous and successful painters of modern times.

43 Picasso's Ability to Paint the Psychopathology of Humans

Most of the people know Pablo Picasso and some of his works. Of course, each individual sees different things in pieces of art including the art and here especially the paintings of Pablo Picasso. Being a medical doctor, Fox (2004) has focused on a specific aspect in this regard and outlined in a precise way, how Picasso captured his vis-à-vis. Pablo Picasso recognized and captured the people he painted in an intuitive and impartial way. As in the discussion many critics describe Picasso as a man with a destructive view on people, the critics overlook that Picasso captured his vis-à-vis in their personality or like a medical doctor would say in their psychopathology. Picasso recognized and captured the personalities in a diagnostic way and this by the way most of the times out of his memory. He once said, 'I do not search for something, I find it'. He finds in the portraits of his objects in a visionary way their mental state and psychological sensitivities. He finds the dreadful face of war without having had to experience war itself, he finds joie de vivre, flowering beauty, blank sexuality, surrealistic sublimated erotic attraction, and he finds irony and comic. In his own personality, he finds self-confident, hopeful expectations and helpless, desperate emptiness. In this sense, Picasso did not paint destructiveness; he incorporated the form, shape, and figure of the world. As an example, he painted Gertrude Stein in 1906 (Souhami 1998) as a reflected woman in her Middle Ages. But, at the time when he painted her, she was a vivid, young woman. When asked about that he did not paint her in a precise way, he answered 'This does not matter. She will look like this on day'. Photo portraits 30 years later showed that he was right. There are numerous examples in his relationships with partners where he anticipated state or portraited emotions that were not visible to others at that moment. One painting that most of us know is the portrait of his first wife Olga in 1935. Picasso was not primarily interested in the psychopathology of his vis-à-vis; he was interested in the human condition, in the current state always including a certain self-reference. Even when painting war 'Krieg' (1951) with the help of Dora Maar, his paramour at the time, he gave the war a face, an identity that could be indicted (Kahnweiler 1968). In his self-portraits of 1972, he even painted his own vanity coming out of his artistic genesis. Picasso does not search for something; he finds it, he finds people and tells about them, but always also includes himself and the effect on himself (Giraudy 1986). In this regard, he is an engaged, non-illusionary, beloved, and brutal impersonator of the human condition (Ludwig 1950).

In our context, Pablo Picasso would be a very good purchaser, as one decisive key to success in purchasing is the ability to read people.

44 Conclusion

This chapter has tried to touch some aspects that potentially influence purchasing in a natural way. Of course, the core task in purchasing remains to create and to enhance competition in order to achieve optimal results taking into account the rules of economics. In my personal experience, numerous elements of nature have an enormous presence in daily purchasing life and impact the results. Our decision making is strongly influenced by our human behaviour or in other words by our natural behaviour.

References

Aarts, H., & Dijksterhuis, A. (2002). Category activation effects in judgement and behavior: The moderating role of perceived comparability. *British Journal of Social Psychology, 41,* 123–138.

Acerbi, A., Lampos, V., Garnett, P., & Bentley, R. A. (2013). The Expression of emotions in 20th century books. *PLoS ONE, 8*(3), e59030.

Aloe, L. (2004). Rita levi-montalcini: The discovery of nerve growth factor and modern neurobiology. *Trends in Cell Biology, 14*(7), 359–399.

Addessi, E., Bellagamba, F., Delfino, A., De Petrillo, F., Focaroli, V., Macchitella, L., et al. (2014). Waiting by mistake: symbolic representation of rewards modulates intertemporal choice in capuchin monkeys, preschool children and adult humans. *Cognition, 130*(3), 428–441.

Addessi, E., Beran, M., Bourgeois-Gironde, S., Brosnan, S., & Leca, J.-B. (2020). Are the roots of human economic systems shared with non-human primates? *Neuroscience and Biobehavioral Reviews, 109,* 1–15.

Addessi, E., Crescimbene, L., & Visalberghi, E. (2007). Do capuchin monkeys (Cebus apella) use tokens as symbols. *Proceedings of the Royal Society B, 274,* 2579–2585.

Addessi, E., Mancini, A., Crescimbene, L., Padoa-Schioppa, C., & Visalberghi, E. (2008). Preference transitivity and symbolic representation in capuchin monkeys (Cebus apella). *PLos ONE, 3*(6), e2414.

Addessi, E., Paglieri, F., & Focaroli, V. (2011). The ecological rationality of delay tolerance: Insights from capuchin monkeys. *Cognition, 199,* 142–147.

Addessi, E., & Rossi, S. (2010). Tokens improve capuchin performance in the reverse-reward contingency task. *Proceedings of the Royal Society B: Biological Sciences, 278,* 849–854.

Ahne, P. (2017). Wölfe. In J. Schalansky (Ed.), Naturkunden; Naturkunden No. 27 (2nd ed.). Berlin: Matthes & Seitz.

Altenmüller, E., & Kopiez, R. (2012). Ein Beitrag zum evolutionären Ursprung der Musik: Was kann uns die Gänsehaut lehren. In Braunschweigische Wissenschaftliche Gesellschaft (Ed.), *Jahrbuch 2011* (pp. 133–152). Braunschweig: J. Cramer Verlag.

Altenmüller, E., & Kopiez, R. (2005). *Zur Neurobiologie der durch Musik ausgelösten Emotionen*. In Musik: gehört, gesehen und erlebt, IfMpF-Mobographie (Nr. 12, pp. 160–179).

Amasino, D. R., Sullivan, N. J., Kranton, R. E., & Huettel, S. A. (2019). Amount and time exert independent influences on intertemporal choice. *Nature Human Behaviour.*

Anderl, S. (2018, April 1). Die Vermessung der Wissenschaften. Frankfurter Allgemeine Zeitung, Frankfurt am Main.

Aubert, V. (1965). *The hidden society*. New York: Bedminster Press.

Auersperg, A. M. I., Laumer, I. B., & Bugnyar, T. (2013). Goffin cockatoos wait for qualitative and quantitative gains but prefer 'better' to 'more'. *Biology Letters, 9*(3), 2013.

Auersperg, A. M. I., van Horik, J. O., Bugnyar, T., Kacelnik, A., Emery, N. J., & von Bayern, A. M. P. (2015). Combinatory actions during object play in Psittaciformes (Diopsittaca nobilis, Pioites melanocephala, Cacatua goffini) and corvids (Corvus corax, Corvus monedula, Corvus moneduloides. *Journal of Comparative Psychology, 129*(1), 62–71.

Baek, S. K., Minnhagen, P., & Kim, B. J. (2011a). The ten thousand Kims. *New Journal of Physics*, *13*, 073036. https://doi.org/10.1088/1367-2630/13/7/073036, preprint at arXiv:1109.6221.

Baek, S. K., Bernhardsson, S., & Minnhagen, P. (2011b). Zipf's law unzipped. *New Journal of Physics*, *04*.

Bagusche, F. (2019). *Das blaue wunder*. München: Ludwig Buchverlag.

Barber, S. J., Harris, C., & Rajaram, S. (2014). Why two heads apart are better than two heads together: Multiple mechanisms underlie the collaborative inhibition effect in memory. *Journal if Experimental Psychology Learning Memory and Cognition, 41*(2), 2014.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71,* 230–244.

Barnett, S. A. (1958). Experiments on 'Neophobia' in Wild and Laboratory Rats. *British Journal of Psychology, 49,* 195–201.

Barros-Loscertales, A., Gonzalez, J., Pulvermüller, F., Ventura-Campos, N., Bustamante, J. C., Costumero, V., et al. (2012). Reading salt activates gustatory brain regions: fMRI evidence for semantic grounding in a novel sensory modality. *Cerebral Cortex, 22*(11), 2554–2563.

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology, 59,* 617–645.

Barsalou, L. W. (2009). Simulation, situated conceptualization, and prediction. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1521), 1281–1289.

Bartens, W. (2018, July 4). Lust auf Luxus – Testosteron befeuert Nachfrage nach Statussymbolen. Süddeutsche Zeitung, Medizin, München.

Bastian, B., Koval, P., Erbas, Y., Houben, M., Pe, M., Kuppens, P. (2015). Sad and alone: Social expectancies for experiencing negative emotions are linked to feelings of loneliness. *Social Psychological and Personality Science*, *51*.

Bastian, B., Kuppens, P., Hornsey, M. J., & Park, J. (2011). Feeling bad about being sad: The role of social expectancies in amplifying negative mood. *Emotion, 12*(1), 69–80.

Bednekoff, P. A. (2007). Allocation of foraging efforts when danger varies over time. In D. W. Stephens, & J. S. Brown, & R. C. Ydenberg (Eds.) Foraging (pp. 305–329). The University of Chicago Press.

Bellos, A. (2010, October 4). Alex's adventures in numberland; Bloomsbury paperbacks. London 2010; referred to in: Warum wir so oft automatisch die Zahl 7 wählen. Welt, Axel Springer, Berlin.

Beran, M. J., & Evans, T. A. (2006). Maintenance of delay of gratification by four chimpanzees (Pan troglodytes): The effects of delayed reward visibility, experimenter presence, and extended delay intervals. *Behavioral Processes, 73,* 315–324.

Bickel, W. K., Koffernus, M. N., Moody, L., & Wilson, A. G. (2014). The behavioral and neuro-economic process of temporal discounting: A candidate behavioral marker of addiction. *Neuropharmacology, 76,* 518–527.

Blawat, K. (2013, June 4). Die Chemie der Monogamie; in: Süddeutsche Zeitung, München.

Blawat, K. (2016, August 29). Mut zur Kultur; in: Süddeutsche Zeitung, 199, München.

Blood, A. J., & Zatorre, R. (2001). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proceedings of the National Academy of Sciences, 98*(20), 11818–11823.

Bodderas, E. (2015, October 12). Warum Zwangsehen bei Zebrafinken schlecht enden. Welt, Axel Springer, Berlin.

Boesch, C., & Tomasello, M. (1998). Chimpanzees and human cultures. *Current Anthropology, 39* (5), 591–614.

Boogert, N. J., Reader, S. M., & Laland, K. N. (2006). The relation between social rank, neophobia and individual learning in starlings. *Animal Behavior, 72*(6), 1229–1239.

Bosch, O. J., Nair, H. P., Ahern, T. H., Neumann, I. D., & Young, L. J. (2009). The CRF system mediates increased passive stress-coping behavior following the loss of a bonded partner in a monogamous rodent. *Neuropsychopharmacology, 34*(6), 1406–1415.

Bosch, O. J., & Young, L. J. (2017). Oxytocin and social relationships: From attachment to bond disruption. *Current Topics in Behavioral Neurosciences*.

Brafman, O., & Brafman, R. (2010). *Click—The forces behind how we fully engage with people, work, and everything we do Crown publishing group*. New York: Random House, Inc.

Brafman, O., & Brafman, R. (2013). Auf Anhieb sympathisch. *Psychologie heute compact, 34,* 32–39.

Braun, M. (2011, May 24). Amazonas-Volk lebt ohne Uhr und Kalender. Welt, Axel Springer, Berlin.

Breckwoldt, M., von Luckner, F. (2012). Lavendel: Duft und Sinnlichkeit im Garten; BLV.

Brosnan, S. F., de Waal, F. B. M. (2004). A concept of value during experimental exchange in brown capuchin monkeys. *Cebus apella Folia Primatologica*, *75* (5), pp 317–330.

Bruderer Enzler, H., Diekmann, A., & Meyer, R. (2014). Subjective discount rates in the general population and their predictive power for energy saving behavior. *Energy Policy, 65,* 524–540.

Brugger, P. (2001). From haunted brain to haunted science: A cognitive neuroscience view of paranormal and pseudoscientific thought. In J. Houran, & R. Lange (Eds.), *Hauntings and poltergeist: Multidisciplinary perspectives* (pp. 195–213).McFarland.

Buck, J., & Buck, E. (1968). Mechanism of rhythmic synchronous flashing of fireflies. *Science*, *159*, 1319–1327.

Buck, J., & Buck, E. (1978). Toward a functional interpretation of synchronous flashing by fireflies. *The American Naturalist*, *112*(985), 471–492.

Bulley, A., & Pepper, G. V. (2017). Cross-country relationships between life expectancy, intertemporal choice and age at first birth. *Evolution and Human Behavior, 38,* 652–658.

CAPS. (2019). Ways to find new suppliers; CAPS Research; Tempe, AZ; CAPS Stats September 2019.

Catchpole, C. K., & Slater, P. J. B. (2008). *Bird song: Biological themes and variations* (2nd ed.). Cambridge: Cambridge University Press.

Chapman, G. B. (1996). Temporal discounting and utility for health and money. *Journal Experimental Psychology Learning Memory Cognition, 22,* 771–791.

Chiarati, E., Canestrari, D., Vera, R., & Baglione, V. (2012). Subordinates benefit from exploratory dominants: Response to novel food in cooperatively breeding carrion crows. *Animal Behavior, 83*(1), 103–109.

Clauset, A., Larremore, D. B., & Sinatra, R. (2017). Data-driven prediction in the science of science. *Science, 355*(6324), 477–480.

Danel, S., Osiurak, F., & von Bayern, A. M. P. (2017). From the age of 5 humans decide economically, whereas crows exhibit individual preferences. *Scientific Reports, 7*(1), 2017.

Dambeck, H. (2016, March 26). So fühlt sich eine 100 an. Spiegel Online, Hamburg.

Davis, S. J., Vale, G. L., Schapiro, S. J., Lambeth, S. P., & Whiten, A. (2016). Foundations of cumulative culture in apes: Improved foraging efficiency through relinquishing and combining witnessed behaviors in chimpanzees (Pan troglodytes). *Scientific Reports, 6*(35953), 2016.

Davies, M., & Pelé, A. -F. (2019). *Neuromorphic Revolution to start in 2024*. Europe: EETimes.

Davies, M., Srinivasa, N., Lin, T.-H., Chinya, G., Cao, Y., Choday, S. H., et al. (2018). Loihi: A neuromorphic manycore processor with on-chip learning. *IEEE Micro, 38*(1), 82–99.

Dean, L. G., Kendal, R. L., Schapiro, S. J., Thierry, B., & Laland, K. N. (2012). Identification of the social and cognitive process underlying human cumulative culture. *Science, 335*(6072), 1114–1118.

DePasquale, C., Neuberger, T., Hirrlinger, A. M., & Braithwaite, V. A. (2016). The influence of complex and threatening environments in early life on brain size and behavior. *Proceedings of the Royal Society B: Biological Sciences, 283*(1823), 2016.

Derryberry, E. P. (2007). Evolution of bird song affects signal efficacy: An experimental test using historical and current signals. *Evolution, 61*(8), 1938–1945.

Desai, R., Binder, J., Contant, L., & Seidenberg, M. (2010). Activation of sensory-motor areas in sentence comprehension. *Cerebral Cortex, 20*(2), 468–478.

De Solla Price, D. J. (1963). *Little science, big science*. New York: Columbia University Press.

Ditz, H. M., & Nieder, A. (2016). Numerosity representations in crows obey the Weber-Fechner law. *Proceedings of the Royal Society B, 283*.

Drapier, M., Chauvin, C., Dufour, V., Uhlrich, P., & Thierry, B. (2005). Food-exchange with humans in brown capuchin monkeys. *Primates, 46*(4), 241–248.

Dufour, V., Pelé, M., Sterck, E. H. M., & Thierry, B. (2007). Chimpanzee (Pan troglodytes) anticipation of food return: Coping with waiting time in an exchange task. *Journal of Comparative Psychology, 121*(2), 145–155.

Dufour, V., Wascher, C. A. F., Braun, A., Miller, R., & Bugnyar, T. (2011). Corvids can decide if a future exchange is worth waiting for. *Biology Letters, 8*(2), 201–204.

Einstein, A., & Infeld, L. (1938). *The evolution of physics*. New York: Simon and Schuster.

Emanuele, E., Politi, P., Bianchi, M., Minoretti, P., Bertona, M., & Geroldi, D. (2006). Raised plasma nerve growth factor levels associated with early-stage romantic love. *Psychoneuroendocrinology, 31*(3), 288–294.

Evans, T. A., & Westergaard, G. C. (2006). Self-control and tool use in tufted capuchin monkeys (Cebus apella. *Journal of Comparative Psychology, 120*(2), 163–166.

Fadiga, L., Craighero, L., Buccino, G., & Rizzolatti, G. (2002). Speech listening specifically modulated the excitability of tongue muscles: A TMS study. *European Journal of Neuroscience, 15,* 399–402.

Feierabend, S., Plankenhorn, T., & Rathgeb, T. (2017). JIM-Studie 2017: Jugend, Information, (Multi-)Media; Medienpädagogischer Forschungsverbund Südwest (mpfs); Stuttgart.

Ferreira, C. M., Nagelkerken, I., Goldenberg, S. U., & Connell, S. D. (2018). CO_2 emissions boost the benefits of crop production by farming damselfish. *Nature Ecology & Evolution, 2*(8), 1223–1226.

Filosa, A., Barker, A. J., Dal Maschio, M., & Baier, H. (2016). Feeding state modulates behavioral choice and processing of prey stimuli in zebrafish tectum. *Neuron, 90*(3), 596–608.

Flexner, A. (1939). The usefulness of useless knowledge. *Harper's Magazine, 179,* 544–552.

Flynn, F. J., & Adams, G. (2009). Money can't buy love: Asymmetric beliefs about gift price and feelings of appreciation. *Journal of Experimental Social Psychology, 45*(2), 404–409.

Fortunato, S., Bergstrom, C. T., Börner, K., Evans, J. A., Helbing, D., Milojevic, S., et al. (2018). Science of science. *Science, 359*(6379), 2018.

Fox, J. M. (2004). Pablo Picasso, eine Wissenschaft vom Menschen. *Deutsches Ärzteblatt, 101* (36), 2004.

Fox, R. A., & Millam, J. R. (2004). The effect of early environment on neophobia in orange-winged Amazon parrots (Amazona amazonica. *Applied Animal Behavior Science, 89* (1–2), 117–129.

Gage, F. H., Coates, P. W., Palmer, T. D., Kuhn, H. G., Fisher, L. J., Suhonen, J. O., et al. (1995). Survival and differentiation of adult neuronal progenitor cells transplanted to the adult brain. *Proceedings of the National Academy of Sciences of the United States of America, 92*(25), 11879–11883.

Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., et al. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology, 92,* 325–336.

Ganteför, G. (2018). Das Gesetz der Herde. Edition Zeitblende, AT Verlag; Aarau and Munich.

Genty, E., & Roeder, J.-J. (2006). Self-control: Why should sea lions, Zalophus californianus, perform better than primates? *Animal Behavior, 72*(6), 1241–1247.

Gesundheit. (2018). Die Kraft der Klänge. Gesundheit aktuell, 03/2018; pp. 6–9; UKV; Saarbrücken.

Gilbert, D. T., & Ebert, J. E. J. (2002). Decisions and revisions: the affective forecasting of changeable outcomes. *Journal of Personality and Social Psychology, 82,* 503–514.
Gino, F., & Flynn, J. F. (2011). Give them what they want: The benefits of explicitness in gift exchange. *Journal of Experimental Social Psychology, 47*(5), 915–922.
Giraldeau, L. A., Valone, T. J., & Templeton, J. J. (2002). Potential disadvantages of using socially acquired information. *Philosophical Transactions of the Royal Society B: Biological Sciences, 357*(1427), 1559–1566.
Giraudy, D. (1986). *Pablo Picasso—Die Bilanz eines schöpferischen Lebens*. Stuttgart: Zürich.
Goodall, J. (1986). *The chimpanzees of Gombe: Patterns of behavior*. Cambridge (Massachusetts): Harvard University Press.
Greenberg, R., & Mettke-Hofmann, C. (2001). Ecological aspects of neophobia and neophilia in birds. *Current Ornithology, 16,* 119–178.
Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., et al. (2019). Mapping the world's free-flowing rivers. *Nature, 569,* 215–221.
Grimaud, H. (2013). Retour à Salem. Albin Michel.
Grippo, A. J., Gerena, D., Huang, J., Kumar, N., Shah, M., Ughreja, R., et al. (2007). Social isolation induces behavioral and neuroendocrine disturbances relevant to depression in female and male prairie voles. *Psychoneuroendocrinology, 32*(8–10), 966–980.
Grippo, A. J., Carter, C. S., McNeal, N., Chandler, D. L., Larocca, M. A., Bates, S. L., et al. (2011). 24 hour autonomic dysfunction and depressive behaviors in animal model of social isolation: implications for the study of depression and cardiovascular disease. *Psychosomatic Medicine, 73*(1), 59–66.
Guillette, L. M., Reddon, A. R., Hurd, P. L., & Sturdy, C. B. (2009). Exploration of a novel space is associated with individual differences in learning speed in black-capped chickadees, Poecile atricapillus. *Behavioural Processes, 82*(3), 265–270.
Guillette, L. M., Hahn, A. H., Hoeschele, M., Przyslupski, A. M., & Sturdy, C. B. (2014). Individual differences in learning speed, performance accuracy and exploratory behavior in black-capped chickadees. *Animal Cognition, 18*(1), 165–178.
Hackenberg, T. (2009). Token reinforcement: A review and analysis. *Journal of the Experimental Analysis of Behavior, 91*(2), 257–286.
Haidle, M. N., Bolus, M., Collard, M., Conard, N., Garafoli, D., Lombard, M., et al. (2015). The nature of culture: an eight-grade model for the evolution and expansion of cultural capacities in hominins and other animals. *Journal of Anthropological Sciences, 93,* 43–70.
Hardisty, D. J., & Weber, E. U. (2009). Discounting future green: money versus the environment. *Journal of Experimental Psychology, 138,* 329–340.
Harford, T. (2016): Messy, the power of disorder to transform our lives; Riverhead Books; 2016.
Harmand, S., Lewis, J. E., Feibel, C. S., Lepre, C. J., Prat, S., Lenoble, A., et al. (2015). 3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya. *Nature*, *521*, 310–315.
Hartbauer, M., Haitzinger, L., Kainz, M., & Römer, H. (2014). Competition and cooperation in a synchronous bushcricket chorus. *Royal Society Open Science*, *1*(2), 1–17.
Hartbauer, M., & Römer, H. (2016). Rhythm generation and rhythm perception in insects: The evolution of synchronous choruses. *Frontiers in Neuroscience, 10*(286), 2016.
Hauk, D. O., & Pulvermüller, F. (2004). (2004): Neurophysiological distinction of action words in the fronto-central cortex. *Human Brain Mapping, 21,* 191–201.
Hawks, J. (2019). Still evolving—For 30,000 years our species has been changing remarkably quickly. *And we're not there yet*, Scientific American, Special edition, 104–109.
Heisenberg, W. (1927). Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. *Zeitschrift für Physik*, *43*(3–4), 172–198.
Heinrich, J. (2015). The secret of our success: How culture is driving human evolution, domesticating our species, and making us smarter. Princeton, NJ: Princeton University Press.
Herrmann, S. (2013, June 28). Warum sich Menschen ihren Beziehungsstatus schönreden. Süddeutsche Zeitung, München.

Herrmann, S. (2015, February 9). Melancholie unerwünscht. Süddeutsche Zeitung, München.
Herrmann, S. (2018, July 3). Hitparade der Hybris; Forscher messen das Selbstwertgefühl einzelner Nationen. Süddeutsche Zeitung, München.
Hillemann, F., Bugnyar, T., Kotrschal, K., & Wascher, C. A. F. (2014). Waiting for better, not for more: Corvids respond to quality in two delay maintenance tasks. *Animal Behavior, 90,* 1–10.
Ihle, M., Kempenaers, B., & Forstmeier, W. (2015). Fitness benefits of mate choice for compatibility in a socially monogamous species. *PLoS Biology, 13*(9), 1–21.
IPSERA. (2018). *Proceedings of the International Purchasing and Supply Education and Research Association 2018 conference*, Athens, March 25–28, 2018.
IPSERA. (2019). Book of abstracts. In *International Purchasing and Supply Education and Research Association 2019 conference*, Politecnico Milano, April 14–17, 2019.
Isaacson, W. (2011). Steve jobs: The exclusive biography. New York: Simon & Schuster.
Izard, V., & Dehaene, S. (2008). Calibrating the mental number line. *Cognition, 106*(3), 1221–1247.
James, K. H., & Engelhardt, L. (2012). The effects of handwriting experience on functional brain development in preliterate children. *Trends in Neuroscience and Education, 1*(1), 32–42.
Jimura, K., Myerson, J., Hilgard, J., Keighley, J., Braver, T. S., & Green, L. (2011). Domain independence and stability in young and older adults' discounting of delayed rewards. *Behavioral Processes, 87,* 253–259.
Judge, P. G., & Essler, J. L. (2013). Capuchin monkeys exercise self-control by choosing token exchange over an immediate reward. *International Journal of Comparative Psychology, 26,* 256–266.
Kabadayi, C., Taylor, L. A., von Bayern, A. M. P., Osvath, M., & Ravens, M. (2016). Ravens, new caledonian crows and jackdaws parallel great apes in motor self-regulation despite smaller brains. *Royal Society Open Science, 111*(4), 2140–2148.
Kahneman, D. (2011). *Thinking, fast and slow*. London, England: Penguin Books.
Kahnweiler, D. -H. (1968). Guernica 1956 (pp.118). Köln: Ästhetische Betrachtungen.
Kalenscher, T., & van Wingerden, M. (2011). Why we should use animals to study economic decision making—A perspective. *Frontiers in Neuroscience, 5*(82), 1–11.
Kant, I. (1787). Critik der reinen Vernunft; Johann Freidrich Hartknoch; Riga 1787. Stuttgart: Reclam.
Kaube, J. (2014, September 14). Intime Verhältnisse: Wie lernt man, was im Verborgenen stattfindet; Frankfurter Allgemeine Zeitung, Frankfurt am Main.
Kempermann, G., Gast, D., & Gage, F. H. (2002). Neuroplasticity in old age: sustained fivefold induction of hippocampal neurogenesis by long-term environmental enrichment. *Annals of Neurology, 52*(2), 135–143.
Kiet, H. A. T., Baek, S. K., Jeong, H., & Kim, B. J. (2008). Korean family name distribution in the past. *Journal of Korean Physical Society*, *51.*
Killingsworth, M. A., Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, *330*, 932.
Koelsch, S. (2010). Towards a neural basis of music-evoked emotions. *Trends in Cognitive Sciences, 14*(3), 131–137.
Koelsch, S. (2012). *Brain and music*. UK: Wiley-Blackwell; John Wiley & Sons; Chichester.
Koepke, A. E., Gray, S. L., & Pepperberg, I. M. (2015). Delayed gratification: A grey parrot (Psittacus erithacus) will wait for a better reward. *Journal of Comparative Psychology, 129*(4), 339–346.
Kranz, G. (2016). Aktuelle Erkenntnisse zur Neuroplastizität; Der Merkurstab. *Journal of Anthroposophic Medicine*, *69*(5).
Krasheninnikova, A., Höner, F., O'Neill, L., Penna, E., & von Bayern, A. M. P. (2018). Economic decision-making in parrots. *Scientific Reports, 8*(12537), 1–10.
Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy, 99,* 483–499.

Kubovy, M., & Psotka, J. (1976). The predominance of seven and the apparent spontaneity of numerical choices. *Journal of Experimental Psychology: Human Perception and Performance, 2*(2), 291–294.

Kuchler, B., Beher, S. (2014). *Soziologie der Liebe. Romantische Beziehungen in theoretischer Perspektive*; Berlin: Suhrkamp Verlag.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. New York: Basic Books.

Laland, K. N. (2004). Social learning strategies. *Animal Learning & Behavior, 32*(1), 4–14.

Laland, K. N., & Janik, V. M. (2006). The animal cultures debate. *Trends in Ecology & Evolution, 21*(10), 542–547.

Larsch, J., & Baier, H. (2018). Biological motion as an innate perceptual mechanism driving social affiliation. *Current Biology, 28,* 3523–3532.

Laurin, K., Kille, D. R., & Eibach, R. P. (2013). The way I am is the way you ought to be: Perceiving one's relational status as unchangeable motivates normative idealization of that status. *Psychological Science, 24*(8), 1523–1532.

Leadbeater, E., & Chittka, L. (2007). Social learning in insects—from miniature brains to consensus building. *Current Biology, 17*(16), 703–713.

Lee, R. J., & Cohen, N. A. (2016). How bitter taste receptors defend the body against bacteria. *Scientific American, 314*(2), 38–43.

Lembke, G. (2016). *Im digitalen Hamsterrad*. Heidelberg: medhochzwei Verlag.

Lembke, G. (2019). *Verzockte Zukunft, wie wir das Potenzial der jungen Generation verspielen*. Weinheim Basel: Beltz.

Lempert, K. M., & Phelps, E. A. (2015). The malleability of intertemporal choice. *Trends of Cognitive Science, 20,* 64–74.

Leonardi, R. J., Vick, S.-J., & Dufour, V. (2012). Waiting for more: The performance of domestic dogs (Canis familiaris) on exchange tasks. *Animal Cognition, 15*(1), 107–120.

Lepousez, G., Nissant, A., & Lledo, P. M. (2015). Adult neurogenesis and the future of the rejuvenating brain circuits. *Neuron, 86*(2), 387–401.

Levi-Montalcini, R., & Angeletti, R. (1968). Nerve growth factor. *Physiological Review, 48*(3), 534–568.

Lewin, K. (1931). Der Übergang von der aristotelischen zur galileischen Denkweise in Biologie und Psychologie. Zeitschrift Erkenntnis, Band 1; S. 421–466; Berlin 1931; digitalized version by Hoffmann, T. (2001): Lewin, K. (1981); Werkausgabe Band 1: Wissenschaftstheorie I; Graumann, C.-F. (Hrsg.); Huber/Klett-Cotta; S. 233-278; Bern/Stuttgart 1981.

Liévin-Bazin, A., Pineaux, M., Clerc, O., Gahr, M., von Bayern, A. M. P., & Bovet, D. (2018). Emotional responses to conspecific distress calls are modulated by affiliation in cockatiels (Nymphicus hollandicus). *PLoS ONE, 13*(10), 2018.

Longcamp, M., Velay, J. -L., Wise Berninger, V., & Richards, T. (2016). Neuroanatomy of handwriting and related reading and writing skills in adults and children with and without learning disabilities: French-American connections. *Pratiques: Linguistique, littérature, didactique*, 171–172, 1–11.

Longcamp, M., Zerbato-Poudou, M.-T., & Velay, J.-L. (2005). The influence of writing practice on letter recognition in preschool children: a comparison between handwriting and typing. *Acta Psychologica, 119*(1), 67–79.

Ludwig, P. (1950). Das Menschenbild Picassos als Ausdruck eines generationsmäßig bedingten Lebensgefühls. Mainz: Inauguraldissertation.

Lück, H. E. (1996). *Die Feldtheorie und Kurt Lewin*. Weinheim: Eine Einführung; Psychologie Verlags Union.

Luther, D. M. (1545). Evangelische Deutsche Original-Bibel. Evangelische Deutsche Original-Bibel; Fromman, Züllichau 1740, 1741.

Ly, M., Haynes, M. R., Barter, J. W., Weinberger, D. R., & Zink, C. F. (2011). Subjective socioeconomic status predicts human ventral striatal responses to social status information. *Current Biology, 21,* 794–797.

Markham, J. (2019). On neuromorphic processors. In A. Pressmann (Ed.), Intel gains first big corporate partners for brain computing push, Tech–Intel, 18.11.2019. fortune.com.
Marshall-Pescini, S., & Whiten, S. (2008). Social learning of nut-cracking behavior in East African Sanctuary-Living Chimpanzees (Pan troglodytes schweinfurthii. *Journal of Comparative Psychology, 122*(2), 186–194.
Martin, S. (2016). Total recall: Business Life; British Airways; 12/2016 and 01/2017, p. 52. Cedar Communications Limited.
Martin, S., Goldstein, N., & Cialdini, R. B. (2014). The small big: Small changes that spark big influence. London: Profile Books.
Martin-Jung, H. (2018, April 17). Die haben Nerven. Süddeutsche Zeitung; Gehirnforschung, München.
Masicampo, E. J., & Baumeister, R. F. (2008). Toward a physiology of dual-process reasoning and judgement: Lemonade, willpower, and expensive rule-based analysis. *Psychological Science, 19,* 255–260.
Matlock, T. (2004). Fictive motion as cognitive simulation. *Memory and Cognition, 32*(8), 1389–1400.
McGrew, W. C. (1992). Chimpanzee material culture: Implications for human evolution. Cambridge: Cambridge University Press.
Mech, D. (1999). Alpha status, dominance and division of labor in wolf packs. *Canadian Journal of Zoology*, *77*.
Medwell, J., & Wray, D. (2017). What's the use of handwriting: A white paper.
Medwell, J., & Wray, D. (2014). Handwriting automaticity: the search for performance thresholds. *Language and Education, 28*(1), 34–51.
Meier, S., & Sprenger, C. D. (2012). Time discounting predicts creditworthiness. *Psychological Science, 23,* 56–58.
Miles, L. K., Nind, L. K., & Macrae, C. N. (2010). Moving through time. *Psychological Science, 12*(2), 222–223.
Milojevic, S. (2015). Quantifying the cognitive extent of science. *Journal of Informetrics, 9*(4), 962–973.
Moiseff, A., & Copeland, J. (2010). Firefly synchrony: A behavioural strategy to minimize visual clutter. *Science*, *329*(5988), 181. https://doi.org/10.1126/science.1190421 .
Maritz, P. (2005). Sir Thomas Muir, 1844–1934. *Linear Algebra and its Applications, 411,* 3–67.
Murnighan, K., & Conlon, D. (1991). The dynamics of intense work groups: A study of British string quartets. *Administrative Science Quarterly, 36*(2), 165–186.
Nave, G., Nadler, A., Dubois, D., Zava, D., Camerer, C., & Plassmann, H. (2018). Single-dose testosterone administration increases men's preference for status goods. *Nature Communications, 9*(2433), 2018.
Niedenthal, P. M., Barsalou, L. W., Winkielmann, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review, 9*(3), 184–211.
Nieder, A., & Dehaene, S. (2009). Representation of number in the brain. *Annual Review of Neuroscience, 32*(1), 185–208.
Noë, R., van Hooff, J. A. R. A. M., & Hammerstein, P. (2001). Economics in nature: Social dilemmas, mate choice and biological markets. Cambridge: Cambridge University Press.
Nowak, M. A., Page, K. M., & Sigmund, K. (2000). Fairness versus reason in the ultimatum game. *Science, 280*(5485), 1773–1775.
O'Hara, M., Mioduszewska, B., von Bayern, A. M. P., Auersperg, A. M. I., Bugnyar, T., Wilkinson, A., et al. (2017). The temporal dependence of exploration on noetic style in birds. *Scientific Reports, 7*(4742), 2017.
Osiurak, F., Morgado, N., Vallet, G. T., Drot, M., & Palluel-Germain, R. (2014). Getting a tool gives wings: Overestimation of tool-related benefits in a motor imagery task and a decision task. *Psychological Research, 78*(1), 1–9.

Pal, R., Singh, S. N., Chatterjee, A., & Saha, M. (2014). Age-related changes in cardiovascular system, autonomic functions, and levels of BDNF of healthy active males: Role of yogic practice. *Age, 36*(4), 2014.

Plassmann, H. (2018). Interview on Testosterone & brand awareness: Men shop differently when their juices are flowing. How testosterone influences men's preference for luxury products. INSEAD Knowledge; Marketing, 03.07.2018.

Pohl, T. T., Young, L. J., & Bosch, O. J. (2018). Lost connections: Oxytocin and the neural, physiological, and behavioral consequences of disrupted relationships. *Journal of Psychophysiology*.

Poundstone, W. (2015). *How to predict the unpredictable*. London: Oneworld Publications.

Rae, T. C. (Ed.) (2010). Professor Andrew Whiten: Osman Hill Memorial Lecturer 2010; PSGB Winter Meeting. *Primate Eye; Primate Society of Great Britain*, *102*.

Rajaram, S. (2011). Collaboration both hurts and helps memory. *Current Directions in Psychological Science, 20*(2), 76–81.

Rajaram, S., & Pereira-Pasarin, L. P. (2010). Collaborative memory: Cognitive research and theory. *Perspectives on Psychological Science, 5*(6), 649–663.

Reiniger, R. (1923). *Kant—Seine Anhänger und seine Gegner*. München: Ernst Reinhardt Verlag.

Rentfrow, P. J., & Gosling, S. D. (2003). The do re mi's of everyday life: The structure and personality correlates of music preferences. *Journal of Personality and Social Psychology, 84* (6), 1236–1256.

Riechelmann, C. (2016, February, 21). Die Songs der Dachsammer. *Frankfurter Allgemeine Sonntagszeitung*, Frankfurt am Main.

Rietz, F., Stannarius, R. (2008). On the brink of jamming: Granular convection in densely filled containers. *Physical Review Letters*, *100*(7).

Rosato, A., Strandburg, K. J., Prinz, F., & Swendsen, R. H. (1987). Why the Brazil Nuts are on top: Size segregation of particulate matter by shaking. *Physical Review Letters, 58*(10), 1038–1041.

Rother, M. (2016, November 25). Handy macht Jugendliche unsozial. *Augsburger Allgemeine*, Augsburg.

Rueschemeyer, S. A., Van Rooji, D., Lindemann, O., Willems, R. M., & Bekkering, H. (2010). The function of words: Distinct neural correlates for words dentoing differently manipulable objects. *Journal of Cognitive Neuroscience, 22,* 1844–1851.

Schupp, J. (1964). Die freie Reichsstadt Pfullendorf und ihre Geschichte. Stadt Pfullendorf, Pfullendorf/Baden.

Schupp, F. (2004). *Versorgungsstrategien in der Logistik*. Wiesbaden: Deutscher Universitätsverlag.

Semaw, S., Rogers, M. J., Quade, J., Renne, P. R., Butler, R. F., Dominquez-Rodrigo, M., et al. (2003). 2.6-million-year-old stone tools and associated bones from OGS-6 and OGS-7, Gona, Afar, Ethiopia. *Journal of Human Evolution*, *45*(2), 169–177.

Semmelhack, J. L., Donovan, J. C., Thiele, T. R., Kuehn, E., Laurell, E., & Baier, H. (2014). A dedicated visual pathway for prey detection in larval zebra-fish. *eLife*, *3*, 1–19.

Sinha, C. (2011). When time is not space. The social and linguistic construction of time intervals and temporal event relations in Amazonian culture. *Language and Cognition*, *3*(1), 137–169.

Sip. (2014). Die Kraft des Lavendels. Die Welt am Sonntag, 37, Berlin: Axel Springer.

Souhami, D. (1998). *Gertrude Stein und Alice B*. Frankfurt: Suhrkamp Verlag.

Spitzer, M. (2003). *Selbstbestimmen: Gehirnforschung und die Frage: Was sollen wir tun?*. Heidelberg: Spektrum Akademischer Verlag.

Spivey, M. J., & Geng, J. J. (2001). Oculomotor mechanisms activated by imagery and memory: Eye movement in absent objects. *Psychological Research, 65*(4), 235–241.

Srull, T. K., & Wyer, R. S. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology, 37,* 1660–1672.

Stiglitz, J. E. (1993). *Economics* (1st ed.). New York: W. W. Norton & Company.

Story, G. W., Vlaev, I., Seymour, B., Darzi, A., & Dolan, R. J. (2014). Does temporal discounting explain unhealthy behavior? A systematic review and reinforcement learning perspective. *Frontiers in Behavioral Neuroscience*, *8*, 76.

Stout, D. (2011). Stone toolmaking and the evolution of human culture and cognition. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 366* (1567), 1050–1059.

Strang, S., Hoeber, C., Uhl, O., Koletzko, B., Münte, T. F., Lehnert, H., et al. (2017). Impact of nutrition on social decision making. *Proceedings of the National Academy of Sciences of the Unites States of America, 114*(25), 6510–6514.

Sun, Q. Q. (2007). The missing piece in the 'use it or lose it' puzzle: Is inhibition regulated by activity or does it act in its own record. *Review in the Neurosciences, 18*(3–4), 295–310.

Sunnafrank, M. (1992). On debunking the attitude similarity myth. *Communication Monographs, 59*(2), 164–179.

Tennie, C., Call, J., & Tomasello, M. (2009). Ratcheting up the ratchet: on the evolution of cumulative culture. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 364*(1528), 2405–2415.

Taylor, A. H., Hunt, G. R., Holzhaider, J. C., & Gray, R. D. (2007). Spontaneous metatool use by New Caledonian crows. *Current Biology, 17*(17), 1504–1507.

Tebbich, S., Taborsky, M., Fessl, B., & Dvorak, M. (2002). The ecology of tool-use in the woodpecker finch (Cactospiza pallida. *Ecology Letters, 5,* 654–664.

Tettamanti, M., Buccino, G., Saccuman, M. C., Scifo, P., Fazio, F., Rizzolatti, G., et al. (2005). Listening to action-related sentences activates fronto-parietal motor circuits. *Journal of Cognitive Neuroscience, 17*(2), 273–281.

Thomas, J.A., & Birney, E. C. (1979). Parental care and mating system of the prairie vole, Microtus ochrogaster. *Behavioral Ecology Sociobiology*, *5*(2), 171–186.

Tsukayama, E., & Duckworth, A. L. (2010). Domain-specific temporal discounting and temptation. *Judgement Decision Making, 5,* 72–82.

Tüpker., R. (2005). Die therapeutische Nutzung von Musik: Musiktherapie. In De la Motte, H., & Rötter, G. (Eds.), *Musikpsychologie* (pp. 339–356), Laaber.

Urban, M. (2011, May 25). Wo keine letzte Gewissheit zu haben ist. *Süddeutsche Zeitung*, 119, München.

Velay, J. -L., Longcamp, M. (2012). Handwriting versus typewriting: Behavioural and cerebral consequences in letter recognition. Learning to Write Effectively: Current Trends in European Research (pp. 371–373). Brill.

Vick, S.-J., Bovet, D., & Anderson, J. R. (2010). How do African grey parrots (Psittacus erithacus) perform on a delay of gratification task? *Animal Cognition, 13*(2), 351–358.

Vincenot, C. E. (2018). How new concepts become universal scientific approaches: insights form citation network analysis of agent-based complex systems science. In *Proceedings of the Royal Society B: Biological Sciences* (pp. 285).

Von Liebig, J., Poggendorf, J. C., Wöhler, Fr. (1858). Handwörterbuch der reinen und angewandten Chemie (pp. 727 and pp 740). Braunschweig: Friedrich Viehweg und Sohn.

Wang, H., Duclot, F., Liu, Y., Wang, Z., & Kabbaj, M. (2013). Histone deacetylase inhibitors facilitate partner preference formation in female prairie voles. *Nature Neuroscience, 16,* 919–924.

Wascher, C. A. F., Dufour, V., & Bugnyar, T. (2012). Carrion crows cannot overcome impulsive choice in a quantitative exchange task. *Frontiers in Psychology, 3*(118), 1–6.

Watzlawick, P., Beavin, J. H., & Jackson, D. D. (1967). *Pragmatics of human communication*. New York: W. W. Norton.

Weber C. (2011, July 28). Zehntausend Kims. *Süddeutsche Zeitung*, 172, München.

Wehling, E. (2016). *Politisches Framing, Wie eine Nation sich ihr Denken einredet – und daraus Politik macht; edition medienpraxis, 14*. Köln: Halem Verlag.

Whiten, A. (2005). The second inheritance system of chimpanzees and humans. *Nature, 437* (7055), 52–55.

Whiten, A. (2011). The scope of culture in chimpanzees, humans and ancestral apes. *Philosophical Transactions of the Royal Society B, 366,* 997–1007. https://doi.org/10.1098/rstb.2010.0334.
Whiten, A., Goodall, J., McGrew, W. C., Nishida, T., Reynolds, V., Sugiyama, Y., et al. (1999). Cultures in chimpanzees. *Nature, 399*(6737), 682–685.
Whiten, A., Hinde, R. A., Laland, K. N., & Stringer, C. B. (2011). Culture evolves. *Philosophical Transactions of the Royal Society of London B: Biological Science, 366*(1567), 938–948.
Whiten, A., & van Schaik, C. P. (2007). The evolution of animal 'cultures' and social intelligence. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 362*(1480), 603–620.
Whiten, A., Watson, S. K. (2018). Illuminating the evolution of cultural cognition through comparative studies of humans and chimpanzees. In *Proceedings of the 31st International Congress of Psychology*. K. Shigemasu, S. Kuwano, Sato, & T. Matsuzawa (Eds.), *Diversity in harmony—Insights from psychology* (pp. 164–187). International Union of Psychological Science.
Whiten, A. (2017). Culture in child and chimpanzee. *Annual Review of Psychology, 68*(1), 2017.
Wickert, J. (1972). *(1972): Einstein*. Reinbeck: Rowohlt.
Winkler, H., & Leisler, B. (1999). Exploration and curiosity in birds: Functions and mechanisms. In N. J. Adams, & R. H. Slotow (Eds.), *22nd International Ornithological Congress*, Durban.
Yaxley, R. H., & Zwaan, R. A. (2007). Simulating visibility during language comprehension. *Cognition, 105*(1), 229–236.
Zaromb, F. M., Liu, J. H., Paez, D., Hanke, K., Putnam, A., & Roediger, H. L., III. (2018). We made history: Citizens of 35 countries overestimate their nation's role in world history. *Journal of Applied Research in Memory and Cognition, 7*(4), 521–528.
Zeigarnik, B. (1927). Das Behalten erledigter und unerledigter Handlungen. In K. Lewin (Hrsg.) (Ed.), Untersuchungen zur Handlungs- und Affektpsychologie; III. Psychologische Forschung, Band 9, Berlin.
Zeilinger, A. (2001). Es stellt sich letztlich heraus, dass Information ein wesentlicher Grundbestandteil der Welt ist; interview with A. Zeilinger by A. Naica-Loebell. https://heise.de/-3448658.
Zeilinger, A. (2003). *Einsteins Schleier—Die neue Welt der Quantenphysik*. München: Beck Verlag.
Zimen, E. (2003). Der Wolf: Verhalten, Ökologie. Kosmos: Mythos.
Zink, C. F., Tong, Y., Chen, Q., Bassett, D. S., Stein, J. L., & Meyer-Lindenberg, A. (2008). Know your place: Neural processing of social hierarchy in humans. *Neuron, 58*(2), 273–283.
Zittlau, J. (2016, May 22). Bitter macht stark. Berlin: Welt, Axel Springer.
Zwaan, R. A., Stanfield, R. A., & Yaxley, R. H. (2002). Language comprehenders mentally represent the shape of objects. *Psychological Science, 13,* 168–171.
Zwaan, R. A., & Pecher, D. (2012). Revisiting mental simulation in language comprehension: Six replication attempts. *PLoS ONE, 7*(12), 2012.

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Upskilling for "Purchasing 4.0"

How European Automotive OEMs Master the Future of Purchasing with the Right Skill Set

Yasmin Weiß and Sonja Kamm

1 Introduction: Trends in the Automotive Industry

The automotive industry is facing an era of disruptive change. The industry is likely to experience more changes in the next decade than in the last 20 years.[1] Intense competition and structural changes characterize the industry. Companies have to transform their core business. The four automotive megatrends mobility, autonomous driving, digitization, and electrification will continue to have a major impact on the automotive industry in the upcoming years with an impact on all company functions. The following Automotive trend radar illustrates in detail how different industry trends are influencing the automotive industry in the short and long term (Fig. 1).

Facing those changes, the European automotive industry has to take appropriate measures to defend its global technological leadership. A high focus is put on flexibility as well as on innovation as rapid progress in, for example, autonomous driving, big data analytics, and the Internet of things are creating new opportunities for innovative services, products and therefore business models. Today's cars already resemble rolling computers on four wheels with their connected services

[1] See Miller (2017).

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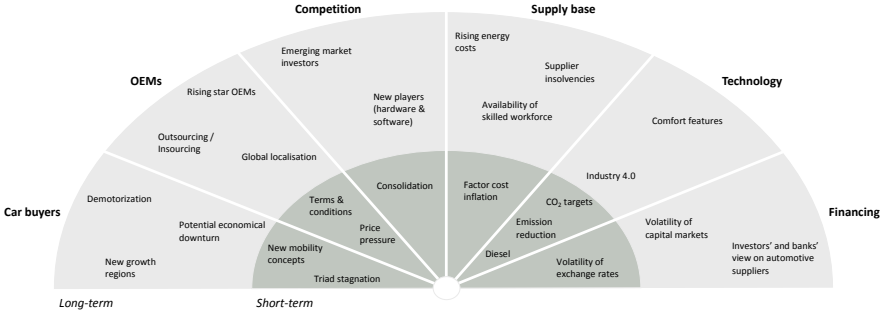

Fig. 1 Automotive industry trend radar (authors' own figure, based on Lazard/Roland Berger: Global Automotive Supplier Study 2018)

and driving assistants. Original equipment manufacturers (OEMs) have to transform themselves from "hardware" manufacturers into connected mobility solutions providers. As a consequence, present requirements for the workforce change. This article offers an overview and description of the top skills for purchasers of automotive OEMs facing the challenges as described. It is based on many discussions and expert interviews with HR experts as well as purchasing executives of leading automotive companies. This article was designed to answer the most crucial questions: What are overall trends which characterize the purchasing function 4.0? Which skills therefore do purchasers need in order to be successful in the presence and future? How does the qualification profile of a "well-rounded purchaser 4.0" look like to face the challenges of the increasing complexity of the industry? Which special requirements do purchasers need in China as important sourcing location for European OEMs?

2 Overall Trends: How Does Purchasing 4.0 Look Like?

There are five overall trends in terms of key challenges that automotive OEMs need to currently address. They directly or indirectly affect the purchasing function:

- *Increasing complexity and cost pressure*: The overall complexity of the automotive industry has reached a historic peak. The worldwide increase in regulations with respect to environmental and safety standards such as in China and Europe will raise costs and at the same time increase complexity. Additionally, "the growing number of derivatives serving different vehicle segments and markets based on a single platform also raises complexity. At the same time, OEMs have to develop alternative powertrain technologies in order to lower emission" (McKinsey 2013, p. 9). This will require significant investment from all OEMs. Given all these different pressures in combination with a flat net price

development, it is more difficult for OEMs to differentiate themselves with new features while extracting economic value from these forces.

- *Digital demands*: Consumers worldwide ask for more connectivity and connected mobility services and ease of use. Customers more and more want to combine mobility with communication and entertainment. This is an opportunity for OEMs, but only if they can figure out how to earn money from this consumer desire.
- *Shifting industry landscape*: As OEMs have to develop alternative powertrain technologies, suppliers will likely provide more of the value-added content per car so that more innovation is shifted toward the suppliers. In addition, different stakeholder groups expect from OEMs to ensure that their suppliers' production footprints—especially in emerging markets—match future market demands as well as their own production plans. All OEMs have to deal with emerging Chinese competitors entering new segments and markets and which have become serious players.
- *"Diverse sources of unpredictability*: The number of regions witnessing significant changes in their political landscape, rise in terrorism, social tensions, and interstate conflicts reflect a current worldwide instability. Having established a footprint across most major markets" (EY 2017), European OEMs are now being challenged by local volatilities, including stability of trade relations, access to raw materials, foreign exchange, and financial markets with an impact on the OEMs profitability.
- *Strategic partnerships*: As a consequence of the trends mentioned above, building up strategic and sustainable partnerships with external partners will play an increasing role for OEMs. "Coopetition"—a partnership based on cooperation with a competitor—becomes more and more common. The latest partnership between the BMW Group and Daimler on connected mobility services and autonomous driving is a recent example for this. Daimler and BMW are teaming up to develop autonomous driving technology to cut costs and set an industry standard that aims to shape future regulation for self-driving cars.

So what are the concrete consequences for the purchasing function of European automotive OEMs? Which transformation has taken place and how is the new role of purchasing defined?

3 The Transformed Role of Purchasing: Upskilling the Workforce

The purchasing function needs to source products and services which provide optimum customer value using the best possible cost structures. In order to achieve this, the purchasing function needs to gain access to supplier innovations, leverage company-wide synergies, and ensure an effective and efficient as well as secured supply chain. The purchasing function contributes to a high degree to an OEM's

product quality and overall profitability. Below we have listed statements concerning the new role of the purchasing function which have been given recurrently in many of our conversations with purchasing executives. They describe the profound transformation process which is currently taking place:

- The *complexity* of the purchasing role is increasing and therefore a higher level of overall qualification is needed. Today's purchasers need skills that transcend functional mastery; they additionally need comprehensive social and functional skills across the whole value chain.
- Managing the *relationship with strategic partners and suppliers* becomes a more explicit dimension of a purchaser's job description. Fulfilling short-term as well as long-term objectives is a crucial balance act in the negotiating process and requires a high level of intuition, empathy, and long-term strategic thinking.
- Purchasers must be able to cope with *growing market volatility* and political and economic instabilities increase. Therefore, purchasers must be able to take decisions in an ambiguous and fast-changing environment and must be well informed about current determining factors such as geopolitics which influence the supply chain.
- The structure of the *supplier portfolio becomes more dynamic and diverse*. This affects the direct environment of the purchasing function as well as the whole global supply chain. Also, a higher focus is placed on sustainability issues. Hence, more interdisciplinary and intercultural skills are needed in a purchasing team.
- As more and more *innovations* are bought from suppliers, the purchasing function has to transform from pure "purchasing" to "managing partnerships." Purchasers must, therefore, better understand the suppliers' perspective and requirements in order to be able to develop integrative solutions for both sides. Innovative suppliers are seen as strategic partners which have an impact on the negotiating process and strategy.
- More and *more processes and procedures are digitalized* and artificial intelligence (AI) will more and more be able to fulfill selected purchasing tasks. Hence, administrative functions will decrease, and purchasers can more concentrate on strategic jobs such as joint product development with suppliers, identifying new supply markets, and synergy potentials. A purchaser will more and more act as an "ambassador" of a company which requires soft-skills like representing, convincing, conflict solving, and relationship building.
- Increased transparency of *relevant data and information* facilitates a fully automated information flow in the process chain. In order to make use of the huge potential, purchasers need more skills in data analytics.

These developments and the transformed role of purchasing make it necessary for OEMs to invest in "upskilling" of their purchasing workforce. So how can the different qualification requirements be identified systematically? Which skills will be needed in the presence and the future? And which mindset helps to cope with the current challenges?

4 Top Skills for Purchasers: Which Skill- and Mindset Is Needed?

Being able to master a broad transformation process always requires the right skill- and mindset. The workforce must be able *and* willing to transform from the former to a new role. Derived from the previously described transformed role of the purchasing function, purchasers more and more act as "intrapreneurs" with increasing degrees of autonomy and responsibility, and a broader perspective across different company functions. For example, when negotiating with suppliers they continuously have to look for the best overall solution for the company—both short term and long term—especially when entering a new strategic partnership with an innovative partner. They very often have to define their individual role and concrete tasks newly as in a digitalized environment there are hardly any blueprints on how to conduct the particular purchasing process. This requires the willingness to adapt, learn, and to understand the need for change. This of course does not happen overnight but requires a continuous learning process in which the following questions need to be asked—both by human resource management (HR Management) and the responsible purchasing executives: How future-proof is the current skill- and mindset of our purchasing team? In which areas do we especially need to invest in order to cope with the new requirements? Which competencies will become more important in the future, which ones will lose importance? What are effective and efficient ways for the workforce to acquire the new skills? Which additional skills for purchasers are needed in specific regions of major importance such as China? The following chapters reflect the major findings of our scientific research work and interviews with purchasing executives.

4.1 Strategic Approach to Identify Skill Needs: Which Are the "Future Hot Skills"?

No one learns skills such as data analytics, state-of-the-art negotiating methods or better communications or intercultural skills overnight. It takes time to qualify people or to hire new specialists from the external labor market and integrate them into the existing team and culture. Therefore, it is of major importance to strategically identify the company's specific "future hot skills," which should receive special attention as they are characterized by two dimensions:

- They will be of *high importance* in the next years
- and are *scarce* on the internal and external labor market.[2]

Different HR processes such as recruiting, development, qualification, and retention have to be involved to ensure that the "future hot skills" are available in a sufficient number and quality (Fig. 2).

[2]For detailed information about this approach and methodology see Weiß (2017b).

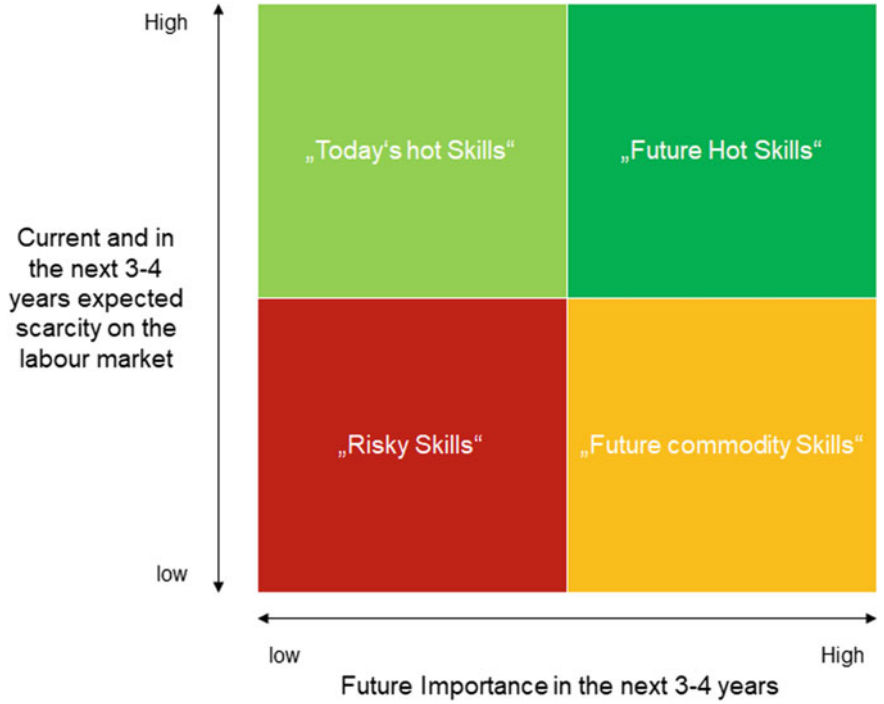

Fig. 2 Strategic competency matrix (authors' own figure)

This strategic skill analyses based on the competency matrix needs to be done individually by every company. However, certain trends seem to be applicable for the majority of OEMs. Our research has shown that for most companies, *specific digital skills* in

- Digital product development,
- Digital business
- Industry 4.0 or
- Advanced analytics

in *combination* with

- *Profound experience in purchasing*

represent "*future hot skills.*" Such skills combinations are highly requested in the new purchasing environment and at the same time relatively scarce.[3] Administrative and repetitive purchasing tasks, however, can in the future be more and more

[3]For a detailed list of specific digital skills see Strack et al. (2017).

replaced by AI solutions and digitized processes. For those jobholders with "risky skills" new fields of application need to be found or they need to be "upskilled" for new tasks.

In addition to the "future hot skills," we have analyzed in our research, which additional skills are needed in order to foster "well-rounded" qualification for purchasing tasks.

5 Successful Purchasers: How Does a "Well-Rounded" Qualification Profile Look like?

The characteristics of purchasing 4.0 with its increased complexity require more comprehensive and generalist qualification profiles of purchasers than ever before. Purchasers need a so-called T-shaped model of their qualification, which reflects *deep knowledge* in one area on the one hand and a *broad base of general supporting knowledge* on the other hand. Figure 3 gives an overview, which breadth of knowledge is desirable and should be part of the continuous qualification process for purchasers.

Referring to profound purchasing experience, Fig. 4 offers a broad overview, which specific skills and mindset are needed to complement the breadth of knowledge.

On the level of an individual purchaser, it is desirable to fulfill the majority of the requirements listed above. A diverse purchasing team is helpful to supplement individual skill gaps with skills from other team members. Or as Siemens CEO Joe Kaeser sees it: "*No one can be perfect. But a team can be.*" In this context,

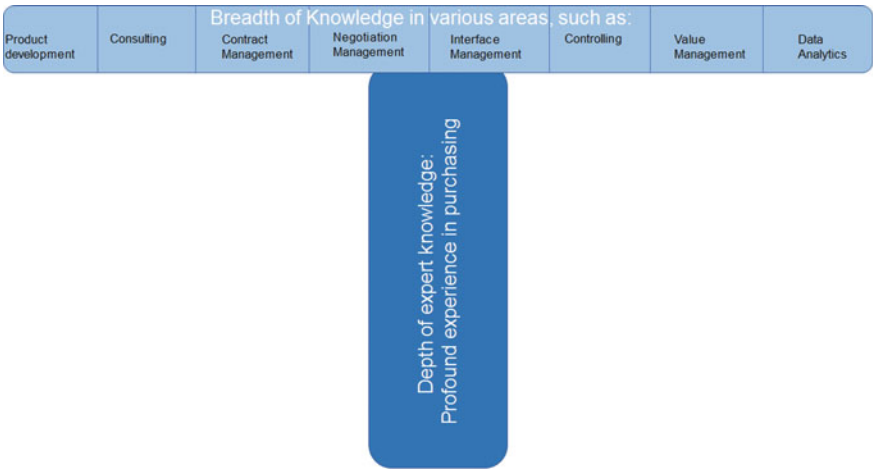

Fig. 3 T-shaped model of qualification: well-rounded qualification profile (authors' own figure)

Skills	Mindset

Functional
• Distinct technical skills which are equivalent to a developer
• Technical assessment competence
• Functional knowledge on supply chain management
	• High degree of responsibility
	• Self-reflection
	• Open-mindedness
	• Mental flexibility
	• Willingness to
	  • be a multi-talent generalist
	  • continuously learn and improve
	  • travel

Methodical • Negotiation management and negotiation methods • Project- and time management • Thinking in alternatives • Strategic planning and planning in scenarios • Decision-making ability in ambiguous environments • Agile working methods • Creativity • Management of complexity • Handling of conflicts of objectives	
Social • Networking skills, skills to build up sustainable relationships • Ability to work in interdisciplinary teams • Empathy & intuition • Cooperative negotiating skills • Communication skills • Intercultural and foreign language skills • Frustration tolerance	

Fig. 4 Qualification profile purchaser 4.0 (table compiled by authors)

responsible managers must be well trained in diversity management and in forming and leading diverse teams as well as in fostering cooperation within the team.

China is one of the most important sourcing markets for automotive OEMs. So, which additional skills do purchasers need in order to master the specific challenges in China and to successfully work with Chinese partners?

6 Additional Skills Needed in China

Before we will elaborate on the specific skills needed in China, we would like to give a short overview on how the purchasing function in China looks like. In most Chinese companies, the purchasing function is still in its beginning, even in companies which have been active in international environments for several years. Purchasing functions as in European OEMs are mostly not existing in an equivalent way. Purchasers of Chinese OEMs often fulfill administrative tasks but are not responsible for strategically selecting suppliers, negotiating, or building up long-lasting relationships with partners. In China, usually, the developer in cooperation with the management team takes the decision which suppliers are selected. The strategic relevance of the purchasing function is currently not seen as high as in Europe but might change in the future.

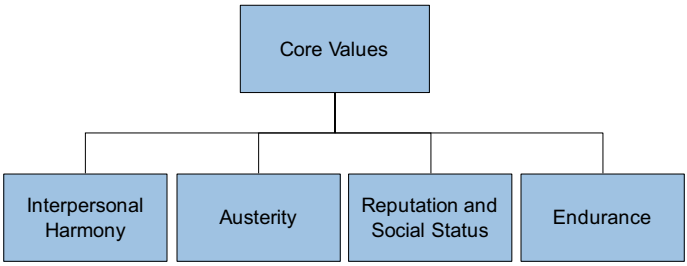

Fig. 5 Core values in the Chinese culture (authors' own figure)

When dealing with Chinese business partners, it is crucial to understand the core values of the Chinese culture, which are derived from Chinese Confucianism and which strongly influence Chinese thinking and behavior.[4] Knowing and understanding these core values is especially important for purchasers who aim to build up relationships with Chinese suppliers for the first time or who aim to build up sustainable and long-lasting strategic partnerships in areas of mutual specific interest such as battery cells (Fig. 5).

- *Interpersonal harmony*: Building up harmonious interpersonal relationships plays a major role in Chinese society. Only after having established a solid and harmonious relationship, Chinese are willing to offer loyalty and trust.
- *Austerity*: Due to economic and political instability in the past, generations of Chinese have learnt to save money and to manage their personal financial resources with a long-term orientation. This established core value influences Chinese behavior in price negotiations.
- *Reputation and social status*: Chinese children are trained from early age on to have a high reputation and to contribute to aim for a high social status in society. Therefore, ranks and titles play a major role in the Chinese business world.
- *Endurance*: Also, from early childhood on, Chinese are trained to work hard for their goals. Laziness and inactivity are frowned upon. Therefore, Chinese are trained to work with a high level of energy and persistency until they have reached their objectives.

A special element of the Chinese culture is the concept of "Guanxi."[5] Many China experts see guanxi as one of the most crucial success factors for doing business in China. Fundamentally "*guanxi* means building a network of mutually beneficial relationships which can be used for personal and business purposes. In this sense, *guanxi* is not so much different than the importance of having a strong network when doing business in any country. However, in China, *guanxi* plays a far more important role than it does in the West" (Business Insider 2011).

[4]For more details see Weiß (2017a), p. 101 seq.
[5]For more details see Weiß (2017a), p. 105 seq.

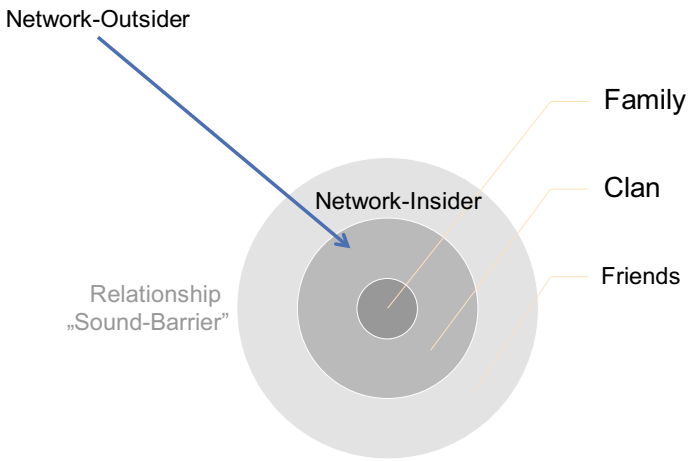

Fig. 6 Guanxi as success factor in China (authors' own figure)

Chinese clearly differentiate between "Network-Outsiders" and "Network-Insiders." Family, clan, and friends represent the personal network of a Chinese person, and they are part of the personal "guanxi." Only within this network, trustworthy relationships and cooperation are possible. The term "friend," however, has a broader scope than in Western cultures. Everyone who breaks through the "relationship sound barrier" can be regarded as a friend. Therefore, repetitive activities outside the board room and office such as dinners and sharing time in the evening or week-end together are appropriate measures to become a business "friend" (Fig. 6).

So how can European purchasers prepare themselves for cooperating and negotiating with Chinese partners? What are special characteristics of the Chinese business culture? Which special skills are relevant?

- *Strategic relationship building* and *networking* in the sense of *guanxi* are crucial for finding the right Chinese partners. Investing in *guanxi* takes time but is a necessary investment for entering long-term and trustworthy relationships.
- Therefore, a *high level of interest* for the Chinese culture in combination with *distinct intercultural skills* is necessary for every purchaser in China. Personal relationship building often takes place *outside regular office hours*. Joint dinners and "socializing activities" help to better understand the Chinese partner and to build up trust. Relationships in the Chinese culture should be fostered on a *continuous and ongoing basis*, even if there is no current project.
- *Status and hierarchy* play a major role when negotiating with Chinese partners. Chinese want to negotiate only with partners on the same level. Titles and status symbols play a major role.
- Moreover, *language skills* are relevant. With many Chinese business partners, negotiation discussions cannot take place in English because the language skills of the Chinese counterparts are not sufficient. Consequently, it is recommendable

to have own team members who are able to translate during negotiations. As the Chinese language is highly ambiguous, translators must not only be able to speak the Chinese language fluently, they additionally need a profound functional knowledge about the negotiation topics in order to be able to translate adequately.
- When negotiating with Chinese partners, it is recommendable to aim at finding a win-win situation. The concept of "giving face" to the Chinese partners and avoiding "losing face" in negotiations is crucial for every negotiation and long-lasting relationship.[6]

7 Forecast: Do Not Forget the Culture

The complexity and dynamic of the purchasing role will remain high. Thus, the transformation of the purchasing function will continue in the next years. The nature of purchasing will become more and more a cooperation with suppliers at eye level with a strong focus on managing sustainable partnerships as well as mutual interests. The purchasing function will need to adapt quickly to new and continuously changing supplier portfolios and to cope with dynamic supplier structures. The digitalization of purchasing provides high data transparency and fully automated information flow within the value chain. Purchasers are more and more released from administrative work and must focus on added value data analytics or strategic evaluation. Companies should therefore continuously invest in "upskilling" and "reskilling" the purchasing workforce.

Not only skills but also the culture should be in the center of interest: We all know: "culture eats strategy for breakfast." Managers should be willing to establish a culture in which purchasers have enough freedom for their decisions and are able to act as "intrapreneurs" within the company. Strongly hierarchical structures, however, work against the success of a modern purchaser who is able to successfully master the complex challenges of purchasing in the 4.0 environment. Therefore, an appropriate organizational and structural environment needs to be established to facilitate new ways of working together and to establish good conditions for lifelong learning.

References

Boston Consulting Group Report. (2016). *Supply chains that become real value chains*. Retrieved from: https://www.bcg.com/industries/automotive/solutions.aspx.

EY. (2017). The six trends driving change in the automotive industry. https://www.ey.com/en_lu/automotive-transportation/the-six-trends-driving-change-in-the-automotive-industry.

Goh, A., & Sullivan, M. (2011). The most misunderstood business concept in China. Business Insider. https://www.businessinsider.com/the-most-misunderstood-business-concept-in-china-2011-2?IR=T.

[6]For further details about cooperating with Chinese partners see Weiß and Weiß (2014) and Weiß (2017a).

Hecht, D. (Hrsg.). (2014). Modernes Beschaffungsmanagement in Lehre und Praxis. Berlin: Uni-Edition.

McKinsey. (2013). The road to 2020 and beyond: What's driving the global automotive industry? https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Automotive%20and%20Assembly/PDFs/McK_The_road_to_2020_and_beyond.ashx.

Miller, R. (2017). The six trends driving change in the automotive industry. Retrieved from: https://www.ey.com/en_gl/automotive-transportation/the-six-trends-driving-change-in-the-automotive-industry.

Lazard, & Roland Berger. (2018). Global automotive supplier study 2018. Retrieved from: https://www.rolandberger.com/publications/publication_pdf/roland_berger_global_automotive_supplier_study_2018.pdf.

Strack, R., Dyrchs, S., Kotsis, A., & Mingardon, S. (2017). How to gain and develop digital talent and skills, a Boston Consulting Report. Retrieved from: https://www.bcg.com/de-de/publications/2017/people-organization-technology-how-gain-develop-digital-talent-skills.aspx.

Weiß, Y. (2017a). Strategisches Talentmanagement in China: Mitarbeiter finden und binden: Leitfaden für erfolgreiche Personalführung. 2. Auflage, Wiesbaden 2017.

Weiß, Y. (2017b). Erfolgskritische Kompetenzen im digitalen Zeitalter: Was sind die „Future Hot Skills"? Sonderdruck der Technischen Hochschule Nürnberg, Nr. 67, Nürnberg 2017.

Weiß, Y., & Weiß, F. (2014). Deutsch-chinesisches Projektteams erfolgreich führen. In D. Hecht, (Hrsg.), Modernes Beschaffungsmanagement in Lehre und Praxis (pp. 269–280). Berlin: Uni-Edition.

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Zero Shades of Gray—Reaching Zero Defects by Externalization of the Quality Philosophy into the Upstream Supply Chain

Johanna Ewald and Florian Schupp

1 Review of Literature

Based on the zero-defect philosophy, quality management and supply management are merging over the years toward supply quality management, which is focusing on evaluation, measuring and developing supplier quality performance.

Originating from the total quality movement, the zero-defect philosophy generated by Philip Crosby is the foundation of all interpretive quality activities, since "it is always cheaper to do the job right the first time" (Crosby 1979). Reaching this level requires a commitment to the zero-defect philosophy from all members of the supply chain (Weißbrich et al. 2008). In terms of Porter's corporate strategy (Porter 1999), supplier quality therefore has to be assigned to the functional strategy as a part of the supply strategy.

Deming and Juran were among the first ones to publish about quality in the purchasing process in the 1960s and 1970s. A deeper connection between quality management and supply management started in the late 1990, when it was recognized that a qualitatively high product can only be produced with a quality commitment of the whole supply chain (Ross 1998). This stretch of the total quality movement into the supply chain can be considered as a consequential step of completion (Ross 1998), while Levy (1998) contemplates supply chain quality management as a new organizational field. Today, the idea of supply chain quality evolves toward managing the supplier and improving its quality by evaluation, quality performance measurement and supplier development (Noshad and Awasthi 2014).

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Likewise, the evaluation of supplier performance has evolved over time, starting with Ishikawa's description of audits as an appropriate quality tool in the 1980s (Ishikawa 1985). Shrimali (2010) finds seven reoccurring steps for the supplier evaluation in literature: Identify critical commodities, identify critical suppliers, form a cross-functional team, meet with supplier's top management, identify key projects, create a target agreement and oversee status and strategies. Other quality-evaluating tools are capability analysis (Behrens 2008) and quality and reliability metrics (Fernandez 1995). Besides the mentioned quality tools, today's evaluation is also focusing on the cooperation between two companies. The cooperation level should be investigated, regarding the kind and the quality of the relationship. The supplier's stage of integration into the customer's processes (Pang and Tan 2017) and the relationship characteristics have a powerful impact on a company's delivery quality (Soares et al. 2017).

After evaluating the areas of failure, a performance measurement system should be implemented which provides information about the scope of failure (Supply Chain Council 2012). The creator of the zero-defect philosophy already found out that "people really like to be measured when the measurement is fair and open" (Crosby 1979). In terms of quality, a fair and open measurement system should reward those suppliers that deliver according to all service and product specifications (Sanchez-Rodriguez et al. 2005). Performance indicators for supplier quality can be used from the beginning of the product development process by measuring "success of new product introduction" down to the delivery of poor quality by "percentage of defective products received" or "defective parts per million" (Roberts 2013). The used measurement should emphasize on actions and improvement possibilities to help develop the supplier (Narasimhan and Kim 2002).

One main objective in supplier development is to improve the suppliers' overall quality (Hartley and Choi 1996). This can be supported by an internal quality management of the customer, which does not only impact the downstream quality directly but also significantly affect the upstream and downstream quality management in the supply chain (Zeng et al. 2012; Quang et al. 2016). Besides own quality improvement, long-term supplier–buyer relationships (Choi and Liker 2004), rewarding well-performing suppliers (Sanchez-Rodriguez et al. 2005) and quality trainings (Shokri et al. 2010) can support suppliers to improve. Besides the operational development, the supplier's management has to be involved in the process. It is not only part of the management responsibilities to establish a quality orientated mindset in a company (Feigenbaum 1993), but the practiced leadership style influences the quality performance of a company (Teonman and Ulengin 2017).

Literature is in most parts focusing on the supplier evaluation and development prior to the start of a serial production, launch of a product or ownership transition. The delivery of poor quality after the beginning of production in a business-to-business context has received less attention. Complaint management has often been investigated regarding consumer markets, but it is as well important in business-to-business markets since it can damage long-term relationships (Döscher 2014). Brock et al. found that important factors in handling complaints are

their effective processing and an adequate compensation of the potential loss (Brock et al. 2013). An emerging practice shows that an effective complaint processing can be ensured by a cross-company IT-Structure (Roberts 2013). Another tool, the 8D-Report, first introduced by the US Military in the norm "Corrective Action and Disposition System for Nonconforming Material," investigates the complaint out of eight different dimensions to ensure a holistic completion. It should prevent repetitive errors by identifying long-term improvement actions. With the completion signature from the customer, the responsibility is split between the customer and the supplier (Jung et al. 2011). Another revealing method is the cost tracking of poor quality delivered, which ensures a fair compensation of the failure costs incurred (Brock et al. 2013).

Only a few authors consider the connection between supplier quality development and complaint management in their publications. This relation is considered by using performance indicators like bad quality delivered to evaluate the supplier but not by developing the supplier based on occurring failures. This combination should be examined closer especially because product recalls in the automotive industry have increased during the past few years (Steinkamp and Reed 2016). This indicates that the approach of error prevention is not working properly. Some supplier rating systems are using the number of complaints among others as a quality performance indicator (Irlinger 2012). The advantage of using simply the absolute number of complaints as a base for supplier development needs a closer investigation. Besides performance measurement, other quality improvement measures should be defined. One possible approach is the analysis of root causes from previous complaints. Learning from the past failures shall make the definition of future improvement measures easier and more concrete. Additionally, it will open the possibility of defining the place and extent of supplier improvement actions.

Furthermore, when supplier quality development starts with internal quality management, then complaint management should also start with evaluating internal complaint processing by respective measuring. References about internal complaint management and how to measure this process are not closely observed by scholars, so far. The target is to find a measurement that provides information about the efficiency and effectiveness of the complaint process that improvements can be introduced. The following questions will be answered in the corresponding sub-chapter: Which possibilities exist to develop internal processes? Can supplier development methods be modified and implemented also at the customer?

2 Objective and Structure

The emphasized gaps in literature are the business-to-business complaint management, the connection between complaint management and supplier quality improvement and the evaluation and development of the customer's internal complaint process. Based on these gaps, this chapter deals with the supplier

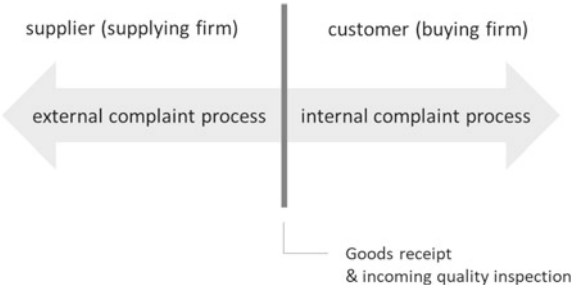

Fig. 1 Improving supplier quality by external and internal processes (authors' own figure)

complaint processing and connects it to supplier quality improvement. To illuminate the topic further, the chapter splits the complaint management into three different facets: supplier quality performance measurement, supplier quality improvement and the internal complaint process development. The measurement and analysis of poor quality of supplied parts or materials provide the basis for the conceptual conclusions in this chapter. The relative value of the measurement with absolute numbers will be answered, and a possible tracking procedure will be suggested. Based on the collected data, the implementation of protective, corrective and improvement actions will be discussed. While improving the supplying firm, opportunities to develop the customer's internal complaint processes are suggested. Therefore, an appropriate measurement system will be introduced, which builds the foundation for further improvements (Fig. 1).

3 Supplier Quality Performance Measurement

To measure supplier quality performance, the different performance indicators are compared with each other and among those the measurement of incidents or single claims is used as the basis for improvement. Using this performance indicator, a transparent tracking procedure is applied. In order to conceptually develop a holistic supplier quality management concept, supplier complaint data from a large, multinational supplier to the industrial and automobile industries is collected and analyzed.

3.1 Measuring Supplier Quality

The fact that a lot of "costs are arising due to poor quality" (Noshad and Awasthi 2015) confirms that many companies have not reached the zero-defect level yet. These costs have many different origins, for example, costs for line stops, return shipments or working time for complaint processing. They do not necessarily occur

for every defective part, rather for every opened complaint. The origin of each case differs and needs to be defined individually. To minimize costs and to reach the zero-defect level, an appropriate measurement system for poor quality delivered needs to be applied.

A common performance indicator for poor materials or components supplied in the automobile industry is the measurement of defective parts per million (Brunner and Wagner 2016). The measurement in parts per million shows the relation between the defective parts and the number of delivered parts. It does not show how many complaints were opened due to these defective parts. If a whole batch is defective, it results into one complaint. Meanwhile, several defective parts from several batches result into more than one complaint. Consequential, it is not possible to see the total number of complaints in this performance indicator. Furthermore, an improvement of this performance indicator can be achieved by delivering more parts and not by improving the absolute quality itself. However, zero-defective part per million indicates that the zero-defect strategy is fulfilled. In general, measuring a relation of indicators always faces the same problem. An immediate statement regarding the number of complaints and therefore the number of cases that need to be solved is not possible. A performance indicator, which makes the total number of occurring complaints visible, would be advantageous. The measurement of the absolute number of complaints is one possibility, which is already used for example in the automobile industry. This provides the opportunity to see the fulfillment of the zero-defect strategy and more important, the number of opened quality complaints. Another advantage of this performance indicator is the direct allocation of the complaint costs to each incident. Finally, ranking the different suppliers by the yearly number of complaints enhances the competition. The competition is harder, because a supplier can only improve his ranking by decreasing the number of yearly complaints, not by more deliveries. Concluding, the view of the authors is that measuring each complaint is the most advantageous performance indicator to decrease the number of complaints and their respective costs.

On the basis of a chosen performance indicator, the extent of the improvement needs to be defined. Therefore, a fixed target to be reached will be set. The overall target can be any number of yearly complaints; it should be challenging and reachable. Thus, each supplier shall be guided to reach zero defects with realistic steps.

Summarizing, the absolute number of complaints is the chosen performance indicator to measure the supplier's quality performance. This way of measuring fulfills the point of fairness, and it rewards suppliers that deliver according to all specifications. The target of the measurement system will be a fixed, challenging but reachable number of yearly complaints.

3.2 Strategic Supplier Quality Tracking and Improvement

Having chosen the performance indicator and the target, a clear tracking procedure needs to be developed. Transferring an ABC-Analysis into complaint management would mean that 20% of all suppliers are causing 80% of the complaints, 30% are causing 15% of the complaints and 50% are causing 5% of the complaints. Based on such an ABC-Analysis, evaluations mostly point toward the suppliers classified as A-Suppliers for rewarding or C-Suppliers for developing. The suppliers evaluated as neither good nor bad are often disregarded and therefore show a high risk of a quality decline. To avoid this, a fair complaint measurement system from the authors' point of view classifies into two groups with one group of suppliers causing complaints and another group of suppliers that have already reached zero defects. Suppliers causing 80% of the complaints are being defined as Flop-Suppliers, while suppliers causing the other 20% are called Non-Flop-Suppliers. Suppliers, which already fulfill zero defect, are called Zero-Defect-Suppliers and are representing the target for all other suppliers. The present work is establishing a link between complaint management and supplier quality management looking in an exemplary way into the supplier quality data of a large supplier to the automobile and industrial industries. This data is used to understand focus areas for supplier development from a quality perspective in a holistic way not limited to the actual data itself.

Concerning the introduced supplier classification method, the analyzed case data suggests that 66% of the suppliers can be classified as Zero-Defect-Suppliers and on the other hand 34% of the suppliers cause complaints. Out of these suppliers, 17% are causing 80% of the complaints and are classified as Flop-Suppliers, while 83% of these suppliers cause 20% of the complaints and are classified as Non-Flop-Suppliers (Fig. 2).

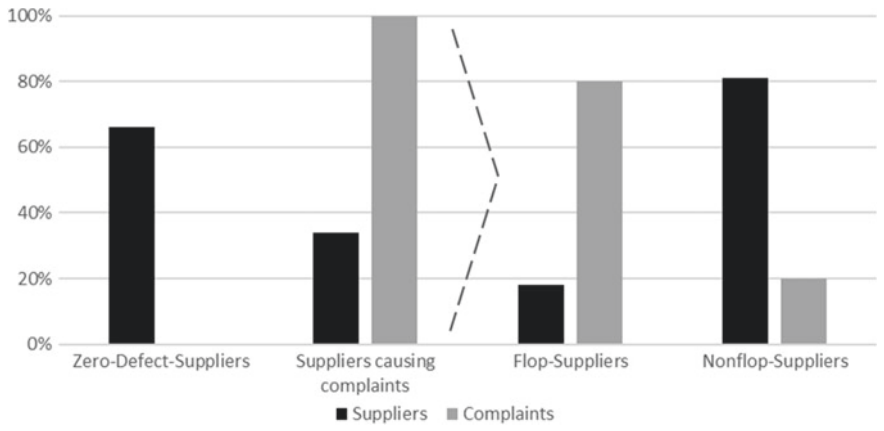

Fig. 2 Spread of suppliers causing complaints (authors' own figure)

In a first step in quality improvement, Flop-Suppliers will receive higher attention. It is recommendable to track their results individually to see the specific progress or regress. To see the progression immediately, the tracking on a monthly basis with all involved employees is necessary, as a holistic view on the supplier's performance can only be provided by an interdisciplinary team. Decision making or strategy changes based on the supplier's results will be discussed at this point as well. Furthermore, it is recommendable that the suppliers get an individual improvement target. This target is set in reference to the overall target and fulfills the same attributes as stated above. The special attention is not only for the measurement system, but also the improvement measures are defined individually. As illustrated in Fig. 3, the improvement process should be based on five basic steps. The first step of identifying the critical suppliers is already done. For these suppliers, expertise in the specific production processes will be applied (step 2) and meetings with the supplier's top management are taking place (step 3). It is important that the top management is involved in quality improvement, because it is their task to develop a quality program and a mindset for the company (Feigenbaum 1993). Further, the supplier's processes need to be improved on a technical level (step 4). Based on the results of improvement, target agreements have to be created (step 5). Since the technical capability of the supplier should gradually ameliorate, the last two steps of supplier quality improvement need to be overviewed regularly. In case of a significant negative drift of a supplier, another top management meeting should be reconsidered to align the company's quality standards.

In summary, the tracking procedure for supplier quality improvement is done by a classification of the suppliers into Flop-, Non-Flop- and Zero-Defect-Suppliers. This Flop-, Non-Flop-, Zero-Defect-Suppliers classification is a modification of the ABC-Analysis. Flop-Suppliers are tracked individually on a monthly basis to see their progress or regress. The supplier quality improvement is a process consisting of five steps in which the last two steps build a loop that should be reviewed on a regular time basis. In the following case, the historical complaint data of an automobile and industrial supplier has been analyzed. The occurring major technical problems of the suppliers will provide the basis of generalized quality improvement measures.

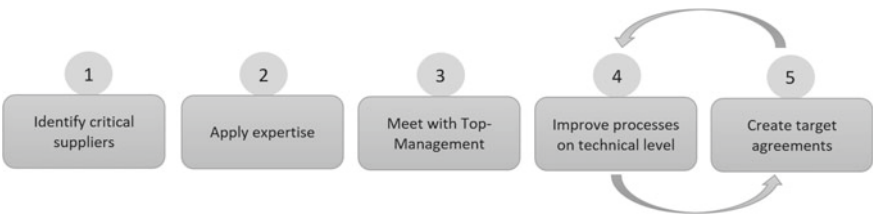

Fig. 3 Five steps of supplier quality improvement (authors' own figure)

3.3 Database for Quality Improvement Measures

An occurring error pattern is only a sign for the *existence* of a problem. Eliminating this error pattern does not necessarily solve a problem sustainably, analogous to medicine. Medicating the symptom does not mean the disease should not occur again. The same disease could probably come to the surface again or potentially even through another symptom. Therefore, the root cause needs to be found and to be eliminated to sustainably remove one problem.

To build a database for the elimination of root causes, the complaint data from the analyzed company was collected. All complaints of Flop- and Non-Flop-Suppliers delivering to different plants of the customer were taken into consideration. The root causes of the respective complaints were detected by an Ishikawa diagram (Ishikawa 1976) and a 5-Why Analysis, first introduced by Sakichi Toyoda in the Toyota Motor Corporation (Ohno 1988), as part of the 8D-Report. Resulting over a period of nine months, 333 complaints were investigated.

In a first step, occurring root causes were counted according to the seven influence factors (refer to Fig. 4) used in the Ishikawa diagrams, also called seven M's: Management, Man (human), Material, Measurement, Machine, Mother Nature and Method.

A first analysis of the data shows that 30% of the investigated complaints cannot be reproduced due to an incompletion of the 8D-Report. However, human, method and machine are the root cause of 195 complaints, which represent 59% of all complaints. The other 11% are separated into the four missing influence factors. Because of the gap between the three main influence factors and the other ones, only the ones occurring the most will be further investigated to introduce improvement measures. Resulting from the incomplete 8D-Report, improvement measures for the development of the internal complaint process will be followed.

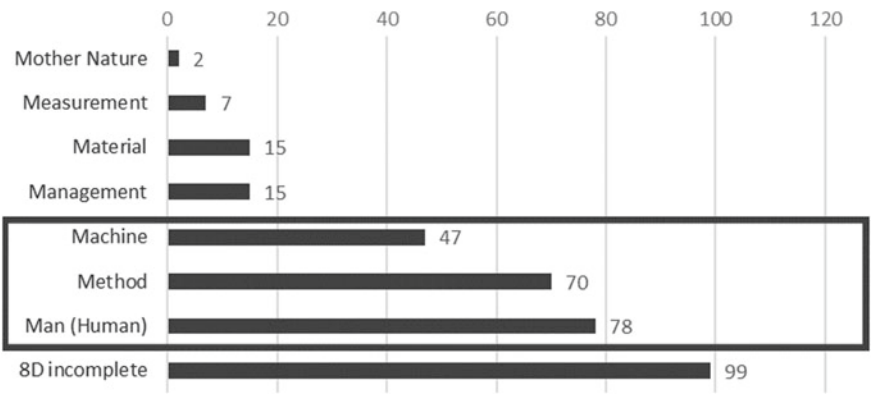

Fig. 4 Root causes classified by the number of occurrence and the different influence factors (authors' own figure)

In the following paragraphs, the different root causes for the three main influence factors are introduced. These influence factors do not occur more frequently in one of the observed plants or in a specific month. Therefore, the analysis will be carried out without a differentiation by plants. Following the Pareto analysis, the problems with the highest occurrence need to be eliminated first.

The method as a cause of complaints looks at all supplier processes. This does not only involve the production process but also logistical processes such as packaging, storage or internal transportation. Generally, the frequency of occurring methodological errors refers to the supplier's lack on control over their processes. To improve the suppliers' processes, customers install supportive functions inhouse, which should manage the suppliers' quality as a starting point of improvement (Noshad and Awasthi 2015). The results of the presented case further show the need for a function that manages the supplier quality after the start of series production. The case shows that additional development methods and actions need to be defined and realized between supplier and customer. The basis for further improvement is built by the information about the different causes as shown in Fig. 5. The data analysis shows that nine different root causes occur related to the Ishikawa influence factor *Method*. Out of these, 70% of the complaints root causes are wrongly implemented production and logistic processes and production line setup. Because the occurrence of these root causes is predominant, actions to reduce the number of complaints in these three areas will be illuminated in the chapter "Supplier quality improvement measures." Since the other six root causes occur more seldomly, detailed improvement measures should be investigated and implemented case by case (Fig. 5).

The Ishikawa factor *Man* describes complaints, which are based on human mistakes. The three most frequently occurring root causes are work instruction ignored, slip in control and setting parts delivered, contributing to 50% of

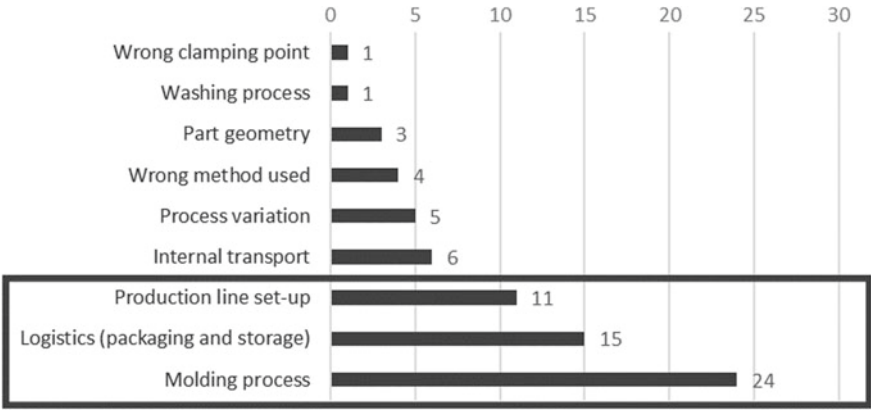

Fig. 5 Different root causes of the influence factor method classified by the number of occurrence (authors' own figure)

human-influenced complaints. The root-cause slip in control describes the process of visual control, e.g., at the end of the production line. Such control is used, when a technology is not robust enough to fulfill the zero-defect strategy. Possible measures for these human-based mistakes will be introduced in the chapter "Supplier quality improvement measures." The other 50% of human-influenced factors are caused by seven different root causes (Fig. 6).

The complaints based on a *Machine* influence show a smaller deviation in the different root causes. Almost 80% of the complaints originate from either a defective machine on which the production continued or from tool wear. This root cause refers to tool usage after the maximum production output was reached. To reduce the number of machine-based complaints, measures for these two root causes should be implemented (Fig. 7).

Concluding, the analysis of 333 complaints shows that 23% of the complaints are based on the influence factor *man*, 21% on the influence factor *method* and 15% on the influence factor *machine*. It also shows that a big amount of complaints was

Fig. 6 Different root causes of the influence factor man (human) classified by the number of occurrence (authors' own figure)

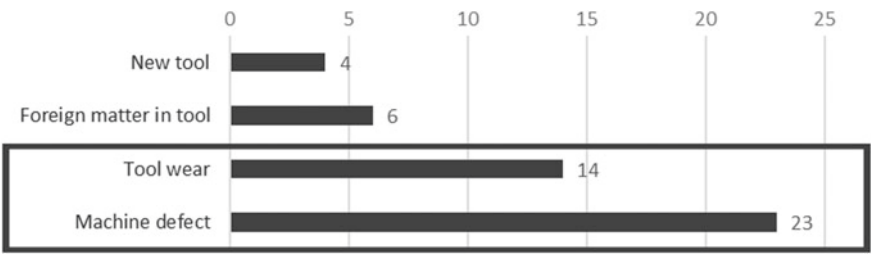

Fig. 7 Different root causes of the influence factor machine classified by the number of occurrence (authors' own figure)

not able to be reproduced due to a lack in the 8D-Report processing. Further, the data confirms that the complaints originate from several different root causes and working in cross-functional teams to resolve the claims can be advantageous. The raised data is setting the basis for the following improvement measures.

4 Supplier Quality Improvement Measures

To ensure that good quality will be delivered in future, protective and improvement actions need to be consequently implemented. At first it needs to be clarified, where these actions should be applied. In the presented case, the quality inspection of incoming goods rarely projects the complaints and therefore the production line is rather identifying bad parts, while producing the own product. This sole way of working shall be avoided. The suppliers commit to deliver parts according to the aligned specification. It is not the customer's duty to ensure the supplied parts quality level. Furthermore, a clear statement that poor quality is not acceptable should be made toward the supplying firm. With the target to put pressure on the supplier and to minimize the default risk at the customer's plant, all corrective actions need to be implemented at the supplier's plant.

These improvement measures can be divided into four main areas (refer to Fig. 8). They are immediate protective actions, limited protective measures, permanent corrective measures and sustainable improvement measures. Only sustainable improvement measures can improve the supplier's processes from a process robustness point of view. Not all technologies can reach zero defects from a technical point of view (Töpfer 2007), sustainable improvement measures are supported by the implementation of permanent corrective actions. Furthermore, protective measures, which ensure a quick coverage of parts delivered in bad quality, will be explained.

An immediate protective action is used whenever the supplier has delivered poor quality. The main focus is to guarantee that no further defective parts will be received from the same defective batch. Therefore, the stock at the supplier's plant and the goods in transit will be sorted 100% by the supplier. This measure is meant

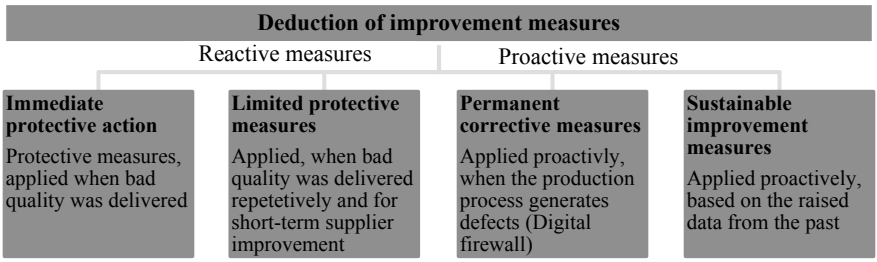

Fig. 8 Different levels of supplier quality improvement measures (authors' own figure)

to avoid further defect parts, which disturb the production process. Still, this is only a short-term protective measure, and for actual quality improvement, additional measures need to be found.

If suppliers deliver several errors on the same product or show repetitive errors, the limited protective measure of controlled shipments will apply. Controlled shipments are commonly used as quality tools in several industries. Controlled shipment measures can be differentiated into three levels of inspection. It targets to ensure the suppliers delivered quality based on a 100% visual control. At the same time, the supplier should evaluate his occurring faults and learn from them for the future. The goal is an improvement of the internal supplier production process regarding the occurring faults.

The Controlled Shipment Level concept consists of three basic steps:

1. 100% inspection by the supplier
2. 100% control by an external service provider
3. 100% control by an external service provider and new business hold.

The supplier moves one escalation level up whenever another defective part of the same part number is delivered to the customer. Important is that this tool is not made to ban suppliers, but to develop them immediately and for the future. This tool is designed for a short-term improvement and learning process, and it is used reactively to enhance the pressure toward the supplier. The last step of this tool is called "new business hold." This final step puts pressure on the supplier to increase his quality level. Certainly, the Controlled Shipment Level is often utilized with Flop-Suppliers, because they mostly show repetitive errors. Still, when Non-Flop-Suppliers have problems with one particular part number or part family, such a tool can prevent the customer from too many defective parts in their production. Accordingly, to develop supplier quality on a long-term horizon, permanent corrective or sustainable improvement measures need to be implemented.

Permanent corrective measures are applied especially in technologies, which cannot fulfill the zero-defect philosophy from a production process stability point of view. The main idea behind this action is to ensure that good quality is delivered to the customer, although the production process can generate defects. In order to deliver according to the zero-defect strategy, a permanent 100% control needs to be implemented. Traditionally, employees would carry out a visual control at the end of the production line. As the presented case data shows, 15% of the human mistakes are slip in these end-of-line controls. This can be explained by the average error detection for automotive components of about 90–98% (See 2012). To prevent the slip in the visual control and to avoid these complaints, the suppliers can, for example, implement automatic camera control systems, which can be called digital firewalls. Digital firewalls can be used as 100% end-of-line control and are more effective than the human eye. The camera control systems are investments, which will probably redeem due to the fact that no compensation costs for complaints occur. This is still not the final target, because bad quality is produced and the intended way for the supplying and customer is to totally avoid the production of bad quality.

For a better cost efficiency, sustainable improvement measures need to be implemented. The goal of these measures is to improve the processes and not to separate good parts from bad parts. These measures are defined by data raised from the past (refer to Figs. 5, 6 and 7) and should be implemented to reduce complaints on a technical level. The data revealed that the influence factors method, human and machine are most frequently leading to complaints.

4.1 Influence Factor Method

In the following paragraphs, possible improvement measures for the earlier identified most often occurring root causes of the influence factor method, production processes, logistics and production line setup are described.

Production process:

Plastic injection molding and metal casting processes are combined in this root cause for the present dataset. In general, the target is to optimize molding and casting processes by implementing sensor techniques. These sensor techniques should monitor the real-time data from the practical molding and casting processes and compare them with the theoretically and required set data. The permanent target-performance comparison should provide information about deviations in the process and delimit parameter-based failures in the production process. The real-time monitoring of molding and casting processes can lead to an enhanced quality performance with a saving potential of 3–5% from the manufacturing cost at the casting company and potential quality cost savings at the customer (Larsen 2018).

Logistics (Storage and Packaging):

Logistics problems that result into quality complaints are either originating from a too long storage time or from insufficient packaging specifications. A main influence factor on the storage time is the used type of storage and the used inventory managing method. The first-in first-out inventory managing method is predestined to be carried out in a wrong manner, when the storage is organized in blocks or bulks. The faulty execution of the inventory managing methods, or the chosen storage organization, could possibly lead to longer storage times, which many materials cannot withstand. The storage problems can occur after the production at the supplier plant and after the arrival at the buying plant. To avoid these problems, a detailed view of the first-in first-out procedure is necessary. A better reconciliation between the supplying and customer could lead to a shorter storage time. In general, the target of this measure is to reduce the storage time.

To avoid problems based on wrong packaging, a look into the details is necessary. Before every new ordered product, packaging specification needs to be aligned. To identify the right packaging specification, the transportation method or

storage should be analyzed as well. An example from the regarded data includes a supplier that delivered a product continental and overseas. The packaging specification for this product was the same for the two different locations. As a result, the supplier had big rust issues with the product delivered overseas, because this packaging was not sufficient. The example shows that there is a need to deeply investigate every case and then align packaging standards and if necessary, define two different storage and packaging specifications for different ship to locations.

Production line setup:

Avoiding production-line-based problems, one effective tool could be a reverse Failure Mode and Effects Analysis (FMEA). Such reverse process FMEA is a continuous improvement tool used to analyze new risks occurring during the real-life serial production of a product, while the original FMEA tries to predict potential failures in the future. Therefore, an interdisciplinary team inspects the production line and tries to identify all possible failures in a manufacturing or assembly process. Actions to correct the possible failures are defined and are transferred to the other production lines (Parrott et al. 2011). This process should be repeated several times. Processing the reverse FMEA in a short interval in the beginning is recommendable. The tool is especially useful to identify not functional sensors and equipment or similar, equipment which lost its functionality due to rework of the production line.

4.2 Influence Factor Man (Human)

In a next step, improvement measures for the influence factor human will be introduced. In general, one-third of the complaints in the analyzed dataset are caused by humans. Assuming that these failures are not intentional, the lessons from these are that the operators' knowledge needs to be enhanced toward a good quality production. In general, it seems like there is no sensitivity for quality communicated and forwarded from the management to the operators. Besides workshops by the own supplier quality department, an employee of the customer can perform trainings at the supplier plant. The employee of the customer has a higher authority to address this topic. Further, the trainings should be held repetitively, in order to actually change the mindset of the operators. Building a better knowledge and mindset should help operators to work according to work instructions.

Nevertheless, zero defects cannot be ensured by eliminating human failures through trainings. Technical improvements, which guarantee that inattention does not lead to a failure, should be established. Therefore, the implementation of Poka-Yoke systems at the supplier's plant is recommendable for every critical production step. The lean manufacturing tool Poka-Yoke is designed to exclude errors caused by operators and to correct them on a long-term time horizon, through

an optimization of the workspace. Quality employees of the customer can support the introduction of the system and help with the implementation if necessary.

Work instruction ignored

Supportive to the explained tool, the focal firm of the present case suggested another quality tool, which is known as linewalk or Gemba Walk. This tool has the character of an audit carried out by the supplier himself. It consists of different audit like questions about the operator, setter and the production line itself. The suppliers' quality department employee walks by the production line once a week, asks the audit questions and identifies poor working sections. Immediately after finishing the linewalk, the employee gives feedback to the operators and setters. The tool reveals human-based problems like the missing qualification of employees or an unclear definition of work instructions. Based on this feedback, improvement actions are suggested. Other employees and managers can perform this tool on a lower frequency and give their feedback.

Setting parts delivered

Before a machine can be released for the serial production, a first batch of parts is produced which may not fulfill the aligned specifications. Of course, this batch is not supposed to be delivered to the customer. Normally, the operators are sensitive to these parts and know that this batch should not be delivered. Besides this sensitivity, which never is a final exclusion of a defect, other actions need to be implemented, so that complaints due to this root cause do not occur. Therefore, an automatization of the removal process of parts out of specification produced after setting a machine should be considered as an additional measure. On the basis of a standardized setup process, which includes the determination of a specific number of defective parts produced after the setup, an automatic removal of these parts should be implemented. The automatic removal should also be applied after each and every planned or unplanned interruption of production.

4.3 Influence Factor Machine

The root-cause machine defect and tool wear can be eliminated by implementing sensor techniques already described for molding and casting processes. These techniques shall identify parameters, which indicate that the machine has a defect or the tools' maximum output is exceeded. By automating this process, the human influence on this root cause as well as the root cause itself can be eliminated.

In summary, by implementing measures to improve the method, machine and human-based complaints, about 50% of complaints could be avoided in the presented case. Regarding the number of missing 8D-Reports, this number could even be higher if the same root causes occur repetitively. Of course, every customer has to identify the causes of complaints in the past individually and apply their expertise

as suggested in the second supplier quality improvement step. The shown measures give an example how supplier quality can be improved by digging deep into the details of complaints. According to the analyzed data, the 8D-Report processing can be improved as well. The next chapter will indicate possible ways to improve here.

5 Developing Internal Complaint Processes

The quality of internal processes at the customer is setting the base for further improvements. Identifying weaknesses of the own complaint processes will reveal the areas of improvement possibilities. Looking at the respective procedures of complaint processes, each customer will identify its own weaknesses in the process. As shown in the chapter "Database for quality improvement measures" in the observed firm, one weakness was the 8D-Report processing. Almost 30% of the reports of Non-Flop-Suppliers are not filled out properly or the complaints were processed without an 8D-Report. Looking into both, the complaints from Flop-Suppliers and Non-Flop-Suppliers, about 25% of the 8D-Reports, are not processed properly. The second step is to identify the causes for the incompletion of the 8D-Reports. It was observed that the processing time of the reports took very long. This means the efficiency of the document is not given. A second cause is a not satisfying content of the reports; therefore, the effectiveness needs to be improved. Performance measurement is defined as the efficiency and effectiveness of action (Neely et al. 1995). This leads toward defining a measurement system, which identifies the actual efficiency *and* effectiveness of the 8D-Report.

5.1 Efficiency of the 8D-Report

First, the completion time of the 8D-Reports will be further investigated. The first three disciplines of the 8D-Report should be closed after 24 h (Jung et al. 2011). The exact processing time for all disciplines is depending on the requirement of the customer. Different companies show that their required average processing time until D5 should take between 8 and 12 business days (Verband der Automobilindustrie e.V. 2017). Processing the required documents in time is not only the responsibility of the supplier. The supplier quality department employee of the customer should track and remind the supplier to turn the document in on time. Therefore, part of the responsibility is on the customer. To guarantee that the customer has a fast processing, the average processing time can be measured. To improve the processing time, further actions can be implemented either directly at the customer's plant or at the supplier. As a supportive tool, an integrated ERP-System application for complaint management can be used at the buying and the supplying firm. Such systems provide automatic reminders and help to keep the overview. As a result, the average D5 completion time should be under 12 working days over all proceeded 8D-Reports.

5.2 Effectiveness of the 8D-Report

Besides decreasing the processing time, the equally important part of the 8D-Report is the quality of its content. Especially the content from dimension four, root-cause analysis, to dimension seven, implementation of corrective actions, is important. To determine where quality problems occur, a content measurement should be implemented. "People will only tell you the troubles that others cause for them. They will not reveal what they make happen themselves." (Crosby 1979). Therefore, a direct measurement is not recommendable. This suggest implementing an indirect performance indicator will be better to measure the effectiveness of an 8D-Report. The target of the tool is to eliminate errors after the first time they occurred. Accordingly, an 8D-Report is called effective, when a complaint does not occur a second time. Repetitive errors can only occur, when a wrong root cause was identified, or the permanent corrective actions were not sufficient. Measuring the number of repeated complaints is a possibility to measure the effectiveness of the 8D-Report. Repetitive errors do not only count, when a fault appears a second time on the same part but also on a similar part from the same supplier. It should be the supplier's interest to implement the corrective actions translationally. Accordingly, the content and therefore the effectiveness of the 8D-Report will be measured indirectly by the number of repeated complaints.

With this measurement, suppliers with the most repetitive errors can be identified.

Finally, as a part of the measurement procedure, the correlation between the two performance indicators will be observed. Therefore, it needs to be determined if the processing time has an influence on the effectiveness of the 8D-Report. A worst-case scenario shows a short processing time with a negative correlation with effectiveness. In this case, the effectiveness of the 8D-Report should be given a greater value upon the processing time. The best case is a positive influence of the processing time toward the effectiveness. Therefore, a high effectiveness and a short processing time show a positive correlation. This correlation needs to be investigated. The target is a high effectiveness and efficiency of the 8D-Report. To reach it, the earlier introduced improvement tools can be implemented.

In summary, the 8D measurement enhances the quality of the 8D-Report content. The average processing time will improve, and consequently, the buying company will be more reactive toward supplier development because the knowledge about the complaint is provided faster and with better content.

6 Summary

This chapter discusses the importance of connecting quality improvement and complaint management in supply management. In fact, quality issues cannot always be avoided and also suddenly occur *when* well-though-about serial production processes have been started. Each quality incident provides a chance to start with

the supplier quality improvement and respective optimization possibilities. The performance evaluation indicator of choice for supplier quality is the absolute number of complaints.

Three groups of suppliers can be differentiated after being ranked by the absolute number of complaints. Flop-Suppliers are causing 80% of the complaints and are the main focus of quality improvement. Non-Flop-Suppliers cause 20% of the complaints, and so-called Zero-Defect-Suppliers have already reached the zero-defect level. Identifying the critical suppliers is the first main step in supplier quality improvement. For these focus suppliers, expertise should be applied to understand the specific production processes that have led to the failure and consequently to the complaints. As only the top management can fundamentally develop a quality mindset, meetings with their involvement and the respective customers' counterparts have to take place. Afterward, the supplier production process shall be developed on a technical level. The analysis of the present case data shows that there are three main improvement areas: wrongly implemented production, logistics or packaging processes, human mistakes and defective machines. Improving these processes by implementing sustainable improvement measures or permanent corrective measures and creating target agreements is the final step in supplier quality improvement. The latter two steps are ongoing and have to be repeated on a regular basis until zero defect is reached.

In addition to the external improvement, the supplier quality evaluation processes inside the customer should be developed. One perception from the analyzed data is the high amount of complaints which cannot be reproduced due to a lack in the 8D processing. This lack can be explained by the missing efficiency and effectiveness of the document. To improve the complaint process, performance indicators for the two attributes are introduced. For the efficiency, the average processing time is measured, and to evaluate the effectiveness, the number of repetitive complaints can be used. Based on these indicators, improvement measures can be derived.

References

Behrens, R. (2008). In *Boeing Supplier Strategy and Lean, 93rd Annual Conference on Supply Chain Management, St. Louis, MO*.

Brock, C., Blut, M., Evanschitzky, H., & Kenning, P. (2013). Satisfaction with complaint handling: A replication study on its determinants in a business-to-business context. *International Journal of Research in Marketing, 30,* 319–322.

Brunner, F., & Wagner, K. (2016). *Qualitätsmanagement: Leitfaden für Studium und Praxis* (6th ed.). München, Germany.

Crosby, P. (1979). *Quality is free: The art of making quality certain* (1st ed.). New York, NY.

Choi, T., & Liker, J. (2004, December). Building deep supplier relationships. *Harvard Business Review*.

Döscher, K. (2014). *Recovery Management in business-to-business markets: Conceptual dimensions, relational consequences and financial contributions*.

Feigenbaum, A. (1993). Creating the quality mindset among senior managers. *National Productivity Review, 12*(3), 313+.

Fernandez, R. (1995). *Total quality in purchasing & supplier management* (1st ed.). Miami, Fl: St. Lucie Press.

Hartley, J., & Choi, T. (1996). Supplier development: Customers as a catalyst of process change. *Business Horizon, 39,* 37–44.

Irlinger, W. (2012). *Kausalmodelle zur Lieferantenbewertung* (1st ed.). Passau.

Ishikawa, K. (1976). *Guide to quality control, Asian productivity organization* (2nd ed.). Tokyo.

Ishikawa, K. (1985). *What is total quality control? The Japanese way*. London: Pentice Hall.

Jung, B., Schweißer, S., & Wappis, J. (2011). *2011, 8D und 7 step—Systematisch Probleme lösen*. München, Deutschland: E-book.

Larsen, P. (2018). Digitalisierung im Einkauf from Schupp F., Woehner, H. (pp. 199–108). Springer Fachmedien Wiesbaden. 978-3-658-16909-1.

Levy, P. (1998). Total quality management in the supply chain. In *Handbook of total quality management* (pp. 275–303).

Narasimhan, R., & Kim, A. (2002). Effect of supply chain integration on the relationship between diversification and performance: Evidence from Japanese and Korean firms. *Journal of Operations Management, 20,* 303–323.

Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management, 15*(4), 80–116.

Noshad, K., & Awasthi, A. (2015). Supplier quality development: A review of literature and industrial practices. *International Journal of Production Research, 53*(2), 466–487.

Ohno, T. (1988). Toyota production system: Beyond large-scale production (1st ed.). Portland: Productivity Press.

Pang, J., & Tan, K. (2017). Supply chain quality and pricing decisions under multi-manufacturer competition. *Industrial Management & Data Systems, 118*(1), 164–187.

Parrott, K., Mattes, P., & Stahl, D. (2011). Applying advanced FMEA methods to vehicle fire cause determinations. In *ASME 2011 International Mechanical Engineering Congress and Exposition Volume 9*, Denver, Colorado, USA.

Porter, M. (1999). Competitive strategy: Techniques for analyzing industries and competitors. Free Press, ISBN: 0684841487.

Quang, H., Sampaio, P., Carvalho, M., Fernandes, A., Thi, D., & Vilhenac, E. (2016). An extensive structural model of supply chain quality management and firm performance. *International Journal of Quality & Reliability Management, 33*(4), 444–464.

Roberts, M. (2013 September 12). Top 5 supplier quality management strategies. *Quality Digest Magazine*.

Ross, D. (1998). Competing through supply chain management: Creating market-winning strategies through supply chain partnerships (1st ed.). New York, NY.

Sanchez-Rodriguez, C., Hemsworth, D., & Martinez-Lorente, A. (2005). Quality management practices in the purchasing function: An empirical study. *International Journal of Operations & Production Management, 24*(7), 666–687.

See, J. (2012). Visual inspection: A review of the literature. Sandia National Laboratories, Albuquerque, New Mexico.

Shokri, A., Nabhani, F., & Hodgson, S. (2010). Supplier development practice: Arising the problems of upstream delivery for a food distribution SME in the UK. *Robotics and Computer Integrated Manufacturing, 26*(6), 639–646.

Shrimali, L. (2010). Analysis of success factors for supplier development (Master thesis). San Diego State University.

Soares, A., Soltani, E., & Liao, Y. (2017). The influence of supply chain quality management practices on quality performance: An empirical investigation. *Supply Chain Management: An International Journal, 22*(2), 122–144.

Steinkamp, N., & Reed, J. (2016). Automotive warranty and recall report 2015. Stout Risius, Ross Global Financial Advisory Service.

Supply Chain Council. (2012). SCOR Quick Reference Guide, Item No. 726770, Texas.

Teonman, S., & Ulengin, F. (2017). The impact of management leadership on quality performance throughout a supply chain: An empirical study. *Journal of Total Quality Management & Business Excellence, 29*(11–12).

Töpfer, A. (2007). Six sigma: Konzeption und Erfolgsbeispiele für praktizierte Null-Fehler-Qualität (4th ed.). Berlin, Germany.

Verband der Automobilindustrie e.V. (2017). Qualitätsmanagement-Methoden Assessments Leitfaden (1st ed). Berlin, Germany.

Weißbrich, A., Fuchsbauer, B., Heinrichs, H., & Plegnier, H. (2008). Qualitätsmanagement in der gesamten Wertschöpfungskette: Grundlagen des gemeinsamen Erfolgs, Automobiltechnische Zeitschrift, Ausgabe 01/2008.

Zeng, J., Phan, C.A., & Matsui, Y. (2012). Supply chain quality management practices and performance: An empirical study. Published online 13 January 2013. New York: Springer Science + Business Media.

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The Value of Contracts in a Long-Term Context—An Example Based on the Lateran Treaty and the Concordat of 1984

Luigi D'Ottavi

1 Genesis of Lateran Pacts

Understanding the content of 1929 Lateran Pacts requires a brief introspection in the "Questione Romana", the strong debate arisen since the battle of Rome in 1870 and the capture of the city.

In fact, the capture of Rome ("*Presa di Roma*"), on 20 September 1870, was the last war event of the long process of Italia's genesis and the Risorgimento, marking both the unification of the whole Italian peninsula under House of Savoy and the ultimate defeat of the Papal States under Pope Pius IX after 1116 of continuous years of reign (since Anno Domini 754).

Cavour, the italian statesman appointed by the King Victor Emmanuel II for the birth of the Italian State, had firmly believed that without Rome as the capital, Italy's unification would be meaningless; it was said that "to go to Rome" was not merely a right but a meaning necessity, not only for the geographical position of the town in the centre of peninsula but also for the remarkable role of the Eternal City embedded by the immortal memories of the Roman Empire, cradle of modern law and spiritual guide of the Catholic Church.

In regard to the future relations between Italian State and Holy See, Cavour's famous dictum was "A free State in a free Church" separating the role of spiritual guide of the Holy See by political affairs of the Kingdom. However, Pius IX, the longest reigning elected pope in the history of the Catholic Church named "Papa Re", refused that concept of cohabitation and in July 1870, two months before defeat (20 September 1870), affirmed the doctrine of papal infallibility through the First Vatican Council. Certainly, it is not a coincidence that the last political act of Holy See just before the final defeat of the Kingdom was to create a special dogma

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that states that the Pope is preserved from the possibility of error while he is defining a doctrine concerning faith or morals to be held by the whole Church.

This declaration was the political response to the "face-saving proposal" previously sent by the Italian King which allowed the Pope to retain the inviolability and connected rights attaching to him as on sovereign and the full jurisdiction of a small part of the city of Rome called the Leonine City. The proposal was strongly refused by Pius IX immediately before Presa di Roma considering it as an act of disloyalty.

After the proclamation of Kingdom of Italy, the Papal States were incorporated into the new nation except for the Roman's premises: for nearly sixty years, relations between the Holy See and the Italian Kingdom were difficult and the struggle became known as the "Roman Question".

In fact, after the capture of Rome, Pope Pius IX and further popes refused to recognize the new institution, and related jurisdiction, established as Italian Government.

Thus, the Italian King perceived different solutions, including reconsidering Florence as the capital of Italy, but there was widespread agreement that government must be held in Rome to ensure the survival of the new state. In an attempt of resolving the dispute, Italy's Law of Guarantees, approved by the Parliament on 13 May 1871, provided to the Pope some privileges at the same level of the Italian Kingdom, included the right to provide proper ambassadors and financial payment on an annual basis to the Vatican.

On the contrary, the Pope did not accept any attempt by the Italian Government to set rules on the former territory of the papal properties ("Stato Pontificio") and clearly declared that the Holy See must be considered independent from political power in both spiritual and domain's jurisdictions.

Emblem of that period of struggle were the words with which the Holy See enjoined upon Italian Catholics the policy of abstention from the polls in italian elections: Roman Curia used the latin phrase "Non expedit" which means it is not fair for a Catholic to deal in political activities.

Moreover, on 11 October 1874, the Pope declared that every kind of opening granted by the Holy See to the Italian Government could be interpreted as the formal end of the Vatican power.

In 1926, Italian Government and Holy See started negotiations for defining the Roman Question; those attempts ended in the Lateran Pacts of 11 February 1929, signed by Benito Mussolini, on behalf of King Vittorio Emanuele III, as Prime Minister of Government, and by Cardinal Pietro Gasparri, on behalf of Pope Pius XI, as Secretary of State: the agreements took place in the Lateran Palace in Rome, from which they take their name "Patti Lateranensi".

2 Context and Scope of Agreement in 1929

The Lateran Pacts were agreements made between the Kingdom of Italy and the Holy See, settling the "Roman Question" signed on 11 February 1929, in the Lateran Palace. The Treaty recognized Vatican City as a State being an independent

entity and the Italian Government agreed to give the Roman Catholic Church financial compensation for the loss of the Papal States.

The Lateran Pacts are three different treaties: a 27-article "Treaty of conciliation", a 3-article financial "Convention" annex and a 45-article "Concordat".

The scope of the agreement is declared in the beginning of the Treaty of conciliation: it reports the convenience among the parties by eliminating the struggles among Italian State and Holy See, pursuing a definitive and stable relationship among them and giving absolute independence in the mission of the Vatican Church. It is said that Holy See has full and international sovereignty and owns the full property of the Vatican City together with jurisdiction in its matters: "*The Holy See and Italy have recognized the desirability of eliminating every existing reason for dissension between them by arriving at a definitive settlement of their reciprocal relations, one which is consistent with justice and with the dignity of the two Parties and which, by assuring to the Holy See in a permanent manner a position in fact and in law which guarantees it absolute independence for the fulfillment of its exalted mission in the world, permits the Holy See to consider as finally and irrevocably settled the "Roman Question", which arose in 1870 by the annexation of Rome to the Kingdom of Italy under the Dynasty of the House of Savoy*; *Since, in order to assure the absolute and visible independence of the Holy See, it is required that it be guaranteed an indisputable sovereignty even in the international realm, it has been found necessary to create under special conditions Vatican City, recognizing the full ownership and the exclusive and absolute power and sovereign jurisdiction of the Holy See over the same; His Holiness the Supreme Pontiff Pius XI and His Majesty Victor Emanuel III King of Italy have agreed to conclude a Treaty, appointing for that purpose two Plenipotentiaries, namely, on behalf of His Holiness, His Eminence Cardinal Pietro Gasparri, his Secretary of State, and on behalf of His Majesty, His Excellency Sir Benito Mussolini, Prime Minister and Head of Government*" (see: https://www.vaticanstate.va/phocadownload/laws-decrees/LateranTreaty.pdf).

The treaty has four different annexes:

- Map and extension of Vatican City-State (SCV);
- List and consistency of the buildings with extraterritorial privilege and exemption from expropriation and taxes;
- Financial convention agreed on as a definitive settlement of the claims of the Holy See following the loss in 1870 of its territories and property;
- Concordat regulating relations between the Catholic Church and the Italian State.

Among the rules, it is important to underline the following articles of the Treaty:

- Unique Catholic religion in the Italian State (1);
- Unique authority of Holy See in religion concerns (4);
- Pope identified as the Governor of the Church (8);
- End of the Roman Question (26).

The concordat states that the "Spiritual power" is limitless and that Rome must be preserved as Eternal City. The Pope is pledged to perpetual neutrality in international relations and to abstention from mediation in a controversy unless specifically requested by all parties.

Since 1871, the Holy See refused to accept any offer by the Italian Government until the agreements of the Lateran Treaty and the Church organization considered themselves as prisoners in a small portion of area inside Rome named the Vatican.

To commemorate the successful conclusion of the negotiations, the Italian governor Mussolini commissioned "Via della Conciliazione" (Road of the Conciliation), which would symbolically link the Vatican City to the heart of Rome, and the railway connection, through a bridge called "Viadotto del Gelsomino", from Italian "S. Pietro" station to the "Vatican" station in the Holy See premises, which is still the shortest international link among two states.

3 Juridical Nature of the Public Contract and Economical Aspects

Since the definition of the agreement known as Lateran Pacts, many historians and law experts investigated the nature of the Treaty: according to some of them, it was an international treaty among Italian Kingdom and Holy See while others believed it was something new, a sort of new entity separated from both Italian State and Catholic Church (third government theory).

Also different theories were elaborated going through a deep analysis regarding the scope of the Treaty: the "*teoria del privilegio*" (privilege's theory), according to which the Church had finally obtained a special status and some financial provisions in order to compensate the end of Vatican Kingdom; the "*teoria contrattuale*" (contract's theory) which underlined the nature of a deal among the two entities from different perspectives concerning both power and economical aspects.

One-third doctrine (Schiappoli 2018; Wernz 1937) describes the Lateran Pacts as a bilateral and public agreement that was firstly reached through a negotiation among parties but became enforceable only after the publication of law in the Italian Government.

This theory in particular points out that only the Italian State has full jurisdiction which can give a binding value to a moral agreement among the two entities. According to the authors, art. 45 of the Concordat does not recognize the value of an international treaty but underlines the conclusion of an agreement that will be enforceable through mutual ratification and in particular the publication of the Italian law: "*The present Concordat shall come into force by exchange of the ratifications at the same time as the Treaty between the two High Parties for the elimination of "the Roman Question*". So, the whole Treaty acquired juridical effects only after the Laws n. 810 27 May 1929 and n. 887 30 November 1939.

The content of art. 44 is also important, as it underlines the value of a long-term contract with the Lateran Treaty establishing that "*If any difficulty shall arise in the future concerning the interpretation of the present Concordat, the Holy See and Italy shall proceed by a common examination to a friendly solution*".

4 Italian Constitution's Recognition (1947) and "Villa Madama" Agreement (1984)

When the Lateran Treaty was undersigned, the Italian Government was ruled by a monarchy and a dictatorship which ended in 1944 after the Second World War. In 1948, the Italian Government turned into a democratic Republic and the Italian Constitution, enacted by the Constituent Assembly on 22 December 1947, had to recognize the unique role of the Catholic Church among other religions in a liberal state.

In the Constitution, Italian State and Catholic Church are both independent and sovereign in its own activity. Also the "Carta Costituzionale" establishes freedom of religion providing for all kind of spiritual thought the right of self-organization within the Italian law while opening to set up specific agreements with the Italian State; in this terms, Article 7 of Constitution provides a special status to the Catholic Church given by the Lateran Treaty of 1929 which can be emended without requiring an approval of constitutional law.

From a juridical point of view, it is important to underline that the agreement was not only fully recognized but, giving a particular value to the Lateran Treaty (art. 45 of the concordat), each modification could be adopted without the complex procedure provided for revising the Constitution.

The Lateran Treaty continued to be unmodified until a new agreement was reached in 1984, named "Accordo di Villa Madama" or "Concordato bis".

The new agreement, which does not overrule the whole Lateran Treaty, originated in order to take into consideration some aspects concerning the Catholic religion and the necessity to consider also different religions in a democratic State.

In fact, the Treaty was later modified by a new agreement between Church and State in 1984.

In this circumstance, both parties agreed to the following declaration: "*The principle of the Catholic religion as the sole religion of the Italian State, originally referred to by the Lateran Pacts, shall be considered to be no longer in force*".

Only in that moment, the sole state-supported religion of Italy ended; at the same time, the original state financial provision was replaced by a personal income tax called "*otto per mille*" (8‰ of tax incomes) also granted for other religious organizations.

The revised concordat set up, for the first time, some rules for Catholic marriages which, if registered as particular contracts, can provide some duties and patrimonial consequences ruled by Italian civil code. The same happens in case of declaration

of "nullity of marriage" by the ecclesiastical court named "Tribunale della Sacra Rota", which is different from ordinary "divorce" not possible for Catholic marriages.

The recognition in the Italian State of titles of nobility granted by the Holy See was abolished as, since the birth of Italian Republic, those kinds of prerogatives could not be legally considered.

Those modifications were a result of a debate in the Italian Society during 1970–1980 which led Vatican and Italian State to confirm the original Concordat, thus introducing new agreements which took into account the development in society and also in the vision of a State open to different forms of religions but always recognizing the strong role of Catholic Church in Italy.

5 What We Can Learn from Concordat's Experience

Some useful lessons can be learned through the analysis of the Concordat over 90 years from the signature.

First of all, it is important to consider that the Concordat is a long-term agreement (LTA) undersigned by two different parties, not only for the statutory scopes of the singular entities but also for the different juridical nature of the proponents; in fact, Holy See could not be considered as a State in a proper manner, because of lack of jurisdiction and also deficit of power originated since the foundation of Italian State since 1870. This is a crucial characteristic of the agreement which is rather unique in the history of international treaties.

Moreover, it is also remarkable to underline the "win-win" attitude in terms of negotiation that both representatives of the two parties have had through the willingness of resolving the "Roman issue". The Italian State, in fact, could not gain political consensus without Catholics which also have a politic influence which, later, became a strong party called "Democrazia Cristiana". The Holy See, at the opposite, had the necessity to obtain a sort of "redemption" in front of the Italian Monarchy in order to justify the loss of material power and the prosecution in the spiritual role of guiding the Catholic religion. There were also economical aspects that needed to be solved in order to compensate bilaterals gains and losses and to create more value on both sides.

Also, the necessity of a stable situation or necessity in balance of power for both negotiators must be taken into account if we assume that, since 50 years from 1870, Rome was yet a former capital of the Italian State but not from a substantial point of view.

The idea besides the concordat was in fact that the Eternal City had to be considered as having a new international guiding role also from an outside view, after the Roman Empire and the Church Empire that lasted for centuries.

It is truly conceivable that, under these pre-conditions, an agreement named "Concordat" could represent the best win-win perspective for both parties.

But the revolutionary idea in which the Treaty showed one of the best agreements which paved the way for a long and not discussed partnership was the vision in a complete new invention of the mission acknowledged by both parties.

In fact, in giving to both entities a different slice of power represented the remarkable difference if compared to past attempts to solve the Roman issue: the strength of the Concordat is, in other terms, to understand the new context and to create conditions, for both parties, is having a modern vision of two modern States, open minded to the changes that they have to face in a complex thus challenging century.

So, while the Italian State needed to reinvent its mission and to appear as a secular institution towards the religious organization, the Catholic Church needed to modify the steady non-compromising approach used in the past and to open up to the world, thus maintaining and reinforcing the international role of teaching and promoting its values—so-called evangelizzazione.

This strong identification of the two fields of interest is the sparkle that allowed both parties to purchase an agreement which could satisfy both different interests in that historical moment and also in further decades.

On referring to nowadays business negotiations, it is useful to underline the mutual understanding of the zone of potential agreement, ZOPA, using a specific term of Harvard School of negotiation (Fisher and Shapiro 2005; Shonk 2020), which was understood by both parties: from the Holy See side, the ZOPA was represented by the necessity of acquiring or maintaining the power in representing the religion guide at a worldwide level and also unique in the Italian State; from the Italian Monarchy side, the ZOPA was identified by assuming that the material power in ruling the nation was only a task of the national government, while the Church could gain this exclusive role of guide only in religion matter.

There is no doubt that the Lateran Treaty can be considered as one of the best agreements in government negotiations and still could be one of the best examples in this particular field.

6 Nowadays Local and Global Challenges: Towards a New Concordat?

Nowadays, the lesson learned from the Concordat and, above all, the long and stable duration of the deal can be and can be seen very useful in an international framework, especially in dealing with government-to-government agreements (Terzi 2013).

Negotiators can assume that sitting at the table having a clear vision of the own and the counterpart objectives is crucial, and the only way in which it is possible to gain advantages is by maintaining a flexible approach to the goal. In other terms is not only important to define, from the beginning, the best result but also to imagine a different scale of solutions in order to purchase a powerful and durable agreement (Salacuse 1991).

In that extent, the Holy See was able to imagine that, instead of attempts on rekeeping the power to rule a State, it was better to maintain the monopoly in teaching religion and values in the Italian State and to obtain the power to promote its values at a worldwide level.

Moreover, the agreement was also significant from a financial side, as the Church obtained relevant compensations by the loss of its lands and its jurisdiction.

Nowadays, and after the 1984 revision, the question concerning the single municipal tax exemption granted by Italy to Holy See is still present not only on religion estates but also in commercial activities.

The position is strongly opposed by the owners of commercial activities outside of religion estates.

Recently, the European Court (decision on Judgment in Joined Cases C-622/16 P C-623/16 P and C-624/16 P) recalls that the adoption of an order to recover unlawful aid (as the tax exemption for commercial activities by the Vatican) is the logical and normal consequence of a finding that it is unlawful.

Admittedly, the EU Commission cannot require the recovery of aid if this would be contrary to a general principle of EU law, such as the principle that "no one is obliged to do the impossible".

However, the Court points out that the recovery of unlawful aid may be regarded as objectively and absolutely impossible only where the Commission finds, following a scrupulous examination, that two conditions are satisfied, namely that the difficulties relied on by the Member State concerned genuinely exist and that there are no alternative methods of recovery.

Now, the Italian State is obliged to reconsider its position on tax exemption for commercial activities related to Holy See which derives directly from the Lateran Treaty.

In that field, it could be possible to renegotiate a new and "third" concordat by reaching a new compromise among the Italian State and the Church in order to maintain stable relationships also at a European Level and, maybe, to reconsider the tax law principles.

After two thousand years since Church foundation and 90 years since Lateran Treaty Rome, the Eternal City, could still be at the cradle of negotiation activities that could modify international juridical frameworks always assuring a long-term agreement for secular entities.

References

Forchielli, G. (1936). *Teoria del diritto ecclesiastico concordatario*. Studi in onore di Francesco Scaduto, cit. (Vol. I, p. 389 ss).

Fisher, R., & Shapiro, D. (2005). *Beyond reason: Using emotions as you negotiate*. Harvard University.

Lateran Treaty. https://www.vaticanstate.va/phocadownload/laws-decrees/LateranTreaty.pdf.

Salacuse, J. (1991, May 24). *Making global deals*. Boston: Houghton Mifflin.

Schiappoli, D. (2018). *Sulla natura giuridica del concordato*. Stato e chiese, rivista telematica. https://riviste.unimi.it/index.php/statoechiese/article/view/9792.

Shonk, K. (2020). *How to find the ZOPA in business negotiations*. https://www.pon.harvard.edu/daily/business-negotiations/how-to-find-the-zopa-in-business-negotiations/.
Terzi, C. (2013). *Review of long-term agreement in procurement in the United Nation Systems*. Geneva: UN.
Wernz, F. X. (1937). *Ius canonicum*. Pontificia Universitas Gregoriana.
Wikipedia Contributors. (2019, November 10). *Lateran treaty*. Wikipedia, the Free Encyclopedia. Web: 26 January 2020.

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Creativity in Purchasing—What a Team Can Do

Nadine Kiratli

1 Introduction

1.1 Purchasing: A Profession in Motion

Confronted with challenges brought about by global economic shifts and sustainability pressures, chief executive officers (CEO) increasingly invite chief procurement officers (CPO) to take over the wheel and steer through or around supply market volatility, supply chain disruption, and rising costs of raw materials (Accenture 2011). Times could not be better for purchasing to prove its worth to the business. But are CPOs and their purchasing organizations really doing enough to help their organizations deal with all of this?

Certainly, since its establishment as a profession in the early twentieth century, purchasing has undergone a metamorphosis from a shunned, back-office function to a well-recognized, internally integrated business partner. As such, purchasing has continuously been professionalizing its organization and kept introducing purchasing tools and processes, all with the aim of creating value and a competitive advantage for the enterprise. Category management, formalization of the sourcing process, spend analysis, adoption of a cost-orientation, supplier relationship programs, and early supplier involvement in innovation are only some examples to illustrate that purchasing has been exerting effort to emphasize its role as a strategic business partner. Surely, cost reduction and cost avoidance are still the top priority of CPOs (Hackett Group 2016)—but the way savings are generated has transformed. Pressured for continuous bottom-line improvements, buyers must save costs in more compelling, strategic ways including, for instance, working capital expenditure improvements, payment term renegotiations, digitizing purchasing

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processes, and reverse-engineering of cost structures (Forbes 2015). Today, purchasing professionals collaborate with internal stakeholders as part of sourcing teams to develop disruptive sourcing strategies required to sustain, and even increase, bottom-line results. More recently, purchasing is also being held accountable for driving top-line results through proactive fueling of innovation. Purchasing professionals work together with key suppliers as part of co-innovation teams to collectively generate and select ideas for successful commercialization. This brief snapshot of purchasing's role as an increasingly strategic, corporate discipline suggests that CPOs and their staff are considerably contributing to companies' competitive advantage in turbulent economic times.

And yet, many purchasing organizations struggle to live up to stakeholders' heightened expectations accompanying the strategic uplift. While teams—composed of internal only or also external stakeholders—are the most appropriate form to tackle problems that are sourcing-related but carry business-wide or even supply chain-wide implications, success is not guaranteed. Many teams fail or fall short of expectations. According to a survey by Deloitte (2016), 62% of CPOs do not believe that their sourcing teams have the skills and capabilities to deliver their purchasing strategy and expected outcomes. In addition, fewer organizations benefit from supplier innovation input: 42% in 2011 compared to 35% in 2012 (State of Flux 2012). Even though tapping supplier innovation is a designated purchasing objective for 55% of global CPOs (Hackett Group 2016), most purchasing organizations still lack the necessary capabilities.

Put simply, in times of increasing competition, consolidating supply markets, political turmoil, environmental pressures, and increasingly complex sourcing environments, many purchasing initiatives struggle to create top- as well as bottom-line value for the business.

1.2 Team Creativity: The Key to Sustained Value Creation in Purchasing

In search of an explanation for these deficiencies and their resolution, recent popular business press and pioneering scholars point to creativity as the key in purchasing—or rather the lack thereof. Creativity is commonly defined as the development of novel and useful ideas or solutions that are ready to be put into practice (Amabile 1996). Contrary to common perception people might have of creativity, it is not the ability to create ideas out of nothing (Amabile 1998). Instead, creativity requires the meaningful, novel recombination and application of existing, relevant knowledge to capitalize on an opportunity or solve a specific problem (Ritter et al. 2012). As individuals are usually not in possession of all relevant knowledge to do so, creative problem-solving and solution-finding often involve the collaboration of individuals within collectives such as workgroups, taskforces or cross-functional and cross-enterprise teams (Perry-Smith 2006). With most purchasing-related work carried out by and in teams, the ability to think out of the box together with other relevant stakeholders—to be collectively creative—is

essential for next-generation purchasing professionals to remain key players in the value-creation game (Busch 2013; Giunipero et al. 2005; Teague 2014).

Nowadays many strategic sourcing problems are not simply tough or persistent —they can be regarded as "wicked" (Camillus 2008). According to Rittel and Webber (1973), there are at least ten distinguishing properties of a wicked problem, among them:

1. There is no definitive formulation of a wicked problem,
2. There are no criteria that tell when a solution has been found,
3. Solutions are not true-or-false but good-or-bad,
4. There is no immediate and no ultimate test of a solution,
5. Every solution is a "one-shot operation,"
6. Every wicked problem is unique.

Purchasing's wicked task of creating value for the business through devising disruptive sourcing strategies can further be categorized along two dimensions (Fig. 1). First, they score high on plurality. That is, opportunities for creating value are highly dispersed within and outside an organization so that a multitude of stakeholders is required to identify and capitalize on them (Chapman et al. 1997). Second, purchasing decisions score high on complexity as they can be multifaceted in nature, pervading and affecting the entire organization. Developing adequate solutions to wicked sourcing challenges requires collective efforts, pooling relevant knowledge and expertise within and across organizational boundaries where needed (Fisher and Amabile 2009). In short, solving wicked problems requires collective, creative efforts of those involved.

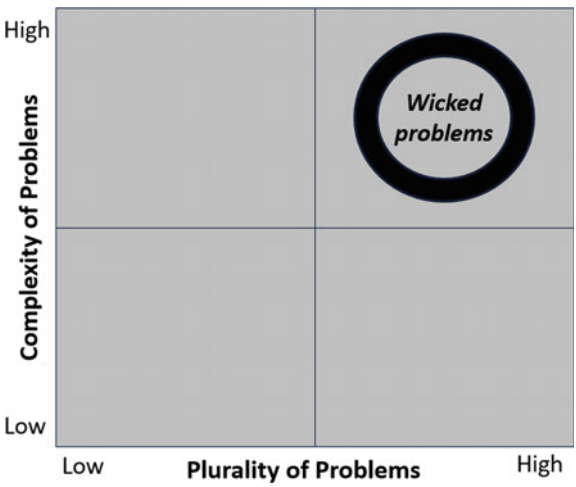

Fig. 1 Value creation in purchasing: a wicked problem (author's own figure)

1.3 Creativity in Purchasing: Establishing the Research Agenda

True, creativity as such is not a new phenomenon—the era of creativity essentially began with humankind setting foot on the planet. Creating new ideas for solving problems is an integral and decisive feature of homo sapiens. Some individuals are natural creative, others have to work hard to activate their creative capabilities and imagination, and yet others will rarely or never have that creative spark. There are scientific debates—especially among neuroscientists, geneticists, and anthropologists—about whether creativity is an innate trait or rather nurtured by upbringing and education. But this is beyond the scope of this chapter. The point of this piece is threefold. First, it gives an introduction of the notion of creativity and its relevance for the purchasing profession as well as an account of extant and relevant literature. Second, it summarizes the main findings of early research into creativity in teams within the purchasing context. Third, it provides researchers with inspiration and a point of reference to conduct future research on creativity and managers with an understanding of how to manage and lead sourcing teams for maximum creative outcomes. In that context, a few essential questions are addressed. *Why is creativity needed in purchasing? How to manage for creativity in sourcing teams? How to lead for creativity sourcing teams? Where and when does creativity matter?*

If research is to find adequate answers to these questions, those working with and being affected by the phenomenon of creativity in purchasing need to be heard. That is why all answers have been derived following rigorous, scientific practices, and by involving individuals as well as teams from different industries. In a series of research projects, data has been collected in the form of desk research, personal interviews via telephone or in person, focus groups with invited participants, workshops, and surveys. In the following sections, the findings will be summarized and the main conclusions drawn.

2 Why Is Creativity Needed in Purchasing?

2.1 The Trigger for Research on Creativity in Purchasing

At the outset of this research journey in 2012 stood one fundamental question: *How can purchasing professionals create value*? This question has been and remains fiercely debated among purchasing professionals and scholars alike. Many different ideas, perspectives, and visions on "how to" exist, ranging from engaging supply partners more intensively in internal processes over connecting better with internal stakeholders all the way to updating the skillset and competencies of purchasing professionals. In a series of conversations with CPOs and purchasing managers at various conferences, during workshops and company visits one element kept coming back: the need to collectively solve problems! According to them, purchasing's ability to create value strongly depends on the profession's ability to

connect with others to develop new and relevant solutions that work. In other words, value creation in purchasing demands collective creativity.

A survey conducted among 141 purchasing professionals within the NEVI network (the Dutch Association for Purchasing Management) in 2013 helped to further substantiate the relevance of creativity and its meaning in purchasing. Nearly 70% of respondents agreed that creativity is important in the purchasing and supply management context. Asked for the extent to which their current job requires creativity, around 45% indicate that their job requires some creativity and 40% indicate that a large extent of creativity is required to carry out their current job. Respondents were also asked to explain in their own words what creativity means to them in their current job. An analysis of respondents' definitions returned the following working definition: *generating and selecting novel and meaningful solutions together with purchasing colleagues and internal stakeholders as well as with suppliers*. This definition not only captures the collective and social nature of creativity as already pointed out in pre-survey conversations with CPOs and purchasing managers. It also illustrates the pluralistic nature of problems and challenges within purchasing and confirms their categorization as wicked problems. Figure 2 outlines three examples of such collective, creative efforts in purchasing.

2.2 Three Reasons Why Creativity Matters

There are at least three specific reasons that justified research on creativity in purchasing. The first is that we live in a VUCA world. That is, in a world full of volatility, uncertainty, complexity, and ambiguity. It is in this very VUCA world that purchasing managers have to find the best source of supply for their raw materials, components, and services. The VUCA world is full of wicked problems whose resolution demands collective creative efforts. Second, and related to the VUCA world, we live in times with change occurring at a breathtaking pace. Following Heraclitus, "change is the only constant in life." We thus need to find strategies and ways to deal with constant change. One potent way is to critically reflect on the skill set of purchasing professionals to subsequently update it accordingly. In its Future of Jobs Report, the World Economic Forum regularly ranks creativity among the top-five skills demanded in the future and predicted it to be among the top-three competencies for 2020, only topped by critical thinking and complex problem-solving. Creativity equips and empowers purchasing professionals to anticipate, recognize, create, and seize opportunities. Purchasing professionals of the future are ambidextrous, they can engage in left as well as right brain activities. That is, they are experts in their field and, at the same time, possess creative capabilities. Third, purchasing is increasingly involved in innovation activities within and outside organizational boundaries. As creativity is the fuel for innovation, purchasing professionals need to understand what creativity is and how it works. To aid this understanding, the next section takes a closer look into the conceptualization of creativity by breaking it down into manageable elements before zooming in on team creativity.

Example 1: Identifying the Purchasing Need at an Oil & Gas Company
A sourcing team of a global oil & gas player was charged with identifying suppliers that would provide larger vessels to ship water from the mainland to one of the company's drilling platforms – the water is critical for operating the platform as it is used to cool the drill heads. When working together with several colleagues from Procurement, R&D, and Operations, the team started to scrutinize the actual purchase need in this project. The team realized that the actual need was not larger vessels with bigger tanks to carry more water – but in fact more water. Drawing on the diverse functional expertise of team members, the team quickly checked the potential for drilling a hole to source groundwater. After approval from relevant stakeholders, the team took action to implement the solution, thereby avoiding huge amounts of costs and delivering a quick sourcing solution in-house.

Example 2: Buying Protective Clothing at a Chemicals Company
The corporate sourcing team of a global chemicals company was confronted with the task of buying protective work gear (e.g., helmets, jackets, safety shoes) for their plant workers. Instead of applying the traditional practice of competitive bidding to reduce the number suppliers and negotiate framework agreements with the few remaining suppliers, the team pursued a more holistic solution by drawing on diverse functional knowledge of the colleagues from Finance and Accounting. By accepting slightly higher prices and selecting best quality suppliers, the team managed to simultaneously negotiate far lower insurance fees for occupational injury of workers with the insurance company. Savings realized from lower insurance fees far exceeded savings that would have otherwise been realized by negotiating lower prices for protective clothing.

Example 3: Creative procurement practices trigger supply chain innovation
Catalysts, substances that cause or accelerate a chemical reaction without itself being affected, are essential for operating refineries and petro-chemical complexes. The corporate sourcing team of a global oil producer was asked to reorganize the enterprise category for catalysts – currently managed on a local level – to improve sourcing effectiveness and secure supply. After some spend and market analysis the team decided to centralize spend at the global level. In a first step, all high level activities for sourcing of catalysts – including associated services, contract management as well as strategic tendering – were placed at the global level to leverage spend. In a second step, the team started to revise the purchasing strategy and standardized the purchasing model by incorporating technology into their contracting and procurement strategy. These changes enabled the company to better identify and have quicker access to latest technology and R&D developments in the market. In the past, suppliers had to contact procurement managers on a local level – getting approval for the use of catalysts in different regions was tedious. With the category organized at the global level, it was easier to certify a supplier's products for use in different regions and applications within the company. The company's current suppliers were thus more interested in entering into innovation relationships with the oil producer, providing readily access to their valuable knowledge on catalysts. As a result, other suppliers were encouraged to also change their profile and adopt a new, innovation-driven business model. Centralizing spend and employing technology-based purchasing thus did not only change the profile of own suppliers and lifted the business with them – creative change of one customer company triggered a whole new industry standard

Fig. 2 Examples of creativity in purchasing (author's own figure)

3 How to Manage for Creativity in Sourcing Teams?

3.1 Creativity as a Process Versus an Output

Effective management of creativity requires an understanding of its individual components and how they relate to each other. In that respect, it is essential to distinguish between creativity as an output, that is how novel and useful the idea is, and creativity as a process, that is how the idea is generated (see Kiratli 2016). If this distinction is not made, any action or attempt targeted at influencing creativity in sourcing teams is doomed to fail or at least expected to show less than satisfactory results. Managing and measuring a team's output versus a team's process while performing a task are two entirely different ball games.

Definitions of creativity as an output are consistent and mainly involve the dimensions of novelty and usefulness (Amabile 1983; Im and Workman 2004; Wang et al. 2008). The novelty of an idea implies that it is original and differs from conventional practice, while usefulness indicates that the idea provides benefits to the parties concerned. Or stated differently, "ideas cannot be merely new to be considered creative; they must be somehow appropriate to the problem or task at hand" (Amabile and Fisher 2000). Outputs are typically assessed by experts that are external to the team and knowledgeable of the domain of interest. Process describes how team inputs are transformed into outcomes. This description of process is in line with Hackman's (1987) normative model of group effectiveness according to which team inputs are transformed into relevant outcomes by means of interaction between team members. This is also referred to as the input-process-outcome (IPO) framework.

While output is relatively easy to define and measure, it is the behavioral component of creativity—creativity as a process—that remains a black box to both practitioners and academics. At the same time, as its quality and effectiveness determine output, the creative processt probably constitutes the most vital element. Hackman and Morris (1975), for instance, argue that explanations for any particular input–output relationship are hiding in the team's interaction process itself. The authors emphasize a need for "interventions that will help group members learn how to deal effectively with issues of individual differences within the group, and to create a climate that supports and facilitates learning and sharing of learning" (1975, pp. 37).

Despite the recognition of the team process being vital to creative output, extant research on the creative process by which individuals act collectively to produce creative outcomes or solve problems as a team remains scattered, anecdotal, and overly context-specific (Anderson et al. 2014; Mumford 2000). A major reason for this might be the fact that the management of creativity—in any context—is complex and paradoxical, demanding a fine balance between formal control and imaginative freedom (Amabile and Pillemer 2012; Mumford et al. 2002; Shalley and Gilson 2004). This is also an apparent challenge during collective, creative solution-finding in sourcing teams. Buyers and non-procurement stakeholders from within or outside the organization must develop a shared understanding for effective teamwork without losing sight of their targets. This proves to be a difficult undertaking, considering that team members have different priorities, functional conflict, and diverging perspectives (Driedonks et al. 2010; Englyst et al. 2008).

3.2 Creative Climates in Sourcing Teams

Albeit great potential of the team approach for superior performance, teams thus do not always provide a guarantee for success. On the contrary, many team initiatives often fail to deliver expected results. In an attempt to shed light on possible sources of failure, Moses and Åhlström (2008) identified typical problems encountered by cross-functional sourcing teams and co-innovation teams with suppliers. Among

them are the lack of a holistic view, misaligned functional goals, over-reliance on standard processes, and inefficient decision-making by team members. At sight of such difficulties, Englyst et al. (2008) criticize the lack of theoretical insights and guidance on specific processes governing effective, creative problem-solving in teams. Recent advancements of Driedonks et al. (2010, 2014) reflect emerging scholarly interest for developing such a team perspective in PSM research. With firms increasingly depending on the creative potential of teams (Fischer et al. 2005; Fisher and Amabile 2009), developing such a perspective is mandatory. Against this backround, Kiratli et al. (2016) borrowed from work-unit climate research to advance the understanding of collective creativity in purchasing.

Organizational behavior literature suggests that the group climate underlying teamwork is crucial for effective team performance (Anderson et al. 2004; Ekvall 1996). Group or work-unit climate is defined as the shared perceptions of team members regarding policies, procedures, and practices that are rewarded and supported in a specific work setting (Zohar and Tenne-Gazit 2008). As such a climate develops, individual team members may become more comfortable to experiment with new forms of behavior such as creativity and feel more confident to engage in the risky and anxiety-arousing activities required to exchange and extend knowledge and skills in a team setting (Hackman and Morris 1975). A number of properties make work-unit climate an appropriate theoretical lens for explaining how relevant creative behavior originates bottom-up within a team:

1. The process by which such climates arise is dynamic in nature, through team member interaction and socialization (Hackman 1987).
2. Climates can be facet-specific (De Jong et al. 2004; Schneider et al. 1992). That is, climate constructs can be directed at a specific goal or activity and at a specific level (Schneider et al. 2013). For an investigation of the collective sensemaking processes, that is, the process by which people give meaning to experience and cues collected from their immediate surroundings, in teams during creative problem-solving, the focal activity is creativity and the project team constitutes the level of analysis.
3. Climates are conceptualized as the shared perceptions of individual team members so that it is possible to measure it on the individual level and then aggregate individual measures to the team level. This is what is referred to as the referent-shift consensus model (Chan 1998).
4. Climates can be related to numerous important outcomes at the individual, group, and organizational level (Patterson et al. 2005). For instance, previous research has shown that climate constructs are appropriate for predicting expected performance outcomes such as creative outcomes (Si and Wei 2012) or general firm performance (Baer and Frese 2003). In a similar fashion, a sourcing team's creative climate can be related to relevant outcomes such as creative performance and financial performance.

Kiratli et al. (2016) define team creativity climate (TCC) as team members' shared perceptions of their joint policies, procedures, practices with respect to

Table 1 Measurement scale[a] for team creativity climate (table compiled by author; Kiratli et al. 2016)

1. In our team, we are open to each other's views and ideas
2. In our team, we strive to think across departmental boundaries
3. In our team, we actively seek out each other for constructive discussions
4. In our team, we encourage each other to try new ways of doing things
5. In our team, we are comfortable with exploring unfamiliar ideas and perspectives
6. In our team, we openly share thoughts without fear of rejection
7. In our team, we build on each other's ideas
8. In our team, we take each contribution seriously
9. In our team, we promote behaviors for a trustful environment

[a]Measured on a 5-point Likert scale ranging from 1 = fully disagree to 5 = fully agree

finding creative solutions. Following prudent scale development procedures, the authors conceptualized and developed a measurement scale to capture the creative process of sourcing teams by means of a one-dimensional nine-item construct (see Table 1). The authors conclude that the measurement scale provides a reliable and valid tool for capturing the collective, creative sensemaking process of sourcing teams. In addition, relatively high Pearson correlations on a sample of 52 sourcing teams reveal that team creativity climate relates positively to both, members' evaluations of their team's creative performance as well as team leader's evaluations of creative team performance. This is indicative for the explanatory power of the team creativity climate construct.

4 How to Lead for Creativity Sourcing Teams?

An understanding of how the creative process within sourcing teams takes shape and how it can be measured allows leaders to proactively and purposefully manage team members for maximum creative performance of developed ideas and solutions. Although research has addressed the issue of leadership for collective creativity, no consensus exists regarding the most optimal leadership style for stimulating problem-solving in teams (Isaksen 1992; Sirkwoo 2015; van Rossum 2007). One of the primary reasons might be that extant research has not sufficiently accounted for the different phases of the creative process, each of which potentially demands a different leadership style to promote a team's creative performance (McKinsey 2015).

A survey conducted among 50 purchasing and supply chain management professionals as described in the following confirms this. Respondents were presented with a randomized list of behaviors corresponding to one of three leadership styles:

- *Transactional leadership*, where leaders focus on supervision, organization as well as performance and promoting compliance through both rewards and punishments.

- *Facilitative leadership*, which entails empowering members to work together and helping members to contribute, speak up, and share ideas.
- *Transformational leadership*, which is about identifying needed change, creating a vision, and executing change in tandem with members.

Based on their own experience during past teamwork involving problem-solving, respondents were asked to pick from the list those leadership behaviors that in their perspective best foster collective creativity in teams. For the purpose of the study, the creative process was described following four stages:

1. Idea generation: also referred to as ideation: generation of a possibly large set of alternative ideas
2. Idea assessment: early assessment of ideas to decide whether an idea is worthwhile pursuing
3. Idea revision: refinement of an idea based on the assessment of requirements, context, resources, etc.
4. Idea selection: choosing the best solution from a short-list of ideas for implementation

While each leadership style appeared to be somewhat relevant in all stages, results confirm that one leadership style is typically dominating in each stage of the creative process (Fig. 3). Specifically, while leaders should apply a facilitative leadership style across all phases of the creative process, respondents indicated a need for an emphasis on transformational leadership during the ideation stage as compared to a more transactional approach toward the idea selection stage. These results indicate that, especially during the divergent phase of the creative process,

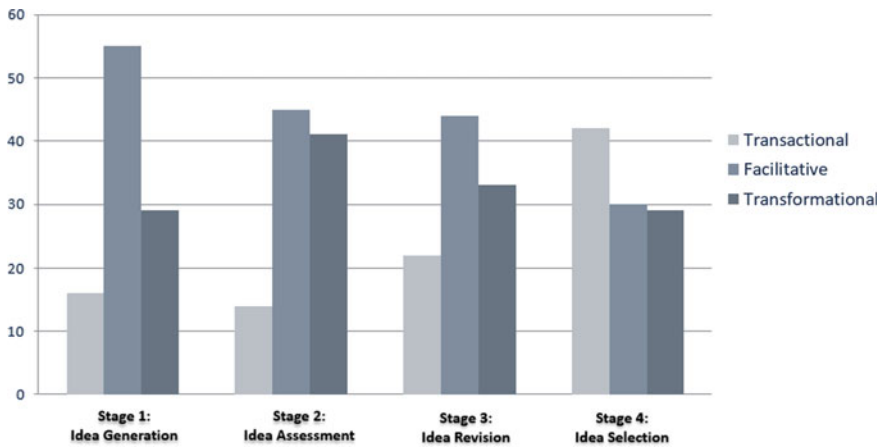

Fig. 3 Dominant leadership styles in the creative process (% of respondents indicating leadership style to fit best the respective stage of the creative process) (author's own figure)

teams perform best when empowered, facilitated, and supported by their team leader. Once ideas are being revised and the team converges in order to select the best solution, the team relies on a somewhat more directive leader to make sure "the job gets done." Bottom-line: team leaders must attend more closely and carefully to the different requirements of collective creativity at different stages of the creative process and adapt their leadership behavior accordingly. That is, leaders need to become ambidextrous themselves for leading teams towards creative outcomes.

5 Where and When Does Creativity Matter?

5.1 Mapping Creativity in Purchasing

All insights gained into the creative process of sourcing teams are invaluable if one does not know the context in which the team operates. Since teams are embedded into an organizational context, they are thus subject to pressures, contingencies, and requirements of their immediate surroundings. There is a paucity of knowledge about the specific contexts in which creative problem-solving and solution-finding can lead to valuable outcomes. The extent to which creativity is relevant varies such that even in one and the same organization, creativity might matter in some but not in other situations. A better understanding of where and when creativity can be applied is crucial to help organizations become more systematic and strategic in encouraging creativity for value-creation purposes. Hence, a systematic overview of where and when creativity matters in the purchasing context is essential to allocate time, talent, and resources to where and when creativity matters most.

Practitioners tend to rely on processes, tools, and frameworks to formulate sourcing strategies and effectively fulfill corporate objectives. PSM scholars have, therefore, developed models and frameworks to visualize and study different purchasing contexts. For the following set of studies, three prominent frameworks were selected to provide practitioners and scholars with a first insight into where and when creativity can be applied:

- *Purchasing maturity model*, a spreadsheet with different stages of maturity that is determined by a purchasing's organization scoring on several dimensions, including strategic alignment, supplier relationship management, internal organization, skills, and competences (see van Weele 2009).
- *Kraljic matrix*, developed by Peter Kraljic in 1983, allows segmenting sourcing items into one of four quadrants (strategic, bottleneck, leverage, and routine) along two dimensions, risk and profitability.
- *Strategic sourcing process*, a management tool that maps the distinct stages of the purchasing process and designed to simplify and streamline the purchasing within an organization (see van Weele 2009).

In order to map creativity across each of these frameworks, two sets of interviews were conducted. The first set of interviews was conducted to assess the impact of creativity in purchasing organizations at different stages of purchasing maturity. The 12 interviewees were purposefully selected based on their level of seniority either in terms of job experience (>10 years) or their position (senior management) to ensure that interview partners would grasp the concept of purchasing maturity and would be able to give an account of the relevance and impact of creativity in their organization (Table 2a). At the beginning of each interview, interviewees assessed their purchasing organization's maturity level and then reflected on the general atmosphere and perception toward creativity among employees.

The second set of interviews was conducted with 12 individuals who were selected according to their experience with and involvement in sourcing teams over a consecutive number of years and across a variety of industries (see Table 2a). The purpose of this set of interviews was to assess whether creativity is more impactful in sourcing certain types of items within the Kraljic matrix and in which stage of the strategic sourcing process creativity occurs. The results of these two sets of interviews are summarized in the following sections. Interviewees had to first recall and describe a sourcing project within which they had experienced a high level of creativity and then categorize the assignment as one of four purchasing situations within the Kraljic portfolio.

5.2 Purchasing Maturity

Maturity models have been introduced to track purchasing organizations' evolvement from a transactional orientation of focusing on price reduction to a value-generating business function that focuses on cost reduction and revenue growth. Each maturity stage prescribes the skills, goals, and approaches an organization employs and fulfills. Higher levels of maturity are equated with more sophisticated approaches toward value creation in terms of cost reduction and revenue growth. In the study, the model served as a guiding framework to systematically investigate whether the occurrence of creativity correlates with one of the "six flavors" of purchasing (Rozemeijer 2008), corresponding to six stages of purchasing maturity (Fig. 4). In other words, does the applicability and appropriateness of creativity as a competence depend on the maturity stage of a purchasing organization? Companies in stages four through six, for instance, are associated with a strategic approach toward purchasing with more need for creative solutions. Does this mean that creativity is only relevant for mature purchasing organizations? Or is creativity a competence that is also relevant for less mature purchasing organizations? Purchasing development models merely serve as a framework to systematically identify and map creativity. As the underlying logic of how creativity relates to purchasing maturity is not clear, no path-dependency was assumed up front. The aim of the study was to build theory, thereby contributing to the competence literature within Purchasing and Supply Management (PSM) and not to

Table 2 *a* Interviewees for mapping creativity against purchasing maturity (table compiled by author). *b* Interviewees for mapping creativity in the strategic sourcing process and the Kraljic matrix (table compiled by author)

a

No.	Industry	Position	# of employees	Work experience
1	Consulting	Senior Consultant	>100,000	1 year
2	Consulting	Senior Consulting	>100,000	5 years
3	Consulting	Owner & Partner	<250	3 years
4	Consulting	Consultant	Self-employed	10 years
5	Training	R&D Manager	<50	26 years
6	Training	Knowledge Manager	<50	8 years
7	Training	Consultant	Self-employed	7 years
8	Life science	Director Purchasing Excellence	<25,000	15 years
9	Life science	Purchasing Excellence Advisor	<25,000	18 years
10	Technology manufacturing	Manager Purchasing	<25,000	4 years
11	Technology manufacturing	Director Purchasing	<25,000	20 years
12	Technology manufacturing	VP Global Purchasing	<25,000	13 years

b

No.	Industry	Position	Company size	Work experience
1	Healthcare	Director Risk & Operations	<25,000	0.5 years
2	Healthcare	Senior Purchaser	<25,000	12 years
3	Cultural institution	Purchasing Manager	<500	17 years
4	Technology manufacturing	Manager Key Accounts	<10,000	25 years
5	Furniture	Procurement Manager	<500	8 years
6	Public sector	Procurement Manager	<50	16 years
7	Real estate services	Procurement Advisor	<500	4 years
8	Public sector	Consultant	<25,000	14 years
9	Consumer goods	Sourcing Manager	<50,000	5 years
10	Pharmaceutical	Procurement Manager	>100,000	5 years
11	Public sector	Procurement Advisor	<10,000	11 years
12	Furniture	Procurement Director	<10,000	12 years

literature on purchasing development models. The study was about calibrating creativity in PSM and making it accessible for future empirical research and more transparent for practitioners.

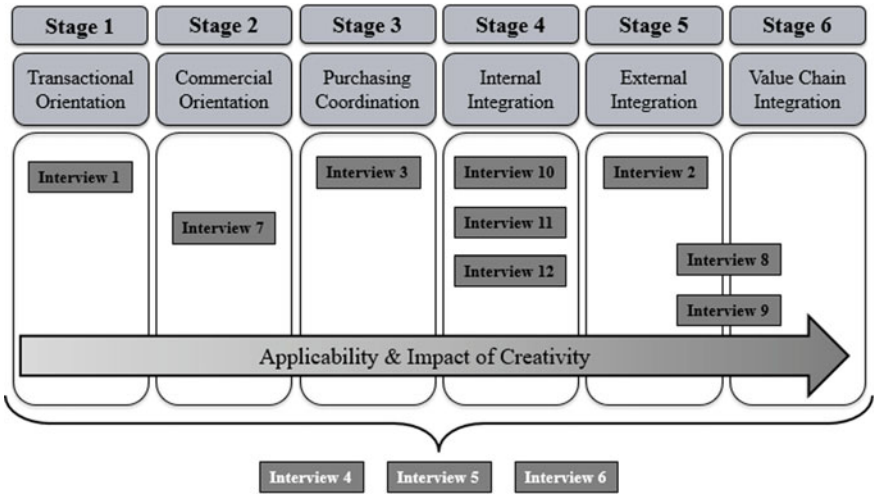

Fig. 4 Creativity and purchasing maturity (author's own figure)

The sampled senior purchasing professionals' companies represented all stages of purchasing maturity, allowing comparison of creativity across the entire range of purchasing maturity (see Table 2a). As interview partners 4, 5 and 6 work for consulting companies, they drew on their general experience to reflect on the occurrence and applicability of creativity across different stages of maturity. Participants were asked to comment on the general status quo of creativity within their company and describe the overall work atmosphere.

In stage 1 and 2, work is very routine-based, thus not demanding or encouraging high levels of involvement or engagement from employees. The work atmosphere is low on energy, passion, and drive. According to the interview partner, employees lack a sense of purpose and recognition by internal stakeholders. As a result, creativity is basically non-existent—no one feels ownership for "doing things differently and better." The interview partner representing a stage 3 company perceived the atmosphere as well as employee base as split: while the younger, more dynamic employees long for change and permission to creatively transform the purchasing organization, the older, more tenured employees resist change. Because of this phenomenon of "two paces" many younger employees leave the organization to unleash their creative potential elsewhere.

Stage 4 provides a clear cut in terms of the applicability and occurrence of creativity as interview partners representing stage 4 or higher mention creativity as a key competence of the modern purchasing professional. All interviewees characterized the work atmosphere as joyful, challenging but stimulating and noted a sense of purpose, future-orientation as well as drive and purpose among their colleagues. As procurement directors have at least direct communication lines to the management board if not a seat at the boardroom table, the purchasing organization

could directly contribute to achieving corporate goals. This appeared to be a decisive factor for unleashing and triggering buyers to pursue new ways for creating value beyond standard KPIs. The adoption of a broader business view within the purchasing organization is also reflected in the variety of KPIs such as risk management, innovation, cost, and quality to monitor purchasing performance. Cross-functional teamwork was cited as the major instrument for igniting creative thinking and problem-solving among purchasing and non-purchasing stakeholders.

Interestingly, two of the participants sharing their experience across all stages came to the conclusion that—in theory—creativity can occur at any development stage if work atmosphere, most proximate colleagues as well as internal stakeholders recognize and value it. Stages would only differ in terms of the impact that creativity has in terms of benefitting the bottom- and top-line. The third was convinced that creativity is a competence reserved for buyers and organizations at the higher level of purchasing maturity. In conclusion, findings from the interviews are indicative for creativity to increase in applicability and appropriateness with progressing purchasing maturity.

5.3 Kraljic Matrix

As a reinforcement of his famous quote "Purchasing must become supply management," Kraljic (1983) developed the Purchasing portfolio. Depicting four sourcing situations mapped along two axes, purchasing impact and supply risk, the purchasing portfolio is regarded a strategic tool as it allows prioritization of purchasing activities and effective allocation of resources (Olsen and Ellram 1997). Given recent economic, environmental, and market developments, purchasing managers must tackle sourcing challenges in more compelling, creative ways. Yet, there is still a lack of guidance and knowledge on whether creativity is relevant for all sourcing situations (Kiratli et al. 2016). Similar to Knight and colleagues (2014), our study attempted to profile creative competences according to "purchase type".

The 12 interview partners shared their experience and perception of 17 sourcing projects in total—some participants shared two exemplary assignments. A short description of all projects can be found in Table 3, the appendix contains the full descriptions of sourcing projects ordered by purchasing type. The sourcing assignments occurred across a variety of different industries, include goods as well as services and represent different sourcing situations (Table 2b). Interviewees made a clear distinction between creative *approaches* and creative *solutions*. An *approach* refers to the process by which a solution is developed or conceived. In more than half of the cases (53%), it was the application of non-standard, novel tool, process, approach or resource that led to an effective solution of an underlying problem or identified value-creation opportunity. In about a third of the cases (29%), interviewees observed creativity in terms of the solution the sourcing team had worked out. *Solutions* were regarded creative when they were novel—deviating from the norm and usual ways of solving a similar sourcing problem—and led to desired performance outcomes in terms of relevant KPIs such as cost savings, risk mitigation, and

Table 3 Short description of examples (table compiled by author)

No.	Sourcing Assignment	Industry	Description
1	Sourcing medical devices	Healthcare	Exchanging and discussing with non-procurement stakeholders outside the healthcare industry to ask critical questions and challenge existing thinking
2	Sourcing implementable cardioverter-defibrillator	Healthcare	Establishment of new specifications together with internal and external stakeholders, demanding suppliers to ensure the latest technology during contracted period
3	Sourcing multimedia tour	Cultural institution	Involvement of relevant stakeholders to challenge specifications, identify actual purchase needs, modify specifications, and make better use of core competences
4	Sourcing closed-circuit video system	Cultural institution	Investigation of the market with critical "why" questions to replace technical specifications with functional specifications to attract better suppliers
5	Sourcing chemical product	Digital printing	Speeding up approval of new supplier through integrating R&D into decisions instead of simply imposing choice, thereby allowing better financing
6	Sourcing aluminum die-cast product	Furniture	Interacting with local governments and stakeholders to develop a circular supply network for an item that was re-shored from an Asian supplier to the NL
7	Sourcing tools and equipment (e.g. hammer, screws)	Furniture	Sourcing materials from single supplier and shifting storage responsibility to supplier in order to free up warehouse storage place needed to expand production
8	Construction of sports center	Real estate services	Employing a total cost of ownership approach to construct a sports center within 4 years when traditional ways of tendering and contracting failed twice
9	Construction of low rent buildings	Real estate services	Consulting an academic expert for developing a new tender procedure that would convince suppliers to engage in a higher risk purchasing contract
10	Sourcing of heating systems	Real estate services	Reconsidering what internal customers actually demand, thereby identifying the actual purchase need and changing specifications and contracts accordingly
11	Increase customer service	Public sector	Involving suppliers from different industries to find and implement a solution from the technology industry that would satisfy customer needs
12	Sourcing flight tickets	FMCG (hygiene)	Assuming the supplier perspective to change the basis of negotiations, thereby getting a better deal that would save costs and satisfy the supplier's revenue threshold.

(continued)

Table 3 (continued)

No.	Sourcing Assignment	Industry	Description
13	Sourcing functional material	FMCG (liquor)	Finding and developing a new supplier outside the industry and the regular supply markets to guarantee supply flows and continuation of production
14	Sourcing packaging material	FMCG (hygiene)	Bringing together two knowledgeable suppliers to develop an innovative solution for a persistent and strategically critical packaging problem
15	Switching from local to global marketing agencies	FMCG (pharma)	Convincing local business partners switch from local to global marketing agencies by bringing the business partner and global suppliers together on an 'Agency day'
16	Sourcing IT application services	Public sector	Enabling smaller suppliers to participate in a European tender by means of a "broker construction" with smaller suppliers executing their contract under a larger contractor
17	Office visitor chairs	Furniture	Spreading supply and production risk by recruiting several suppliers to deliver spare parts and components, and yet others for assembling the product

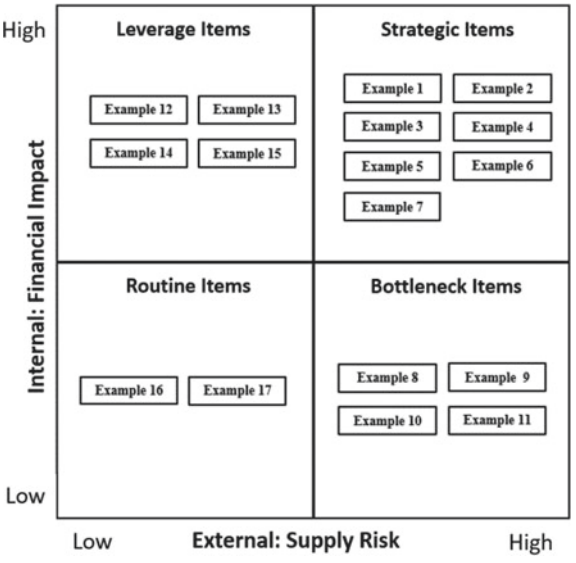

Fig. 5 Mapping creativity in the Kraljic matrix (author's own figure)

cash flow. In the remaining cases (18%), interviewees regarded both, the approach toward finding a solution as well as the solution itself, as creative. An inspection of Fig. 5 reveals that most sourcing assignments can be classified as strategic category projects (41%) followed by leverage and bottleneck category projects (23%). Least projects were observed in the routine category (12%).

A few conclusions follow from these observations. First, creativity in approach and solution seems to foremost occur during sourcing assignment in the strategic category. Despite the lack of evidence for the direction in causality, it seems plausible that the high financial impact and supply risk involved in this type of projects call for creative approaches and solutions to maximize value creation. Buyers might especially benefit when pursuing new paths and never-tried-before solution strategies to fulfill standard expectations and meet KPIs.

Second, findings suggest that whenever a sourcing assignment is categorized as high on any of the two axes of the purchasing portfolio, buyers should at least consider looking for solutions off the beaten procurement-paths. Even though interview results indicate creativity to be somewhat less relevant in bottleneck and leverage categories, it could pay off to gauge the applicability of a somewhat more creative approach toward the assignment—in terms of a novel approach and solution. For sure, creativity can be a last resort option in case traditional approaches and solutions fail consecutively.

Third, creative solutions can be found everywhere—even in routine categories, though to a lesser extent. Altogether these findings give managers a better idea for allocating creative talent, investing resources, and assigning management priority across different sourcing assignment when pressed for time, money, and bottom-line results.

5.4 Strategic Sourcing Process

While the number of steps and the level of detail vary, nearly every purchasing department follows a strategic sourcing process. Keough (1993) introduced a six-step model and argues that the strategic relevance is higher in the beginning of the process. In his paper, the author argues that purchasing has most impact and most room for involvement in the specification and supplier selection phase. Managers must develop and apply distinct creative practices to address new challenges and fulfill their strategic role throughout the entire sourcing process. Since purchasing professionals are usually member of multiple sourcing teams, it is of utmost importance for them to carefully allocate and manage personal resources such as time, skills, and expertise—creativity is such a resource. Following Keough's argumentation, creativity is expected to be applied mainly in the first two steps of the sourcing process.

In terms of the applicability and appropriateness of creativity throughout the strategic sourcing process, more than half of the interviewees agreed that especially the first two steps call and allow for creativity (see Fig. 6). Especially the specification phase gives purchasing professionals plenty of room to have a large impact on sourcing outcomes. For instance, using their expertise and internal or external

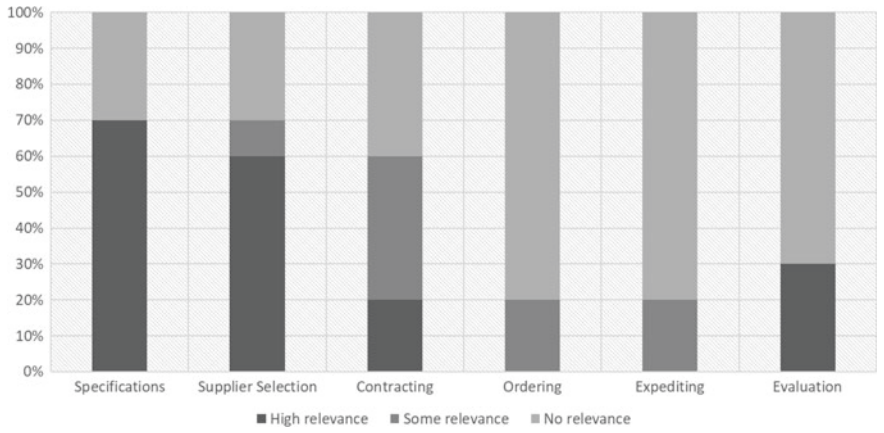

Fig. 6 Relevance of creativity in the strategic sourcing process (author's own figure)

networks, purchasers can help stakeholders to identify actual purchase needs and effectively change the purchasing specifications. Drawing on their knowledge of supply markets, purchasers can then also suggest new, effective ways for identifying, contacting or attracting the right suppliers. Interviewees agreed somewhat less with respect to the role of creativity during the contracting stage—20% see room for creativity, 40% do not regard creativity to play a role while another 40% think it is somewhat applicable. Reasons for this indecisiveness of respondents might be the fact that negotiating and contracting was traditionally the bread-and-butter business of purchasing—the deal-making moment where large cost savings were born. It might take a while until buyers get comfortable with their hobby horse being replaced by new forms of deal-making. Interviewees were rather unanimously with respect to the last three stages of the purchasing process. Commonly referred to as the purchase-to-pay (P2P) process, ordering, expediting, and evaluation are very operational, often-times automated tasks. As a result, 80% of interviewees did not see a lot of potential for creative approaches within these. In light of intensified efforts to digitize and automate many manual and tactical purchasing activities, however, this opinion can be contested: optimal exploitation of technological advancement is a function of purchasing professionals creatively imagining fields of application for rapidly evolving technology. The extent to and manner in which collective, creative efforts can contribute to further advancing the purchasing profession is subject to further research up research. Finally, the evaluation stage—if managed and approached creatively—might provide the starting point for a continuation of the sourcing relation or a follow-up project with the respective supplier.

6 Conclusion

Creativity as the precursor to all innovation is slowly but surely also appearing on the radars of purchasing professionals. Given increasingly complicated, complex, and fast-changing business environment, creativity is a powerful ally and is projected as a key competence for next-generation purchasing professionals. A set of studies involving purchasing professionals constitute the first attempt to establish creativity as a phenomenon in purchasing and systematically map it in the PSM context. Findings provide a promising beginning to further manifest creativity as a key competence for continued cost savings and augmented value creation—but require follow-up by means of broader-scale, empirical research with industry samples. Ultimately, creativity is here to stay!

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Appendix

Strategic Category

Example 1: Sourcing of Medical Devices

During a workshop a cross-functional team composed of two purchasing specialists from two hospitals and one finance director from the banking industry was given the task to establish a rather straight forward proposal about how purchasing can be more efficient in sourcing medical devices in hospitals. Sourcing medical devices are of strategic importance to hospitals. Through discussing their ideas and asking questions to each other, the subject and perspective changed to how purchasing can add more value for the patient. Thus, a new approach was taken on by taking the perspective of different stakeholders, including patients, doctors, and nurses. Through asking "why" and "how" questions non-purchasing stakeholders like the finance director, challenged the usual purchasing procedures and triggered reconsidering the purchasing process and procedures. This approach was seen as a totally different way of looking at purchasing, departing from a simple cost-cuttings function to one that would most efficiently buy medical devices.

Example 2: Sourcing of Implementable Cardioverter-Defibrillator

Within the healthcare industry, the purchasing function of a big University Hospital was given the task to source implantable cardioverter-defibrillator (ICD) while saving costs. ICDs are items categorized as having high financial impact and supply risk. All surgery hospitals are subject to strict European tender regulations and suppliers are constantly improving their models. Hence, contracts were traditionally renewed on a regular basis and purchasing had to constantly search the market for the best model. Driven by stakeholder input, the purchasing manager had the idea to establish a new set of product specifications (specs) with which purchasing would go to the market. These were restricting suppliers to ask a maximum price and ensuring they always provided the newest top model during the entire time being under contract. This resulted in having longer contract periods while ensuring that purchased models would be up to date. Further, as no research money was demanded from the supplier, the hospital would be less dependent on the supplier while keeping a good relationship. Thus, while the approach of sourcing the items was done through a traditional European tender, changing the specifications ensured that the solution sourced was different and new.

Example 3: Sourcing of Closed-Circuit Video (CCV) System

Within the cultural institutions, the purchasing manager of a big museum had to renew the supplier contract for closed-circuit video (CCV). These items are considered as having a high financial impact and supply risk and have been outsourced from the same supplier for many years. Thus, the purchasing manager saw the opportunity to re-investigate the market to find a potentially better supplier. Through his often-used approach of asking "why" questions to all stakeholders capturing their needs and wants, he discovered what was actually needed and developed functional questions instead of technical ones. Thus, through the approach of changing perspective from a technical side to a functional side, he was able to ask for different specifications to the market. As a result, the initial supplier was better able to serve exactly their needs and was able to reduce its price.

Example 4: Sourcing of Chemical Product

Within the digital printing industry, the purchasing manager was given the task to source a chemical product, while saving costs. This chemical product was seen to have high financial impact and high supply risks, and as switching suppliers was not easy. The main cost savings were seen to be generated if Supplier A could take over the product volume of Supplier B. However, the R&D function needed to approve Supplier A to be capable of supplying the product of Supplier B with the same quality. The problem was that the R&D function did not have enough

financing resources to approve Supplier A. First, the purchasing manager started to change the question asked to the R&D function from "why is it not possible?" to "when is it possible." R&D perceived this question as less offensive and thus people started to think in a "creative way." The solution resulted from this approach was in the end having the Supplier A paying for the R&D and once the product of Supplier A was approved, the company would pay back the supplier. This "new financing model" was seen as a creative solution to tackle the problem of financing.

Example 5: Sourcing of Aluminum Die-cast Products

Within the furniture industry, a multinational company could not trust a supplier anymore and decided to re-shore from Asia to the Netherlands sourcing of aluminum die-cast products, which were considered as having high financial impact and supply risk. Further, through interacting with local governments and employer organizations, the idea was to transform the product into a circular one. Due to the economic principles and regulations for making the transformation, the company could not just conduct standard market research and ask for quotes in order to identify a new supplier within the Netherlands. Thus, through a cross-functional team and by involving externals as well, the company decided to use a new approach of social networks to find a partner to form alliances with in order to transform the product into a circular one.

Example 6: Sourcing of the Heating System of Houses

Within the public sector, the purchasing leader of a real estate service company was responsible to source the heating system for houses. These were generally considered as having a high financial impact and supply risk. Traditionally, all sub-parts were purchased from different suppliers and assembly was done internally. The purchasing leader was given the task to save costs. By taking a different perspective, he started to think about what the end product really was, instead of how it works and how it is composed from the technical side. Mainly, by asking to relevant stakeholders the question of "what does the company want to deliver to the customer?", he decided to change his way of approaching the market. Thus, through questioning, it came up that the actual need is to have an entire heating system. By changing the way of thinking to look at the actual end product, of what is needed, instead of its composition and functioning, the real estate service company contracted a full service supplier who would then supply the entire system, including installation and maintenance. This focus on actual needs and the total cost of ownership resulted in overall lower costs.

Example 7: Sourcing of Functional Material

Within the liquor industry, a US business partner wanted to launch a new product and addressed the sourcing manager of a company for questions about the design and materials, such as delivering in a wooden bottle and especially on how to place a sticker on the bottle. However, this type of needed sticker—a tacky material or kind of rubber—was not available in the industry. The functional material to be sourced was seen as having a high financial impact and supply risk. By forming a cross-functional team composed of all relevant stakeholders, the team started to look for solutions beyond their own industry and thus tried to find a supplier who would—with some modifications to their product—be able to serve the liquor industry. However, especially due to the resistance and inflexibility of many suppliers to serve another industry, it was difficult to find one. Nonetheless, the team ended up finding a suitable supplier in the motion capture industry. The suppliers were specialized in technical materials and ready to try and serve a new industry. Thus, taking on a new approach of looking beyond its own industry, the company was able to find a suitable supplier, who through innovative changes and adoptions of processes and specifications could supply the needed solution.

Bottleneck Category

Example 8: Constructing Low Rent Buildings

Within the public sector, a real estate service organization planned to build low rent houses in a small municipality. However, due to the financial crisis, a European Tender would not have been possible: the high costs of tendering and banks' reluctance to lend money would not incite any supplier to make an offer. In case of a tender, the supplier would have to buy the land very soon, which was perceived to be too risky by them. Since finding a supplier was difficult, the supply risk was relatively high. Purchasing's task was to find another way to get the supplier to buy the buildings. Together with a cross-functional team, the appointed project leader sought the advice of a university professor to work out a new approach. In the new approach, the real estate company took the perspective of the supplier in order to generate a win-win situation. This implied signaling and proving to potential partners that demand for housing existed, thus decreasing the risk to potential suppliers substantially and applying regular market research to identify viable suppliers, thus bringing down costs considerably. In the end, a suitable supplier saw the opportunity and built the houses.

Example 9: Sourcing of Packaging Material

Within the hygiene industry, a multinational company is producing very light-weight products, for which a good stretch film is necessary to wrap the pallets for transportation. It was observed that if not correctly wrapped with high-quality films, the products would arrive damaged. Thus, the stretch film was considered to have a low financial impact but to bear high supply risk. Traditionally, the film was sourced by searching for the cheapest supplier. As products were often damaged, the sourcing manager had the task to find a way to save costs, while ensuring the quality of product. Two purchasing and sourcing managers realized that it is suppliers that know most about film and thus started to take on a new approach of bringing the material supplier and the wrap machine supplier together. Therefore, the purchasing managers set out to find a material supplier who would be able to work together with the company's machine supplier. As a result, the new material supplier and the machine supplier developed a new multi-layer film that was rolled out across European, resulting in less damaged products and overall lower costs.

Example 10: Sourcing of IT Application Services

Within the public sector, IT application services have been entirely outsourced. As the contract to a big service provider is soon about to expire and a renewal will be necessary, the authority realized that the contract established years ago was set up too specific and tailored to the time when it was set up. Further, smaller suppliers are often more innovative, as the big ones are too standardized in their solutions. However, the smaller suppliers could not be contracted, as the authority is required to contract within the European tender, where smaller parties, due to a lack of resources, do not participate. Thus, the purchasing function was asked to find a way to provide more flexibility and give smaller suppliers a possibility to be contracted. By establishing a cross-functional team, where through several discussion rounds of what is and what is not possible, the idea to use a so-called broker construction came up. As a broker was already used in HR to find employees, why would it not work in the IT application service category as well? In this case, it would be a larger service provider who would through sub-contracting ensure servicing through smaller suppliers. Thus, the smaller suppliers running under the larger supplier's contract would be able to provide innovative services, while the larger provider would supply the traditional services and is contracted through a European tender. Furthermore, this gave larger suppliers the choice between engaging as broker and becoming innovative itself.

Example 11: Sourcing of Office Visitor Chairs

Within the furniture industry, a multinational company was traditionally out-sourcing different parts of an office chair, while doing the assembling as well as

some parts internally. These chairs were considered as having low financial impact at high supply risk. As the company decided to close the factory where these chairs were assembled and partly produced, the task for purchasing was to find a way to outsource. The traditional solution and straightforward thought were to find a supplier able to provide the entire chair. However, outsourcing to one supplier was seen as too risky due to lead times and being less flexible. Through building up a cross-functional sourcing team, a solution was developed of redirecting responsibilities and structure risk in a creative way. Mainly, the company would still be in charge of sourcing all items, which have always been outsourced. Further, purchasing set out to identify new suppliers for sourcing previously internally produced parts and for assembling all items. Thus, the solution was focused on risk spreading, which helps the company to keep more control over the product while maintaining maximum flexibility. In addition, suppliers became creative in how the previously internally produced parts could be produced as they were subject to technical limitations.

Leverage Category

Example 12: Sourcing of Flight Tickets

Within the hygiene industry, a multinational company purchased flight tickets for their employees, which were traditionally sourced through a global agency and perceived as having high financial impact and low supply risk. The company had a certain deal to get a bonus, which was in percentage of total volume of flight tickets bought from the airline. However, the sourcing manager was given the task to see whether the company could get a better deal and being able to save more money. In turn, the sourcing manager had the idea to establish a direct deal with a national flight company. The manager took on the perspective of the airline and investigated how to arrange a deal that would yield a win-win situation for both. By involving a cross-functional team, including the airline, a new deal was arranged of giving a certain bonus based on the percentage of total flights purchased with the airline to a certain destination. Thus, by taking on the perspective of the supplier, the sourcing manager together with the cross-functional team managed to develop a creative new supplier's bonus model, which was more detailed in how, when and how much to receive a bonus. This increased the companies' incentive to book from the national airline, as it yields a higher saving through bonuses than before and it was beneficial for the supplier as more flights were booked.

Example 13: Sourcing of Multimedia Tour

Within the cultural institutions, the purchasing manager of a big museum was given the task to search the market to upgrade the traditionally outsourced audio tour to a

multimedia tour. Initiated by the purchasing manager, he investigated the business model and started to ask several "why" questions to all relevant stakeholders in order to gain a better understand of what is actually needed. Thus, through discussing and reconsidering the business model, he identified several elements that could be made instead of bought and vice versa. This tour is considered as having a high financial impact and low supply risk. As a result, instead of completely outsourcing and receiving a small percentage of revenue, the personnel, content, and storyline for the tour were done internally, while the devices and software were outsourced. Further, the outsourced parts were found by selecting a partner through asking functional questions to the market. The new solution, where responsibilities were redirected, resulted in having more control, higher customer satisfaction, and achieved educational goals. Generally, the approach of the purchasing manager to ask "why" questions has been used by him in several occasions at the museum as it enhances stakeholders to rethink their ideas and broadening their perspective and different solutions will come into play, thus generating creativity.

Example 14: Constructing a Sports Center

Within the public sector, the municipality promised to realize a sports center within four years, and the purchasing manager of a real estate service organization was given the task to outsource as much as possible. Constructing the sports center was considered as having high financial impact, although low supply risk as many construction firms are available. However, the traditional way of contracting with a conventional tender failed twice. Thus, the purchasing manager realized the need to use an approach of taking on a broader perspective and to look at the entire total cost of ownership. However, this meant the municipality had to combine different budgets, such as maintenance, energy, and construction, which was not common within the municipality as people were described as still thinking in boxes and as being very budget focused. Further, no experience within their industry was available. Through convincing and discussing with the head of the department and the alderman about the new approach, the purchasing manager managed in the end to receive a higher budget and to find a supplier, through EU tendering, who then was a long-time partner, doing all the construction and maintenance. Thus, in the public sector, the approach to take on a TCO view, as well as the solution of having a partner for construction and maintenance for years was entirely new.

Example 15: Switching from Local to Global Marketing Agencies

Within a multinational pharmaceutical company, the global purchasing manager set up a global strategy to be implemented in each market of passing from local marketing agencies to global agencies. The project has been seen as having a high financial impact and low supply risk. The strategy has been met with strong

resistance from local business partners. Thus, the purchasing manager was given the task to implement this global strategy within the local market. The manager initiated the idea to use a new approach of bringing the business partner and global suppliers together by implementing an "agency innovation day." During this day, all suppliers would come together with the category managers and business partner on a voluntary basis to align all needs and wants with what the suppliers can offer. Suppliers had the chance to present projects they already did and best practice examples and see how suppliers can serve their business as well. Business partners were already involved right from the beginning to set up the agenda of the day with topics of their interest, as well as being offered test projects from the suppliers. Thus, through the new approach of bringing them together, business partners reduced their resistance, discovered the advantages of the global suppliers, and thus the company was able to reduce costs due to global synergies. Due to its success, the supplier day is repeated once a year.

Routine Category

Example 16: Sourcing of Hammer/Screws Products (Routine Category)

Within the furniture industry, a multinational company had initially sourced several small routine items considered to have low financial impact as well as low supply risk, such as hammers and screws, from many different suppliers. The purchasing manager was asked to find a solution to store the items, as the warehouse storage place was needed in order to expand their production. The idea was to outsource all items and to consolidate the supply base to only one supplier, who would also store the items until employees needed them. This solution was especially new to the employees as they had to change their habits and way of ordering and planning, as lead times increased somewhat. Nonetheless, in the end, the solution of redirecting responsibilities to one supplier helped to overcome the problem of storage.

Example 17: Increasing Customer Service

Within the public sector, the government had the goal to increase customer services by helping inhabitants to find their bicycles easier back, when these have been collected from the municipality due to consideration as left alone. This project was seen as having a low financial impact and low supply risk. Through first asking functional questions and inviting the market to present solutions a cross-functional team was formed. Besides purchasing, the depot and the person responsible to collect the bikes, as well as suppliers from different industries were involved to generate and build upon ideas. Through discussions, the solution of creating an app that would help people to find their bikes more easily and quickly was generated.

Thus, through involving suppliers from different industries and being open to search across different industries, it was possible to find and implement a solution from the technology industry.

References

Accenture. (2011). Compulsive contributors more is asked and more is delivered: Accenture research and insights into high performance in procurement. Available at: http://www.cpwerx.eu/SiteCollectionDocuments/PDF/South%20Africa/Accenture-Compulsive-Contributors-More-is-asked-and-more-is-delivered.pdf.

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 4*(2), 357–376.

Amabile, T. M. (1996). Creativity and innovation in organizations. In Amabile, T. M. (Ed.), *The motivation for creativity in organizations* (pp. 1–15). Cambridge: Harvard Business School Press.

Amabile, T. M., & Fisher, C. M. (2000). Stimulate creativity by fueling passion. In Locke, E. (Ed.). (2011). *Handbook of principles of organizational behavior: Indispensable knowledge for evidence-based management*. New York: Wiley.

Amabile, T. M. (1998). *How to kill creativity* (Vol. 87). Boston, MA: Harvard Business School Publishing.

Amabile, T. M., & Pillemer, J. (2012). Perspectives on the social psychology of creativity. *Journal of Creative Behavior, 46*(1), 3–15.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management, 40*(5), 1297–1333.

Anderson, N., De Dreu, C. K., & Nijstad, B. A. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of organizational Behavior, 25*(2), 147–173.

Baer, M., & Frese, M. (2003). Innovation is not enough: Climates for initiative and psychological safety, process innovations, firm performance. *Journal of Organizational Behavior, 24,* 45–68.

Busch, J. (2013). *Procurement in 2020: Creativity and innovation (Sourcing Ideas)*. Available at: http://spendmatters.com/2013/08/27/procurement-in-2020-creativity-and-innovation-sourcing-ideas/.

Camillus, J. C. (2008). Strategy as a wicked problem. *Harvard Business Review May Issue*. Available at: https://hbr.org/2008/05/strategy-as-a-wicked-problem.

Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology, 83*(2), 234–246.

Chapman, T. L., Dempsey, J. J., Ramsdell, G., & Reopel, M. R. (1997). Purchasing: No time for lone rangers. *The McKinsey Quarterly, 2,* 31.

De Jong, A., De Ruyter, K., & Lemmink, J. (2004). Antecedents and consequences of the service climate in boundary-spanning self-managing service teams. *Journal of Marketing, 68,* 18–35.

Deloitte. (2016). *The Deloitte Global CPO Survey 2016. Procurement: at a digital tipping point?* Available at: https://www2.deloitte.com/content/dam/Deloitte/de/Documents/technology/Global-CPO-Survey-2016.pdf.

Driedonks, B. A., Gevers, J. M., & van Weele, A. J. (2010). Managing sourcing team effectiveness: The need for a team perspective in purchasing organizations. *Journal of Purchasing and Supply Management, 16*(2), 109–117.

Driedonks, B. A., Gevers, J. M., & van Weele, A. J. (2014). Success factors for sourcing teams: How to foster sourcing team effectiveness. *European Management Journal, 32*(2), 288–304.

Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology, 5*(1), 105–123.

Englyst, L., Jorgensen, F., Johansen, J., & Mikkelsen, O. S. (2008). Commodity team motivation and performance. *Journal of Purchasing and Supply Management, 14*(1), 15–27.

Fisher, C. M., & Amabile, T. M. (2009). Creativity, improvisation and organizations. In *The Routledge companion to creativity* (pp. 13–24). Routledge.

Fischer, G., Giaccardi, E., Eden, H., Sugimoto, M., & Ye, Y. (2005). Beyond binary choices: Integrating individual and social creativity. *International Journal of Human-Computer Studies, 63*(4), 482–512.

Forbes. (2015). *Sourcing is a competitive differentiator at Target*. Available at: http://www.forbes.com/sites/stevebanker/2013/10/29/sourcing-is-a-competitive-differentiator-at-target/.

Giunipero, L. C., Denslow, D., & Eltantawy, R. (2005). Purchasing/supply chain management flexibility: Moving to an entrepreneurial skills set. *Industrial Marketing Management, 34,* 602–613.

Hackett Group. (2016). The CPO agenda: Reduce purchase costs, improve agility, and become a trusted advisor.

Hackman, J. R. (1987). The design of work teams. *The handbook of organizational behavior* (pp. 315–342). Englewood Cliffs, NJ: Prentice-Hall.

Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed intergration. In L. L. Beckowitz (Ed.), *Advances in experimental social psychology* (Vol. 8, pp. 47–101). New York: Academic Press.

Im, S., & Workman, J. P., Jr. (2004). Market orientation, creativity, and new product performance in high-technology firms. *Journal of marketing, 68*(2), 114–132.

Isaksen, S. G. (1992). Research: Facilitating creative problem-solving groups. *Readings in Innovation,* 99–135.

Keough, M. (1993). Buying your way to the top. *The McKinsey Quarterly, 3,* 41–62.

Kiratli, N. (2016). *Fostering collective creativity in procurement: A conceptualization and application of team creativity climate in sourcing and co-innovation teams*. Doctoral dissertation, Maastricht University: Datawyse/Universitaire Pers Maastricht.

Kiratli, N., Rozemeijer, F., Hilken, T., de Ruyter, K., & de Jong, A. (2016). Climate setting in sourcing teams: Developing a measurement scale for team creativity climate. *Journal of Purchasing and Supply Management, 22*(3), 196–204.

Knight, L., Tu, Y.-H., & Preston, J. (2014, January). Integrating skills profiling and purchasing portfolio management: An opportunity for building purchasing capability. *International Journal of Production Economics, 147*, 271–283.

Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review, 61*(5), 109–117.

McKinsey. (2015). Decoding leadership: What really matters. *McKinsey Quarterly,* Retrieved from: https://www.mckinsey.com/featured-insights/leadership/decoding-leadership-what-really-matters.

Moses, A., & Åhlström, P. (2008). Problems in cross-functional sourcing decision processes. *Journal of Purchasing and Supply Management, 14*(2), 87–99.

Mumford, M. D. (2000). Managing creative people: Strategies and tactics for innovation. *Human Resource Management Review, 10*(3), 313–351.
Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly, 13*(6), 705–750.
Olsen, R. F., & Ellram, L. M. (1997). A portfolio approach to supplier relationships. *Industrial Marketing Management, 26*(2), 101–113.
Patterson, M. G., West, M. A., Shackleton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., et al. (2005). Validating the organizational climate measure: Links to managerial practices, productivity and innovation. *Journal of Organizational Behavior, 26*(4), 379–408.
Perry-Smith, J. E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal, 49*(1), 85–101.
Ramsay, J., & Croom, S. (2008). The impact of evolutionary and developmental metaphors on Purchasing and Supply Management: A critique. *Journal of Purchasing and Supply Management, 14*(3), 192–204.
Rozemeijer, F. (2008). Purchasing myopia revisited again? *Journal of Purchasing and Supply management, 14*(3), 205–207.
Rittel, H. W., & Webber, M. M. (1973). 2.3 Planning problems are wicked. *Polity, 4,* 155–169.
Ritter, S. M., Van Baaren, R. B., & Dijksterhuis, A. (2012). Creativity: The role of unconscious processes in idea generation and idea selection. *Thinking Skills and Creativity, 7*(1), 21–27.
Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational climate and culture. *Annual Review of Psychology, 64,* 361–388.
Schneider, B., Wheeler, J. K., & Cox, J. F. (1992). A passion for service: Using content analysis to explicate service climate themes. *Journal of Applied Psychology, 77*(5), 705–716.
Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *Leadership Quarterly, 15,* 33–53.
Si, S., & Wei, F. (2012). Transformational and transactional leaderships, empowerment climate, and innovation performance: A multilevel analysis in the Chinese context. *European Journal of Work and Organizational Psychology, 21*(2), 299–320.
Sirkwoo, J. (2015). Leading employee creativity-relationship between leadership styles and employee creativity. *Review of General Managment, 21*(1), 27.
State of Flux. (2012). Supplier relationship management—Research report 2012.
Teague, P. (2014). *The key to creativity in procurement: Play time*. Available at: http://www.procurementleaders.com/blog/my-blog–paul-teague/2014/04/14/the-key-to-creativity-in-procurement-play-time.
van Rossum, R. (2007). Investigating and integrating personality, leadership style, and self-other agreement. *Maastricht University Master Thesis,* 1–103.
Van Weele, A. J. (2009). Purchasing and supply chain management: Analysis, strategy, planning and practice. Cengage Learning EMEA.
Wang, Q., Bradford, K., Xu, J., & Weitz, B. (2008). Creativity in buyer–seller relationships: The role of governance. *International Journal of Research in Marketing, 25*(2), 109–118.
Zohar, D., & Tenne-Gazit, O. (2008). Transformational leadership and group interaction as climate antecedents: A social network analysis. *Journal of Applied Psychology, 93*(4), 744–757.

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Today, her research focuses on collaborative creativity and innovation in the supply chain involving individuals, teams, departments, and organizations. Within this research, Nadine advises companies on managing the creative process of individuals, teams and with suppliers. Nadine's research expertise extends to 3D printing, customer centricity, and sustainability in supply chains across industries such as manufacturing, chemical, automotive, and tourism. Her work has been published in the Journal of Purchasing and Supply Management, International Journal of Physical Distribution and Logistics Management, and Journal of Cleaner Production.

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"En Garde!"—What Business Negotiators Could Learn from an épée Fencing Champion

Pascal Fournier and Britta Heidemann

Britta Heidemann, born in 1982 in Cologne, is a former German épée fencer. Having won the world championships in 2007, the Olympic gold medal in 2008 in Beijing and the European championships 2009, Heidemann has been the first athlete in épée fencing to complete the so-called Golden Triple of important titles. In February 2018, she announced the end of her sports career. Today, she works as a management and business consultant with special focuses on China, as she speaks Chinese fluently and has also lived in Beijing for a longer time, sports, renewable energies and management.

Being therefore familiar with both literal and figurative repartees, she clarifies parallels and differences of fencing and business talks which both reach further and deeper than might seem obvious at first sight. Of course, feints, unattended attacks, delaying tactics and counterattacks are categories that obviously fit both the sphere of fencing as well as that of business negotiations. But at a second sight, especially with respect to the mental and contentual preparation of purchase talks, transferring repartee experiences from fencing to business negotiations also might turn out to be concludent at a second consideration—and as an enlightening look from another point of view. The following text is based on an interview Britta Heidemann had with Florian Schupp and Heiko Woehner.

1 Long-Term Preparation

Obviously, any success first and foremost rests on the acquisition and ever continuing perfection of the abilities required in the respective discipline. As Heidemann puts it: "Even the strongest will and determination will not lead far without

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the basic abilities needed". But: "No one is born a master". The main way to gain control over the abilities needed therefore is: routine. Procedures, skills and techniques are reliably mastered only if repeated over and over again. For clarification, Heidemann refers to a well-known experience probably everyone has made during school: the recitation of a poem. After just a few rehearsals, the recitation soon faltered because one practised five times instead of a hundred times and only in privacy.

Nonetheless, preparation does not only take place in the training yard, as athletes also tend to do a lot of mental preparation. According to Heidemann, mental preparation in this context is mostly about understanding situations and contexts and improving procedures. This kind of long-term preparation starts long before the real performance or specific competition, as she points out.

As a most elementary basis for mental strength, Heidemann cites two surprisingly obvious factors: eating and sleeping. Especially with respect to these two basic physical needs, people in her opinion usually do not sufficiently take care of themselves, which she defines as a crucial but at the same time rare characteristic of self-responsibility: "Taking time and doing what feels right to do is simple but still requires a certain mettle".

In the run-up to important events, Heidemann adds, she used to plan for months in advance if necessary by writing down any possibly important aspect that came into her mind and by drawing timelines—all this to create and provide structure. At this point, she introduces another—in her view—highly important element of mental preparation she calls visualization or anticipation, which is, of course: imagining and going through all possible details and facettes of the specific event, including the adversary, over and over again and as concretely as possible. Transferring this from a concrete sports related to a figurative context means: elaborating possible replies or arguments, based on a potential counterpart's imagined actions and reactions. Heidemann verbatim: "It is important to know precisely whom you are dealing with. And to know more about that person than vice versa".

According to her, the deeper sense in reflecting "What is the situation, the location, the ambience going to be like? How will it affect me?" is reducing pressure, diminishing nervousness and increasing one's mental strength. Or, to sum it up, the quintessence and *conditio sine qua non* for a successful performance is: certainty.

2 Step by Step

The complex and differentiated anticipation of an upcoming event not only reduces tensions by providing increasing certainty—it also creates tensions. These, as Heidemann points out, are important elements of addressing the ongoing process, too. According to her, suspense ideally leads to focussing on all the details of the actual challenge. In a second step, this may result in an extended, more profound understanding of the process going on. Subdividing the complexity of the process

as a whole into many smaller and more manageable sections or aspects then can help to avoid a possibly fundamental mistake. In Heidemann's perspective, the long-term overall objective, so to speak: dreaming about having won and standing on the podium makes people "a little sloppy" about the way and its single steps that might lead there. Heidemann's recommendation is: "Live up to the moment. Live from one day to the next". This change in perspective obligatorily causes a fundamental transformation of the goal: instead of aiming at maximal targets like "I want to be Olympic Champion", Heidemann recommends focussing on the next impending stage as a value itself. "It is much more convenient not to be confronted with a giant mountain, but to deal with the details and the daily working procedures". It is therefore important to understand: "The way to the overall objective is the sum of all the small and laborious steps—and every one of them can and should be seen as a source of joy and satisfaction". Such a positive attitude towards work to be done also may appear as an additional key to success, says Heidemann. First because it is helpful for one's mental health as well as for the seriousness and productivity of the approach to any objective: "It is good for us to have fun with what we are doing". Second, it reduces the dimensions of a potential failure from an overwhelming defeat to a normal, everyday experience.

In sports, the most important person, instance and authority right after the athlete him- or herself for developing both main aspects treated so far—craft skills and mental strength—is the coach. Heidemann firmly points out that "working with an unapt coach can suppress up to 50% of one's abilities". To clarify this, she refers to her own experience: during her career, one of her coaches tried to implement a rather "ascetic" working method, which did not work for her, as she "always needed a certain easiness". Simply feeling misunderstood by the coach almost obligatorily leads to the first hit against you. On the other hand, in a good relationship between athlete and coach, the latter is often the first person to refer to. While athletes therefore mostly don't see any problems in having an expert to their side, an instance providing experience and advice, in business especially young male employees tend to feel offended when given advice how to enter negotiations. Contrary to this—in her perception wrong—attitude, Heidemann stresses that even if one really has a clear and successful strategy for a negotiation, it "can never be wrong to have this approach confirmed and reflected by an expert".

3 Reality Test

While all previous considerations concern mainly a long-term approach, the crucial moment remains the one when all the preparations have to stand the test of reality. The real competition, the concrete confrontation with the opponent, according to Heidemann requires a very different kind of last-moment preparation. Her recommendation is: "I believe in the power of rituals". For her, these last preparation rituals were quite simple: "First: warm-up, then, one hour before entering the fight, changing the T-shirt, last consultations with the coach, turning off the mobile phone".

Mentally, these rather external procedures were accompanied by a phase of concentration—rather on one's own strength than on the opponent's. To her, this appeared to be more appropriate, Heidemann says, because from the beginning of the repartee, she would rather set the pace than react. On stage, there is a considerable risk of getting on a wrong track and inflating the opponent which is a rather defensive approach. In the preparation for the Olympic Games 2012, she remembers, the German team almost lost against a rather bad British team only because they were repeatedly said to be strong. Heidemann instead preferred focussing on one question: how to set the next hit. This does not necessarily imply an exclusively offensive strategy: "You can enter a competition either way, offensively or defensively—but never without reflection". In another moment of the interview, she puts it this way: "One has to know WHAT he or she wants to do—and HOW he or she wants to do it".

In the confrontation with the opponent, yet another aspect could come up: the opponent's personality and the question of sympathy or antipathy for him or her. In this concern, Heidemann distinguishes three constellations:

> The other person is completely unknown. This situation, as Heidemann says, is probably the easiest one, as it contains no additional personal or psychological baggage. The confrontation takes place in an emotionally neutral setup.
>
> There is a positive attitude towards the opponent, be he or she familiar or intuitively sympathetic. In Heidemann's view, this is definitely a more difficult constellation, as the emotional distance needed becomes harder to achieve. On the other hand, the general tuning of the confrontation is rather positive.
>
> The adversary is a person you know – and dislike. This in Heidemanns perspective is the most difficult constellation. From the very beginning, it contains a strong preoccupation. Fencing with an unsympathetic person therefore requires a very disciplined work on the mindset to obtain a maximum of inner distance.

Heidemann's recommendations for this third set-up: "Take one step back—and take a deep breath: it's about business now". Or, if preoccupations are too strong, she suggests charging a third person with the negotiations as another solution. The main objective according to her is to avoid entering a contest on a basis of antipathy.

Another important aspect in the concrete situation of competition is a profound and realistic self-assessment. As Heidemann points out, a major obstacle to success is ignoring that badmouthing someone else does not improve one's own capacities. Blaming only hazard, fortune, other instances or persons for a negative outcome thus indicate a lack of self-responsibility. In a great roundup, Heidemann criticizes rejecting responsibility, the incapability of a reasonable time management and missing tenaciousness as major reasons for failure. On the other side, the minimal requirement for any success in her perspective is intrinsic motivation. "Man forges his own destiny", she quotes a famous saying.

Adult people not willing to meet a certain expectation, to "do something particular" simply should try something else, Heidemann concludes. Enviousness in her view is mainly a result of one's own "non-performance".

At this point, she introduces an only seemingly secondary but in fact crucial difference between a sports duel and purchase talks. While fencing is a public event on stage, with an attentive audience, business talks tend to take place behind closed doors. The presence of a public, in her view, is always an asset looking at the outcome of a process. "People tend to work more accurately if the results become public. That is human nature". For herself, Heidemann claims she has always loved to be on stage—which gave her the opportunity "to show everyone I'm the best". When processes remain hidden and secret and potentially without consequences, people by nature tend to drag their feet.

Being on stage also implies an extensive elimination of distractions. Major competitions take place on an illuminated piste in a dimmed environment, Heidemann points out, which makes it much easier to concentrate. Therefore, it is the smaller events that demand more effort against deflection. During her career, Heidemann says, she regularly had duels interrupted if small talk held 20 m from stage restrained her concentration.

Asked, whether fencing was something of an "art", Heidemann agrees, referring to terms like "art of fencing" or "swordsmanship". They indicate certain ability, a competence—an "art" in the same sense as, e.g. a surgeon's work might be considered as "art". In business negotiations, Heidemann concedes, there might be highly skilled and developed techniques, too. In exceptional cases, negotiations might also appear as an "art". There are people negotiating on a highly skilled "premier league level", and however, others tend to deliver a rather mediocre performance.

During the interview, Heidemann repeatedly mentions "innovation" and "recovery breaks". Asked for specification, she answers: "coaches change, rules change, new forms of competition are established, take place in other locations". To meet these ever altering external conditions, she strongly recommends mental preparedness for change. This again includes permanent readiness to work hard on improvement, e.g. trying new movement patterns and making them applicable for competition. In order to obtain this sort of mental flexibility, she sometimes fundamentally changed her entire training procedures or even suspended training for up to two weeks. Working hard on one's skills may lead to a very good or even superior performance—but at this point, Heidemann says, one eventually starts to miss points simply out of laziness or sheer convenience. If the work on personal improvement stops here, sooner or later losing becomes inevitable. Staying concentrated, focussed on accuracy even in a state of mastery therefore helps avoiding the crisis that is always pending. For clarification, Heidemann refers to a break in German tennis player Angelique Kerber's career. Shortly after winning the All England Championships in Wimbledon 2018, Kerber faced a low. Heidemann points out that this was something "completely normal"—presuming that Kerber, as a reaction to the low, certainly changed substantial parts within her training procedures. At best, problems are recognized before they turn into a substantial crisis or even profound grief. "You don't really need a period of gloomy mood if you are actively and constantly reflecting your situation". She also is familiar with "the crash to the ground" from her own experience, Heidemann says, qualifying that notion by adding that "this crisis was absolutely unnecessary".

4 Fencing Technique

Two aspects are essential in épée fencing: measure, in the sense of the Latin root *mensura*, describing the spatial distance between the opponents, and a good intuition for the right moment to attack. To set a hit requires the perfect distance, the ideal *mensura* towards the opponent: the adversary being too close results in a restricted mobility, while too much distance means that the adversary is simply out of reach. In addition, according to Heidemann, a good sense for timing, catching the opponent within an unattended change of movement might be a way to hit an adversary with a rather simple step. For herself, she claims she usually did not fence in a technically complicated manner. Nonetheless, in the decisive moment, everything has to be perfectly harmonized, up to the specific position of the hand and the way the thrust is executed.

All this requires the ability to bide one's time—for a thrust in fencing, for an argument or an approach about a certain issue in a business negotiation. But this also demands the courage to take a decision and make the appropriate step. A lack of this courage to take the initiative inevitably would be punished—while even the strongest determination not always and necessarily leads to the intended results, as Heidemann has experienced herself: "In the Olympic finals in London 2012, I lost by Sudden Death—but: after an own attack! I have not defensively awaited a simple hit. Therefore, I don't have to reproach myself for not trying".

The importance of the first hit in a duel, as she points out, is very much up to one's individual perspective. Nonetheless, marking the first point might shift the entire competition in favour of the weaker fencer. Therefore, as Heidemann points out, it is virtually insane to carelessly give away points in the beginning of a duel while fighting just the harder towards its end. Still, she concedes, this behaviour is comprehensible as it roots in human psychology and nature. While the first hit is rather a matter of interpretation, the last hit in a repartee is of much greater importance.

Awaiting or preparing the last hit in a repartee often induces thoughts like "Hopefully, I will be able to carry this across the finishing line". Finishing is always a difficult thing, Heidemann admits, adding that this problem arises only shortly before the end of a duel. Until this moment it is quite easy to perform 80% of a task —but really sealing the deal is what Heidemann calls "the fine art".

Finally, after a defeat there is certainly a lot to learn from analysing one's own mistakes and the adversary's assets. But, Heidemann insists, victories need to be analysed as well. As she says, it seems to be human nature to focus on what has gone wrong. If things have gone well, on the other hand, this seems to cause such a feeling of relief that no further consideration is taken. Heidemann stresses: there is even most to learn from success.

On the contrary, in her opinion, it is "clever to recapitulate not only the mere event, but the entire day and the day before, asking precisely: Have I been kind towards the partner or rather not? What has gone well? This may be a great asset".

Everything mentioned so far applies to the individual fencer as well as to the individual negotiator. But there are more aspects which can be notably relevant beyond fencing.

One rule of competition in this particular sport is team qualification for individual competition. This implies that first the team has to qualify for a championship. Only then, the individual fencer can compete.

Transposed into business terms, that would mean that first a team had to set up a major negotiation or sourcing. Only thereafter, further progress might depend on the one individual negotiator who is to finalize the negotiations. This does not obligatorily mean that the purchaser permanently has to be the same individual. After the basic arrangements set by a team, specific aspects of the negotiations can very arguably be delegated to the one team member who is actually the most savvy and proficient expert in the area or branch in question.

After that, the only decisive aspect remaining is: stamina. Fight until the last second has run out, see London semi-finals. Remember: there is no guarantee you make the last hit—but you can fight until the last second and try to make it.

Another potentially helpful parallel: in épée fencing, the strike area is the entire body. Hence, there are no restrictions, everything is permitted. And no matter where or how it is placed on any part of the opponent's body: any hit counts, including the ones made by pure coincidence.

5 The Secret of My Success

Taking all previous illustrations and findings together, what purchasers can learn from épée fencer Britta Heidemann is the following:

Repetition

Repetition is a key element to success. Create rituals and follow the ever same schedule when you compete.

Analysis

Sit back and analyse first.

Feedback

Feedback is important. Any critical remark—especially coming from an experienced side—can be helpful.

Change

Prepare for change as it always may occur. Remain flexible, adapt to it if it occurs.

Exposure

Expose yourself to a situation and train.
Self-reflection: Sometimes it helps to take a look into the mirror, in a real mirror.

Balance

Listen to the needs of your body and mind. Take self-responsibility.

6 Extra *by Florian Schupp*

With a certain time lag to the interview, I had the chance to get a live introduction to fencing by Britta Heidemann.

She gave me her fencing vest for the training and the following repartee. Of course, I felt very proud to wear her vest. Then Britta introduced me to the fencing position. While I was using a training épée, Britta always uses her personal épée. The feeling behind the fencing mask was good, I did not sense any fear. But after getting into position, Britta demonstrated with a completely unexpected and especially irresistible "action" (as she usually calls any move) of her arm that she is an Olympic Champion. In a fraction of a second, I was hit!

Britta is not much taller than I am, but her mental presence and irresistibility was enormous and multiplied in the moment of action and her thrust. Britta noticed I was trying to reflect the situation—and in the very same moment, I received the next hit. I did not realize that about 150 spectators were present and watching us. I totally forgot about them and tried to gather my thoughts and at the same time concentrate on Britta and what she was doing. Obviously: Too many things at once.

Britta then asked me if I would like to learn how to attack as well as to defend myself. She introduced me to the first level of defence: Parade, riposte. I tried it and hit her for the first time.

One more time, same sequence, same result—check! Then Britta asked me to attack once more. This time, things went quite different: With a little, hardly visible evasive movement, she dodged my attack, set the parade—and I was hit again. While demonstrating, Britta explained to the spectators what she was doing. Still, in the decisive moment of action, her entire moves and presence did not show the slightest sign of distraction. She was absolutely present and focussed, and her entire concentration culminated in the point of her épée.

I realized: You have to be quick and extremely well on your feet and in harmony with your body and your mind. Physically, I felt good, while mentally, I tried to analyse and plan the fencing action at the same time. Of course, I did not have any routine at all. Nonetheless, I started to understand what Britta meant when she was talking about routine in our interview. More and more, I literally *lived* the text that you have just read. I was no longer a spectator, like the 150 others in the room. On a very humble level: I was fencing.

We thank Britta Heidemann for sharing deep insights of her way of fencing and for introducing us to her art.

Pascal Fournier was born in 1970. He concluded his studies of German literature, political and musical sciences in Freiburg i.Br. with a dissertation on the cultural phenomenon of "diabolical virtuosity". In 1998, he started working as a radio journalist. Today, he is mainly employed as editor and host of daily political radio broadcasts at the German public radio (ARD). Furthermore, he was sent as a correspondent to several international political events in Brussels, Geneva, Basle and Berlin.

Britta Heidemann has been one of the most successful fencing athletes within the last decade: Olympic Champion 2008, World Champion, European Champion, three Olympic medals and eleven medals at World Championships. After having received a diploma in Regional Sciences of China, she works as a consultant and accompanies business or political delegations to China. As a freelancer, she speaks about topics such as "success" and "motivation" and is author of "Erfolg ist eine Frage der Haltung" ("Success is a Matter of Attitude") and "Willkommen im Reich der Gegensätze" taking readers on a journey to China. She also offers fencing workshops for company groups. She supports projects for children, represents Athletes in the International Olympic Committee (IOC) and is Ambassador "Sports for Development" for the Federal Ministry for Development.

The "True" Cost of Mitigating Commodity Price Volatility: Insights from Total Cost of Ownership and Real Options Approach

Roberta Pellegrino, Barbara Gaudenzi, and George A. Zsidisin

1 Introduction

Most organizations purchase commodities in some form as part of its firm's operations. Commodities including metals, energy, and agricultural products can be acquired directly as raw material inputs to a firm's bill of materials, indirectly as components of purchased items from a firm's suppliers, and/or as part of a firm's operations and overhead expenses (Zsidisin et al. 2013). Commodities are a significant input affecting many industries: steel for automotive or electronics companies, lead for battery manufacturing, agricultural commodities for food companies, and jet fuel in the airlines industry are just a few examples. When an extensive portion of the firm's overall purchases consists of price-volatile commodities, a key concern is commodity prices changing sharply, putting the company's economic viability at risk. Significant commodity price volatility puts top-line revenues and cost structure at risk, thus potentially excessively reducing net cash flows and profitability (Finley and Pettit 2011). If not effectively managed, commodity price volatility (CPV) may severely undermine the ability of a firm to meet customer requirements, creating challenges for product pricing decisions, budget planning, and net cash flow management (Matook et al. 2009; Finley and Pettit 2011).

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During the last few years, different approaches have been discussed for mitigating CPV. Several risk mitigation strategies have been identified from the financial literature, namely financial hedging which relies on the use of derivative contracts as futures, options, and averages. Despite the great number of works discussing the use of financial hedging to offset future commodity price changes (Pindyck 2001; Guay and Kothari 2003; Nissanke 2010), its use seems to be somewhat limited in business practice. The empirical evidence reveals that some industrial firms do not use financial hedging due to a lack of knowledge and experience (Zsidisin et al. 2015).

More recently, the proposal of other approaches to manage price volatility from the supply chain risk management literature has been increasingly fostered. Specifically, they are as follows: (1) sourcing approaches, such as forward buying, switching suppliers, substituting commodities, vertical integration, and (2) contracting strategies such as escalator clauses, staggering contracts, and passing price increase to customers (Zsidisin et al. 2013). Table 1 reports a brief description of each strategy (see Gaudenzi et al. 2018 for a detailed taxonomy of commodity price risk mitigation strategies and factors that may influence their adoption).

Although recent research has identified approaches beyond financially hedging CPV, it is not clear how effective these strategies are in mitigating this form of price risk. The supply chain risk management strategies briefly outlined are in fact characterized by different thresholds between costs and benefits, which need to be carefully evaluated before implementing measures to mitigate this form of risk.

Evaluating supply chain risk management strategies means accounting for the trade-off between the investment required for mitigation actions and the reduction of loss or the exploitation of advantages caused by the uncertainty over a significant planning horizon (Ho et al. 2015). Building the mitigation capability is costly

Table 1 Supply chain risk management strategies to mitigate CPV (adapted from Gaudenzi et al. 2018)

	Strategy	Description
Sourcing approaches	Forward buying	Acquire commodities well in advance and store them in inventory until use
	Switching suppliers	Shift volumes among a set of prequalified suppliers having different pricing structures
	Substituting commodities	Switch raw materials for making the final product (with a flexible design) to reduce prices paid
	Vertical integration	Own the distribution channels or production of the needed raw materials
Contracting strategies	Escalator clauses	Contractual agreements which define the process of price adjustments
	Staggering contracts	Use multiple contracts for different quantities and time periods
	Passing price increase to customers	Pass the commodity price increase to the final product price

(Prater et al. 2001) since it often requires dedicated investments in multi-skilled workforce, versatile equipment, multiple suppliers, and/or flexible contracts with suppliers (Tang and Tomlin 2008; Carbonara and Pellegrino 2017). Due to the higher investment required for building mitigation capabilities, firms may have concern with these investments if clear cost–benefit estimates associated with different actions lack.

CPV requires firms to adopt appropriate risk mitigation strategies for reducing the negative effects CPV may have on their economic viability. However, there is a lack of structured tools benchmarking commodity price risk mitigation strategies for understanding which approaches are more effective and efficient in mitigating commodity price risk and to understand the conditions in which some strategies perform better than others. The lack of models that explicitly consider the economic dimension of risk mitigation strategies deprives managers of decision-making tools for choosing the appropriate ones, thus precluding companies to widely adopt them (Deloitte Development LLC 2013). Therefore, this chapter develops a conceptual approach to study CPV and risk mitigation strategies, recognizing in particular how the choice of risk mitigation strategy may affect the firm's financial performance. It is based upon two prominent approaches, namely total cost of ownership (TCO) and real options approach (ROA).

2 Total Cost of Ownership

2.1 Overview

Total cost of ownership is the term used to describe "all costs associated with the acquisition, use, and maintenance" of a good or service (Ellram and Siferd 1993). TCO examines the cost associated with purchased goods and services throughout the entire supply chain, including all the costs from the idea of the product/service through warranty claims due to that part once the final product is used by the customer (Ellram 1993).

According to the TCO approach, the buying firm needs to base sourcing decisions not just on adopting a "price only" focus, as found in the traditional approaches to supplier selection. Rather, firms need to determine which costs it considers most important or significant in the acquisition, possession, use, and subsequent disposition of a good or service. Hence, in addition to the price paid for the item, a TCO approach may include other elements such as—for example—order placement, research, and qualification of suppliers, transportation, receiving, inspection, rejection, replacement, downtime caused by failure, and disposal costs, among many others.

The two primary conceptual insights provided by TCO approach are (1) the evaluation of a broader spectrum of all the costs related to a "total cost of ownership" perspective, considering acquisition costs, all the costs related to suppliers, and generally all internal costs; (2) the evaluation of life cycle costs, which consider

all the costs associated with using a given item from a given supplier during the entire life of the item, including costs incurred when the item is in use.

2.2 TCO Approach for Commodity Price Risk Mitigation Strategies

Several models have been suggested for understanding TCO associated with purchasing a product or service. One of this consists in looking at costs based upon the order in which the cost elements are incurred, following the transaction sequence: *pretransaction*, *transaction,* and *posttransaction* (LaLonde and Zinszer 1976). Following this TCO approach, Table 2 reports some costs elements associated with the commodity purchase under different commodity price risk mitigation strategies, classified as pretransaction, transaction, and posttransaction.

The analysis of the cost components related to the risk mitigation strategies—conducted through a TCO approach of commodity purchases—reveals many additional costs arise beyond the purchase price. This fact highlights the need to carefully revise the decision-making processes regarding risk mitigation strategies based on purchase price.

When organizations create their commodity purchasing strategy, there is a risk to pay limited attention to a detailed ex-ante analysis of the consequences and benefits stemming after its implementation. A purchase price comparison is often the key criteria driving the purchasing strategy, although the practice may highlight additional expenses might occur, such as negotiating and contracting price adjustments, qualifying new suppliers, and personnel travelling costs, for example. Furthermore, uncertainties and risks might increase, such as the risk of supply chain disruptions and the risk related to CPV. For these reasons, the commodity purchasing strategy should holistically consider the costs related to the purchasing process, the risks generated by CPV, and the total costs related to implementing commodity price risk mitigation strategies.

3 Real Options Approach

3.1 Overview

Real options approach has been introduced in the literature as an approach that overcomes the limits of traditional methodologies for evaluating investment opportunities in uncertain environments. Traditional methods, such as those based on discounted cash flows (DCF)—net present value, internal rate of return, discounted pay back period—implicitly assume investment benefits and, therefore, the "expected scenario" of cash flows are known and presume management's passive commitment to a certain operating strategy (Boute et al. 2004). During project management and operations, especially in highly uncertain and dynamic

Table 2 Cost elements associated to the commodity purchase under different commodity price risk mitigation strategies (table compiled by authors)

Cost component	Strategy						
	sourcing approaches				Contracting approaches		
	forward buying	Switching supplier	Substituting commodity	Vertical integration	Escalator clauses	Staggering contracts	Passing price increase to customers
Pretransaction components	• Assessing the feasibility of use for the commodity (e.g., perishability) • Continuous price monitoring • Build up of (extra) storage capacity and handling capability	• Supplier search • Supplier evaluation • Supplier qualification • Adding new supplier to internal systems (e.g., ERP platform) • Educating new supplier in firm's strategies and operations	• Innovative design with multiple materials (R&D involvement) • Testing facilities • Commodity (long term) validation • Obtaining customer approval for using different commodity	• Assessing vertical integration alternatives • Integrating the distribution channel (i.e., relationship-specific investments)	• Negotiating the contractual terms (e.g., frequency of price adjustment, base cost/price, price corridor)	• Negotiating the (multiple) contract terms • (Multiple) contracting	• Customer approval for using a different commodity • Negotiating the contract terms
Transaction components	• Purchase price • Order placement • Delivery/transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections	• Purchase price • Order placement • Delivery/transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections • Supplier switching (change management): (1) setup adjustments for the production equipment (2) handling costs to operate and clean equipment and load the new material (3) extra warehousing space to store the second material	• Purchase price • Order placement • Delivery/ transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections • Commodity switching (change management): (1) setup adjustments for the production equipment (2) handling costs to operate and clean equipment and load the new material (3) extra warehousing space to store the second material		• Purchase price • Order placement • Delivery/ transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections	• Purchase price • Order placement • Delivery/ transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections	• Purchase price • Order placement • Delivery/ transportation • Tariffs/duties • Inspection • Return of non-compliant materials • Follow-up and corrections

(continued)

Table 2 (continued)

Cost component	Strategy						
	sourcing approaches				Contracting approaches		
	forward buying	Switching supplier	Substituting commodity	Vertical integration	Escalator clauses	Staggering contracts	Passing price increase to customers
Posttransaction components	• Monitoring increased inventory levels • Inventory capital costs • Risk/cost of scrap (obsolescence)	• Damages to supplier relationships • Communication/maintaining a (long term) relationship with suppliers	• Customer goodwill/reputation of firm	• Managing the integrated channel	• Administrative activities of making price changes	• (Multiple) contract management	• Administrative activities of making price changes • Damage to customer relationships and reputation of firm • Contract management

environments, managers may make different choices about operating actions when a new information from the market is available. This managerial flexibility to react to uncertainties represents a real option, which, in analogy to a financial option, is defined as the right, but not the obligation, to do something in the future whenever it proves convenient (Dixit and Pindyck 1995). This kind of flexibility is usually acquired at an initial cost—the option cost, which is the sunk cost for developing the flexible system—while the decision of exploiting such a flexibility is a matter of a future date and depends on the evolution of the uncertainty and the net benefits associated to decision—the option payoff.

This flexibility affects not only the future decisions—will the flexibility mechanism be exploited based on the uncertainty evolution?—but also the present one—do the benefits created by the flexibility offset the higher costs for building it? ROA provides a tool for quantifying the value of the managerial flexibility of the decision maker to adapt its decisions as the uncertainty resolves. A broad variety of real options have been studied in the literature including, for example, the option to defer production, temporarily shut down production, hold or abandon a project, decide the timing of investment, choose the production technology, inputs and outputs, and to change a project's output mix (e.g., McDonald and Siegel 1986; Majd and Pindyck 1987; Trigeorgis 1998; Amram and Kulatilaka 1999).

Two key insights underlie the application of ROA. First, the ROA builds upon the assumption that opportunity costs are associated with irreversible investments under uncertainty. Many investments are irreversible since being industry or firm specific, since they cannot be or since not being able to be used in a different industry or by a different firm. Hence, they are a sunk cost. This implies the possibility to defer committing resources under uncertainty, namely the possibility of waiting for new information affecting the desirability or timing of the expenditure, is worthwhile (Pindyck 1986; Trigeorgis 1998). Second, the ROA approach recognizes that many investments create valuable follow-on investment opportunities (Amram and Kulatilaka 1999).

These insights suggest that certain upfront investments enable management to capitalize on favorable opportunities and mitigate negative events by proactively managing uncertainty over time in a flexible way (Kogut 1991) rather than by attempting to avoid uncertainty. This managerial flexibility may be exploited, for example, when new information regarding market demand, competitive conditions, or the viability of new processes technologies is available (Leiblein 2003).

3.2 ROA for Commodity Price Risk Mitigation Strategies

Investments in creating supply chain flexibility can serve as an approach for mitigating the detrimental effects of commodity price volatility. We define flexibility in terms of the firm's ability to proactively react to environmental changes with a little or negligible penalty and sacrifice in terms of time, operational efforts, cost, or performance (Upton 1994; Pérez Pérez et al. 2016; Lu et al. 2018). The choice of the mitigation strategies requires not only a deep understanding of all the costs

associated with the strategies itself, beyond the purchase price but also the assessment of the value created by the flexibility itself.

The two flexibility-based commodity price risk mitigation strategies examined in this chapter are *Switching suppliers* and *Substituting Commodities*. In both cases, the mitigation capability comes from the development of a second source, namely the alternative supplier or commodity, that enables the firm to react to the uncertainty—in this case price fluctuation—by using the alternate source. It is a well-known and widely accepted procedure for mitigating supply chain disruptions in supply chain risk management literature and in business practice (Costantino and Pellegrino 2010; Pochard 2003; Tang and Tomlin 2008; Ho et al. 2015; Pellegrino et al. 2018). These two strategies can be analyzed by operationalizing them from a ROA perspective.

Switching suppliers provides a firm the ability, but not the obligation, to reconsider its cost structure in response to commodity price changes. The company will switch suppliers when the cost efficiency gains outweigh the aggregate transaction costs of setting up operational flexibility. Similarly, *Substituting commodities* gives a firm an option to react to CPV by making the commodity substitution when there are favorable conditions, i.e., when the benefits gained through the substitution are greater than its costs. At the same time, however, to open an option, such as making a substitution technically and commercially viable, there is the need for upfront investments in R&D, market research, and material/supplier qualification, as well as the need for sustaining on-going supply chain costs to manage such flexibility. Table 3 describes both strategies from the perspective of ROA.

Each of these measurement approaches has their benefits and drawbacks. A summary of these pros and cons can be found in Table 4. The next section provides a grounded example of how these approaches are applied.

4 Measuring the Financial Effects of Mitigating Commodity Price Risk: TCO and ROA

To provide a practical example, we derive insights from a Fortune 500 company in the fast-moving consumer goods (FMCG) industry. It is a multinational company offering a broad range of products across the world. The identity of this firm is concealed for confidentiality reasons. In this example, the company was exposed to commodity price volatility in the Europe, Middle East and Africa (EMEA) region, where the company buys surfactants, namely those products which make a detergent an effective cleaning product, to be used in personal care and detergent, cosmetics, cleaning agents, and detergents. In this example, we consider realistic operational conditions and market values, adjusted by a specific coefficient for reason of confidentiality.

For mitigating commodity price risk, the company is interested in exploring the opportunity for substituting a commodity by using a natural surfactant—Commodity A, which is made with organic ingredients, or a synthetic one—Commodity

Table 3 Real options (RO) modeling of flexibility-driven commodity price risk mitigation strategies (table compiled by authors)

RO modeling		Strategy	
		Switching suppliers	Substituting commodity
RO parameters	*Option cost*	The cost of acquiring flexibility: Multiple sourcing arrangements involve higher costs than those of single sourcing (due to the need for managing more than one contract/supplier and the loss of scale economies)	It is the (sunk) cost needed to "implement the flexible system," namely the upfront investment in R&D, market research, and material qualification for having flexible products or processes and being able to change commodity. It is given by the sum of: (1) cost to produce test products with the alternative material (mainly personnel cost for people that work on the qualification), and (2) the cost of the material itself for the test
	Exercise price	Transaction costs when exercising the switching option	Cost of making the switch from one commodity to the other one and vice versa (e.g., tooling, process modifications, inventory costs): (1) setup adjustments for the production equipment (2) handling costs to operate and clean equipment and load the new material (3) extra warehousing space to store the second material since the two commodities cannot be physically mixed
	Underlying asset	Expected cost efficiency gains from flexibility: savings from switching the supplier	Expected cost efficiency gains from flexibility: savings from substituting the commodity
RO value	*Decision of exercising the option at each t*	Switch the supplier if the saving from switching (*underlying asset*) overcomes the cost of making the switch (*exercise price*)	Substitute the commodity if the saving from using the alternate source (*underlying asset*) overcomes the cost of making the switch (*exercise price*)
	Expected payoff from option exercise at t	max (*underlying asset* − *exercise price*; 0)	max (*underlying asset* − *exercise price*; 0)
	Value of the flexibility = total net value created by the strategy	Sum of *expected payoffs* over the strategy lifetime − *option cost*	Sum of *expected payoffs* over the strategy lifetime − *option cost*

Table 4 Pros and cons of TCO and ROA for commodity price risk mitigation strategies (table compiled by authors)

	Pros	Cons
Total cost of ownership approach	• Takes the cost elements associated with a given strategy into consideration • Considers the real cost of purchasing rather than solely the acquisition price (Purchase price comparison) • Provides a tool for negotiating with suppliers by understanding the committed costs induced by that supplier in case of adoption of each strategy • Provides a full understanding of costs that may not be apparent when an item is purchased: Cost of ownership, supplier performance, internal costs	• It is a complex, difficulty to implement system requiring the analysis of serval cost elements, some of which are difficult to estimate and understand • It is a static system; changes in the internal/external environment (e.g., change of technology affecting cost structures, higher maintenance/operating costs) can influence outcomes • Deterministic model relying mostly on uncertain data; difficulties to forecast the future expense or income for a specific purchase • The model ignores some other elements beyond mathematical measurement. For instance, in case of *Forward buying* strategy, the model ignores the intrinsic value of the strategy that consists in eliminating the price volatility at an unknown cost (no way to account for the risk that the fixed prices are higher/lower than the fluctuating price) • The essential TCO metric focuses only on cost: the company relying entirely on TCO ends up following a strategy that minimizes expenditure rather than maximizeing the return for the company. The company adopts the least costly strategy, but it rarely chooses the strategy with the greatest impact for the bottom line • TCO ignores the benefits of flexibility
Real option approach	• Assesses the value created by the flexibility embedded in some strategies • Ability to model the decision-making process of the manager underlying the adoption and implementation of a given strategy • Follows a strategy maximizing cash flow and profit rather than minimizing cost • Has a holistic understanding of the strategy, which considers not only its costs but also its advantages (though of an uncertain nature), as well as the associated risks • Opportunity to understand the impact of changes in internal/external environment on the effectiveness of the selected strategy	• Need for estimating uncertain elements • Computational complexity of RO models: difficulties to accurately develop mathematical models and frame inputs • Need for using tools such as computers and preprogrammed calculators in the development of real options models • The standardization of the calculation of the flexibility which is the main goal of real option valuation approach is undermined by the different calculation methods for option values and their necessary assumptions and simplifications, which may significantly influence the results

B, which is derived from petroleum-based raw materials. The base case considers a total volume of 10 kt of surfactants, a total option cost investment of 0.1 Mio. USD to implement the flexible system able to switch from one material to the other and a switching cost, also referred as an exercise price, from natural surfactant to synthetic one and vice versa of 0.2 Mio. USD.

Table 5 TCO of substituting commodity (table compiled by authors)

Cost component	Strategy
	Substituting commodity
Pretransaction components	• Material qualification cost: investment to implement the flexible system able to switch from one material to the other = 100,000 $
Transaction components	• Purchase price of commodity A = 1105.82 $/unit (tot. volume 10,000 units) • Purchase price of commodity B = 1384.40 $/unit (tot. volume 10,000 units) • Commodity switching (change management) = 200,000 $
Posttransaction components	–

4.1 The Application of a TCO Approach in the Case Study

The analysis of the costs adopting the *Substituting Commodity* strategy according to the TCO approach (as presented in Table 2) is reported in Table 5, where the prices of commodities A and B have been estimated averaging the historical data of commodity prices paid by the company for the two sources.

As shown in Table 5, the TCO approach provides a more holistic understanding of the costs associated to the adoption of *Substituting Commodity* strategy, beyond the pure purchase price. In the specific case, this analysis is useful since it alerts the manager to the presence of pretransaction cost components as well as a transaction cost components. An interesting observation, which is not prominent from the TCO analysis, is the pretransaction component represents a sunk cost, while, contrarily, the transaction component is actually recurrent (this cost is charged anytime there is a commodity substitution). In addition, the TCO approach does not provide any information about the potential economic advantages the substitution of commodity delivers to the firm. In other words, beyond the total cost associated with adopting the *Substituting Commodity* strategy, the *value* created by using the *Substituting Commodity* strategy is not clear. Therefore, there are some limits with using TCO for understanding the overall financial implications for investing in flexibility.

4.2 The Application of a ROA Approach in the Case Study

Using a ROA, we simulated the forecasted values of the two commodities prices (Commodity A and B) for a timeframe of 12 months based on the historical data of commodity prices paid by the company. In running this simulation, in congruence with the literature (Pellegrino et al. 2018), we assume price to vary stochastically in time with the tendency to return back to a long-run mean, following a mean-reverting process (MRP). The key parameters of the MRP related to the long-run mean, annual volatility, mean reversion rate, and the initial values are reported in Table 6. The outcome of the mathematical model in terms of total value of the flexibility is the probability distribution shown in Fig. 1.

Table 6 Parameters of commodities prices (table compiled by authors)

	Long-run mean	Annual volatility	Mean reversion rate (%)	Initial value, S_0
Commodity A	$1021.88	0.055497515	7.17	$923.54
Commodity B	$1171.58	0.051308643	3.06	$1094.21

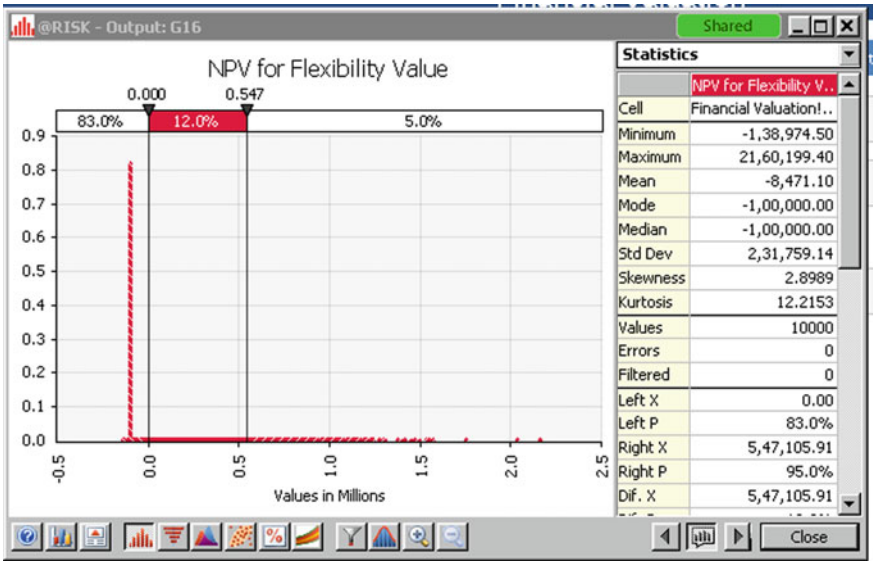
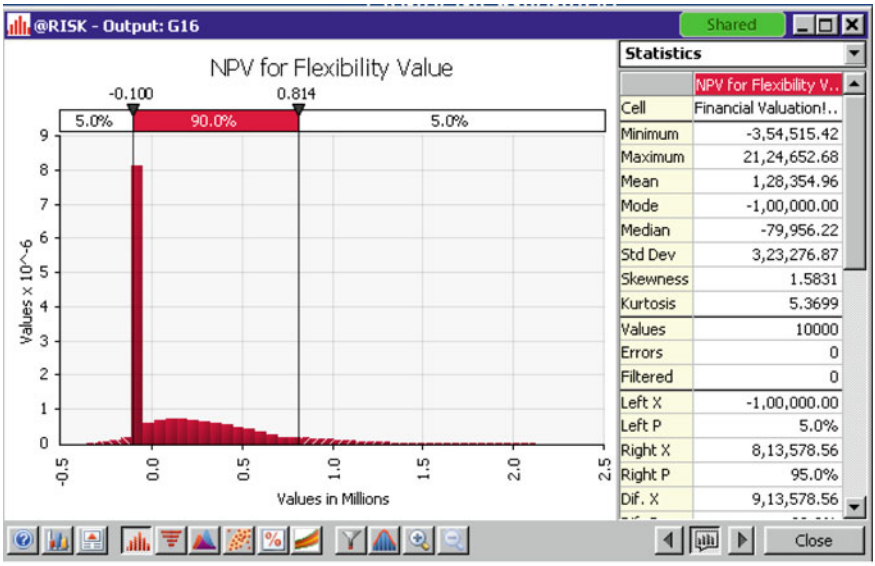


Fig. 1 Probability distribution of the value of flexibility (authors' own figure)

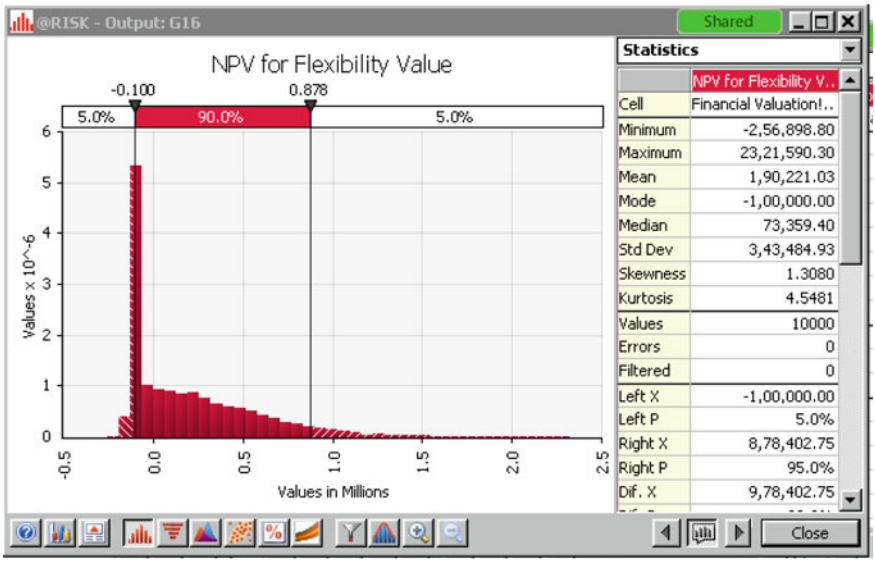
Results show that against the initial price to develop the flexible system, the net benefits associated to *Substituting Commodity* strategy are positive with a certain risk level (measured by the probability that the value of the flexibility is lower than 0). In particular, given the initial parameters considered as inputs of the model, we found that there is a chance of about 17% that this strategy positively impacts on the firm's profit delivering value up to 2.160 Mio. USD. In the remaining 83% of cases, the strategy produces a loss for the firm up to −0.138 Mio. USD.

We also carried out a sensitivity analysis on the switching cost (i.e., the exercise price of the option). The findings are depicted in Fig. 2, while the statistics of the distributions are summarized in Table 7.

As the findings highlight, the *Substituting Commodity* strategy becomes more effective in mitigating CPV by providing greater value when the switching cost decreases: both the mean value of the flexibility and the probability of NPV being positive increase. In other words, the impact of the strategy adoption on the firm's profit becomes more positive when the switching cost is lower: the mean value of the flexibility passes from being negative to positive, as shown with a loss of −0.0085 Mio. USD when switching costs are 0.2 Mio. USD, and a gain of 0.19



Switching – 50%



Switching – 25%

Fig. 2 Results of sensitivity analysis: probability distribution of the value of flexibility when switching costs change (authors' own figure)

Table 7 Results of sensitivity analysis: summary of statistics (table compiled by authors)

	Base case	Switching—50%	Switching—25%
Investment (Mio. USD)	0.1	0.1	0.1
Switching (Mio. USD)	0.2	0.1	0.05
Volume (kt)	10	10	10
Mean value of the flexibility (Mio. USD)	−0.0085	0.128	0.19
Prob. (NPV of flexibility > 0)	0.17	0.45	0.57
Std. dev. (Mio. USD)	0.232	0.323	0.343

Mio. USD when switching costs are 0.05 Mio. USD. At the same time, the risk *Substituting Commodity* produces a loss for the company decreases from 83% to 43%. The reason is when switching cost decreases the chances to exercise the option, namely substitute commodity, increase. As described in Table 3, the rule for the option exercise is substituting commodity any time the saving from using the alternate source (Underlying asset) overcomes the cost of making the switch (Exercise price). This implies that every time there is an inversion of the price of commodities, if the switching costs were null, it would be always convenient to exercise the option exercise. This leads to an increase of the value of flexibility, but also to an increase in risk exposure. The standard deviation, which is a measure of the amount of variation or dispersion of the dataset relative to its mean, increases: the more a strategy's returns vary from the strategy's average return, the more volatile the value of the strategy.

Three main insights may be drawn from the ROA application for commodity price risk mitigation strategies. First, it is interesting to observe the net benefit associated with these strategies is positive with a certain risk level, measured by the probability that the value of flexibility is lower than 0. Beyond the specific numbers found for the value of flexibility in the discussed case, the findings show flexibility-driven strategies may be effective in mitigating CPV since they may positively contribute to the firm's cash flow and profits.

Second, the findings highlight that it is crucial for companies to carefully assess the value of these strategies before their implementation since they are characterized by high implementation costs that need to be justified by the materialized cost savings. In fact, there is still a chance the value of the flexibility is less than 0. It is absolutely essential to consider the value of the managerial flexibility to decide whether it is convenient to switch sourcing options. This shows the importance of adopting ROA to model such managerial flexibility and account for its value. A proper assessment of flexibility value in using a second source for responding to price uncertainty will also enhance the confidence in negotiations by offering the risk averse purchasing manager an effective best alternative to a negotiated agreement (BATNA) (Cannella et al. 2018).

Finally, the sensitivity analysis of flexibility value with regard to switching costs shows how the value of such strategies is not just dependent on the CPV, but also

on the structural characteristics of such strategies and on the costs needed to develop flexibility. The effectiveness of the strategy in mitigating CPV increases when the switching cost decreases.

5 Conclusions

Creating a portfolio of flexible commodity price risk mitigation strategies provides a strategic choice for companies exposed to financial risk from CPV. This chapter describes how commodity price risk mitigation strategies can be analyzed under the perspective of their costs and performance. Two approaches have been adopted in this chapter to address the effective and efficient selection of commodity price risk mitigation: the TCO and ROA approaches. A case study completes the theoretical analysis, providing a practical example.

The contribution of this chapter is to allow purchasing managers, supply chain managers and risk managers to practically improve the effectiveness of the commodity price risk mitigation strategies. In doing so, managers need to collect external historical data regarding commodity price volatility as well as internal data regarding the impact that these fluctuations generated on costs.

This work begins to address an existing gap regarding the use of structured tools for analyzing the effectiveness of approaches in mitigating the effects of CPV. We hope this also provides chief purchasing managers and supply chain professionals useful guidance for measuring the costs and benefits related to these strategies. Although empirical evidence reveals managers are aware of the risk associated with CPV as well as of its impact on firm profitability, they are often reluctant to invest in mitigation capabilities such as flexibility. The reason is that supply chain flexibility is a key organizational and supply chain capability but requires investments that are considered sunk costs. When managers are not able to tie these investments up to the expected advantages/economic benefits, they are averse to invest. Holistically measuring the financial effects of flexibility investments is imperative for gaining executive management support in mitigating commodity price volatility. Utilizing TCO and ROA for measuring the effectiveness of commodity price risk mitigation approaches ex-ante is a step toward this direction.

References

Amram, M., & Kulatilaka, N. (1999). *Real options: Managing strategic investment in an uncertain world*. Boston, MA: Harvard Business School Press.

Boute, R., Demeulemeester, E., & Herroelen, W. (2004). A real options approach to project management. *International Journal of Production Research, 42*(9), 1715–1725.

Cannella, S., Di Mauro, C., Dominguez, R., Ancarani, A., & Schupp, F. (2018). An exploratory study of risk aversion in supply chain dynamics via human experiment and agent-based simulation. *International Journal of Production Research*. https://doi.org/10.1080/00207543.2018.1497817.

Carbonara, N., & Pellegrino, R. (2017). How do supply chain risk management flexibility-driven strategies perform in mitigating supply disruption risks? *International Journal of Integrated Supply Management, 11*(4), 354–379.

Costantino, N., & Pellegrino, R. (2010). Choosing between single and multiple sourcing based on supplier default risk: A real options approach. *Journal of Purchasing and Supply Management, 16*(1), 27–40.

Deloitte Development LLC. (2013). The ripple effect: How manufacturing and retail executives view the growing challenge of supply chain risk. http://deloitte.wsj.com/cfo/files/2013/02/the_ripple_effect_supply_chain.pdf.

Dixit, A.K., & Pindyck, R.S. (1995). The options approach to capital investment. *Harvard Business Review,* 105–115.

Ellram, L. M. L. (1993). Total cost of ownership: Elements and implementation. *International Journal of Purchasing and Materials Management, 29*(4), 3–12.

Ellram, L. M., & Siferd, S. P. (1993). Purchasing: The cornerstone of the total cost of ownership concept. *Journal of Business Logistics, 14*(1), 163–184.

Finley, B., & Pettit, J. (2011). Creating value at the intersection of sourcing, hedging and trading. *Journal of Applied Corporate Finance, 23*(4), 83–89.

Gaudenzi, B., Zsidisin, G. A., Hartley, J. L., & Kaufmann, L. (2018). An exploration of factors influencing the choice of commodity price risk mitigation strategies. *Journal of Purchasing and Supply Management*. https://doi.org/10.1016/j.pursup.2017.01.004.

Guay, W., & Kothari, S. P. (2003). How much do firms hedge with derivatives? *Journal of Financial Economics, 70,* 423–461.

Ho, W., Zheng, T., Yildiz, H., & Talluri, S. (2015). Supply chain risk management: A literature review. *International Journal of Production Research, 53*(16), 5031–5069.

Kogut, B. (1991). Joint ventures and the option to expand and acquire. *Management Science, 37* (1), 19–33.

LaLonde, B. J., & Zinszer, P. H. (1976). *Customer service: Measuring & measurement*. National Council of Physical Distribution Management: Chicago, IL.

Leiblein, M. J. (2003). The choice of organizational governance form and performance: Predictions from transaction cost, resource-based, and real options theories. *Journal of Management, 29*(6), 937–961.

Lu, D., Ding, Y., Asian, S., & Paul, S. K. (2018). From supply chain integration to operational performance: The moderating effect of market uncertainty. *Global Journal of Flexible Systems Management, 19*, 3–20.

Majd, S., & Pindyck, R. S. (1987). Time to build, option value, and investment decisions. *Journal of Financial Economics, 18*(1), 7–27.

Matook, S., Lasch, R., & Tamaschke, R. (2009). Supplier development with benchmarking as part of a comprehensive supplier risk management framework. *International Journal of Operations & Production Management, 29*(3), 241–267.

McDonald, R., & Siegel, D. (1986). The value of waiting to invest. *The Quarterly Journal of Economics, 101*(4), 707–727.

Nissanke, M. (2010). Issues and challenges for commodity markets in the global economy. In M. Nissanke & G. Movrotas (Eds.), *Commodities, governance and economic development under globalization* (pp. 39–64). Basingstoke, UK: Palgrave/Macmillan.

Pellegrino, R., Costantino, N., & Tauro, D. (2018). Supply chain finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility. *Journal of Purchasing and Supply Management, 25*, 118–133.

Pérez Pérez, M., Serrano Bedia, A. M., & López Fernández, M. C. (2016). A review of manufacturing flexibility: Systematising the concept. *International Journal of Production Research, 54*(10), 3133–3148.

Pindyck, R. S. (1986). Irreversible investment, capacity choice, and the value of the firm.

Pindyck, R. S. (2001). The dynamics of commodity spot and futures markets: A primer. *Energy Journal, 22*(3), 1–29.

Pochard, S. (2003). *Managing risks of supply-chain disruptions: Dual sourcing as a real option* (Doctoral dissertation). Massachusetts Institute of Technology.

Prater, E., Biehl, M., & Smith, M. (2001). International supply chain agility—Tradeoffs between flexibility and uncertainty. *International Journal of Operations and Production Management, 21*(5–6), 823–839.

Tang, C., & Tomlin, B. (2008). The power of flexibility for mitigating supply chain risks. *International Journal of Production Economics, 116*(1), 12–27.

Trigeorgis, L. (1998). *Real options: Managerial flexibility in strategy and resource allocation*. Cambridge, MA: MIT Press.

Upton, D. M. (1994). The management of manufacturing flexibility. *California Management Review, 36*(2), 72–89.

Zsidisin, G. A., Gaudenzi, B., Hartley, J. L., & Kaufmann, L. (2015). Understanding commodity price volatility mitigation from transaction cost economics: preliminary results. In *Proceedings of the Paper Presented at the 24th Annual IPSERA Conference*, Amsterdam.

Zsidisin, G. A., Hartley, J. L., Kaufmann, L., & Gaudenzi, B. (2013). *Managing commodity price volatility and risk*. CAPS Research. https://knowledge.capsresearch.org/publications/pdfs-protected/zsidisin2014priceOverview.pdf.

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Auctions as the Most Efficient Form of Negotiations

ZEW—Leibniz Centre for European Economic Research

1 Introduction

Procurement makes up a large volume of the world's economy. The public procurement in the European Union alone is estimated at about 17% of EU GDP with €2000 billion for the year 2007.[1] Many different award mechanisms are used in these procurement processes, and classifying them into auctions and negotiations is a challenge. Still, there have been some attempts in the economic literature.

Gretschko and Wambach (2016) argue that in an auction, rules are set before collecting the offers. Bidders know how the winner of the auction is selected and rely on the auctioneer's commitment to adhere to this announced process. On the contrary, in negotiations, the rules on how a winner is selected are often unclear during the actual negotiation process. Very often, the award criteria and the rules, i.e., the decision rationale, are only determined after all offers are collected.

Subramanian (2010) takes a different approach to distinguish between auctions and negotiations. He argues that it depends on where the competitive pressure originates from. In an auction, the auctioneer is more or less passive and the primary source of the pressure originates from the competition between the bidders, i.e., bidders are competing against each other within a given framework or rule set,

[1]Internal Market Scoreboard, n°19, July 2009.

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whereas in a negotiation, the pressure comes from across the table. The negotiator never negotiates with more than one bidder simultaneously.

Subramanian (2010) also argues that in real-life procurement, a clear-cut separation between auctions and negotiations is not possible as hybrid mechanisms are standard practice. To this end, he coins the term "negotiauction": "A negotiauction is a deal making situation in which competitive pressure is coming from both across-the-table competition and same-side-of-the-table competition."

For the purpose of this chapter, we define auctions as introduced by Gretschko and Wambach (2016). Rules are set before bidders submit their bids and bidders know clearly what it takes to win the business.

In this chapter, we will explain why an auction can be a very efficient award mechanism and we will highlight the advantages of committing to a set of clear rules that is used to determine the winner. We also explain why the transparency and commitment to a specific rule set can lead to superior results compared to negotiation scenarios where the process is less defined and not fully transparent to the bidders.

2 Why Use Auctions?

In procurement, suppliers are generally better informed about their costs than the buyer is, although many organizations try to use surrogate data to second guess the supplier's cost calculation. This means the supplier's cost position is private information. If the buyer were to determine the exact costs of her suppliers, she would, at least conceptionally, be able to skim most of the surplus in the transaction, i.e. leaving the successful supplier with a minimum viable margin. The implicit objective of any award mechanism, be it an auction or negotiation, is therefore to extract information regarding the fallback position of the bidders, i.e., the minimum price a bidder can accept given his own cost position.

In a negotiation, bidders do not have a strong incentive to reveal private information about their fallback and cost positions as submitting a good bid does not necessarily lead to an award of the business. An auction, on the other hand, can be an efficient mean of extracting private information as auctions facilitate the competition between suppliers, and the auction mechanism itself helps to reveal suppliers' willingness to accept certain commercial conditions. The interests of the buyer and the suppliers are more aligned: The buyer prefers attractive commercial offers and the bidders know that the most competitive offer directly leads to an award of the business. This consequence, in conjunction with the transparency of the process and the buyer's commitment to the outcome, drives prices down. In that sense, auctions are the breeding ground for competition between the suppliers.

There is another factor to consider. In a negotiation, a buyer needs to prepare offers and think about how to approach the individual bidders. In an auction, the information is extracted just by running the auction mechanism. The competitiveness of an auction works in favor of the auctioneer, and this competitiveness

increases with the number of bidders. This means that the workload for the auctioneer is not significantly higher if the number of bidders increases. As a result, an auctioneer might be better off trying to increase the number of bidders and let the auction do the work rather than spending costly efforts on information gathering.[2]

The more intimate communication with the bidders in negotiations can of course also work in favor of the buyer under the right circumstances. For complex projects, such as customized products or buildings, the suppliers might have a better understanding about what the optimal design looks like compared to the buyer. This makes it crucial that information flows from the suppliers to the buyer before the design of the project to be procured is finalized. It then depends on how well the buyer knows what the specification of the final product needs to be. Intuitively, one might think that if the buyer has a clear picture of the desired characteristics and can, in the best case, even assign a monetary value to each non-price dimension, an auction should still be the best way to proceed. If, on the other hand, the buyer is unsure about the project or product design and needs input from the suppliers before the business is awarded, the answer might not be so simple. Herweg and Schmidt (2017) consider this trade-off in a setting where renegotiations related to the design of the project can occur after the awarding. If the buyer can specify the characteristics of possible design changes in a complete contingent contract, then a scoring auction can be implemented to achieve this information flow and strong competition among bidders at the same time. According to Asker and Cantillon (2008), in a scoring auction, a certain score is assigned to each non-monetary dimension. Non-monetary attributes that a buyer may care about are, for example, time to completion or simply quality of the good. The buyer announces the scoring rule before the auction is held off, namely which score is awarded to which attribute and how the individual offers are ranked. The supplier who then submits the highest scoring offer wins the contract.

If, on the other hand, the buyer cannot specify the characteristics of possible design changes and renegotiations are costly, a negotiation with a preselected supplier may yield a better outcome for the buyer. This reflects the intuition from above: If the buyer is not sure about what properties she desires, she cannot assign scores to different characteristics of her project. She would tend to rely on a price-only auction. But in a price-only auction, bidders have no incentive to reveal potential design flaws early on in the process. A supplier can expect to recoup profits after winning a "cheap" project by revealing design improvements and renegotiating the price only after he won the auction. One idea to mitigate the renegotiations would be to obligate the suppliers to allow for a fixed amount of design changes or repairs in case of contingencies. In an ideal case, the buyer is able

[2]In a related but different context, Bulow and Klemperer (1994) confirm this intuition. Without considering the additional costs of negotiations for the bidders, they compare the revenue of the best possible negotiation with a simple English auction where prices descend until the second-last supplier drops out. The winner is then awarded the business for the price that the last bidder accepted. They find that if you can convince one more bidder to participate in the auction, the expected revenue of the auction is strictly higher than the expected revenue of the optimal negotiation.

to define envelops of changes for those product characteristics that are particularly prone to changes after the auction. If the buyer is also able to quantify the expected cost implications of such changes, suppliers' can compete, as part of the auction, on their commitment not to charge the buyer for certain changes after the auction. It must be emphasized that these commitments could lead to risk premiums being charged by suppliers in the auction. An auction with sufficient competition will be able to reduce these risk premiums to the fair price for the insurance of not getting on additional cost later. This procedure has been successfully implemented in real-life markets (CIPS 2018).

It should, however, be noted that limited liability can lead to problems in this case, i.e., that the firms can only be held liable up to a certain amount before they file for bankruptcy. If a supplier is unable to carry out the repairs or changes for financial reasons, even if contracted upon, the buyer won nothing by auctioning of the project including potential changes. He would need to put the repairs or changes out to tender.[3]

Bajari et al. (2008) find empirical evidence for this intuition. They examine a comprehensive data set of private sector building contracts awarded in Northern California during the years 1995–2000. When the project is particularly complex or if there are very few bidders for the project, a negotiation is preferred over an auction. If the project is more standardized and there are enough bidders, an auction-like process is used to benefit from competition among suppliers.

3 What Is Needed to Make Auctions Work?

3.1 Commitment Leverages Competition

Most real-life procurement processes are related to multi-attribute goods and services. This makes a price-only auction a suboptimal choice, since the buyer cannot account for factors that she deems relevant for her awarding decision in the auction itself. On the other hand, if in a negotiation the suppliers know or anticipate that the price is not the only relevant criterion in the buyer's decision, they have very limited incentives to improve their price. However, from a buyer's perspective, a non-binding negotiation format where she chooses the winner after having seen all the offers might seem attractive, as it allows to take other non-price attributes into account without specifying them explicitly.

In order to benefit from the advantages of an auction as described before, the buyer must find a way to incorporate the additional attributes, such as product quality, service levels, or technical support into the auction. The bidders need to know exactly how the buyer values each attribute and in the best case how an improvement on each attribute increases their chances of winning. If the buyer is able to achieve this, the successful bidder can be determined as a direct result of the

[3]For a more detailed discussion, see Engel et al. (2006).

auction, i.e., the auction carries a commitment from the buyer, and being competitive pays off for suppliers.

It can be argued that commitment is one of the most important factors of designing the procurement mechanism. Fugger et al. (2016) show that without commitment, there is the risk that competitive pressure cedes. They compare two settings of a reverse auction where prices start high and can be continually lowered by the bidders: In the first setting, there is commitment: The best bid according to pre-communicated rules wins. In the second setting, the buyer can choose her favorite bid after having seen all the final offers. This would be considered a negotiation with our definitions from earlier.

Theoretically, they find that once bidders are uncertain about how the buyer selects the winner, then, in equilibrium, the non-binding reverse auction enables them to implicitly coordinate on high prices. This high-price equilibrium is also found in their experimental study done at the University of Cologne. The participants were students with no experience in procurement. Still, they were able to collude on a high price while not even being able to communicate in any other form than the price. It is worth noting that this collusive equilibrium is only stable because there is a lack of commitment on the buyer's side. The tacit collusion works as follows: The suppliers start with a relatively high offer. These offers are such that if the auction concluded at this point, everyone has a positive probability of winning the contract given the uncertainty regarding the buyer's final decision. If one supplier was to lower the offer, the other suppliers would simply follow. This means the first supplier would have to reduce his offer even further, which makes it unattractive to lower it in the first place. Thus, no supplier has an incentive to improve on his initial offer.

For the buyer, this is just as bad as "standard" collusion, where bidders coordinate on a winner before the auction and split up the revenue of the collusive agreement.[4]

If the buyer is not able to commit to the outcome of the selection process, i.e., the auction, suppliers might collude as described above. Another commitment issue could be the buyer's limited ability to make meaningful longer-term agreements because of a fragmented product portfolio. This can be, for example, the case in the consumer goods industry, where buyers might have to run tens of smaller auctions for very similar requirements every year. Every time the company decides to launch a new product edition or variant, the buyers need to secure the respective supply. As the exact future specification is unknown, the buyer cannot include them in any longer-term agreements without facing the risk of significant on-cost charged by the supplier. This situation not only prevents the buyer from leveraging economies of scale, it also could lead to another form of collusion called strategic demand reduction (Milgrom 2004, pp. 262, 264). With strategic demand reduction, suppliers decide not to compete on all projects and instead to divide the market

[4]In another study regarding commitment, Engelbrecht-Wiggans et al. (2007) find that while buyer-determined mechanisms might generate higher buyer surplus, this is only the case when bidders know that the number of competitors is high.

between each other. That way, every supplier can win some of the many auctions run by the buyer for a non-competitive price instead of maybe winning a larger number of projects with slim margins.

This frequent real-life problem can be addressed by bundling future demands in one single auction. As the future demand is unknown, the buyer needs to move away from sourcing an exact specification at the point it becomes known. Supplier must rather compete on a cost or price model defined by the buyer, which is used after the auction to determine the actual price of a part once the product characteristics have been finally agreed by the business. This approach ensures that the buyer can leverage his full volume over a larger period, i.e., increases the buyer's commitment, and is also likely to attract more bidders as the business becomes more attractive—both effects lead to better outcomes for the buyer.

3.2 Comparability Enables Commitment

As outlined above, the buyer must find a way to incorporate non-price criteria into her award decision in order to allow him to run an auction that carries commitment. But how can this be achieved? In practice, two options are prevailing. (1) Some buyers use qualitative scoring mechanisms in order to evaluate softer aspects of the procurement such as product quality, suppliers' reputation and reliability, relationship issues, supply chain risks, and so on. The buyer then assigns a qualitative point score to each criterion and weighs them according to their perceived relative importance. While this artificial construct allows to add non-price factors and product attributes into the decision, this process is prone to making a suboptimal decision. The process of assigning scores and weights is a highly subjective process which does not fully reflect the financial consequences of a given supplier selection. (2) An alternative approach is to monetize the non-price factors. A buyer could, for example, monetize supply chain risks by asking the question what is needed to mitigate this risk. If the answer is, in this example, additional stock-pilling, then the additional cost for storage is a reasonable proxy for the financial consequences of the selecting a riskier supplier. In this second option, no artificial weighing is needed at all as all aspects are monetized and brought to a common denominator, i.e., in Euros or US Dollars.

In both options, the buyer has the ability to incorporate additional product attributes into her sourcing decision and communicate these to the suppliers, which in return allows her to conduct an auction that carries commitment.

3.3 Controlling the Information Flow to the Bidders

To run an auction with full commitment, the buyer needs to be transparent about the exact award criteria for the project and communicate these clearly to the potential suppliers. However, being transparent about the other types of private information related to the market at hand can have adverse effects on revenue.

There are many details a buyer can choose to pass on to the bidders. A first example is information about the competitors' bids. Haruvy and Katok (2013) experimentally investigate the effect of transparency about the bids in a setting where bidders have two exogenously given characteristics: costs and quality. The score of a bid is the monetary bid minus the quality score, and the lowest scoring bid wins the auction. They compare two auction formats, the sealed-bid auction and an open-bid, dynamic auction. In each of those formats, they compare two information regimes. In one regime, bidders know about the qualities of their opponents, and in the other regime, they do not.

In the dynamic auction, bidders can see all the price offers as they are submitted, while in the sealed-bid auction, bidders only know their own bid. This means that in the four treatments, there are varying levels of uncertainty concerning the rank of a bid. In the open-bid dynamic auction with information, bidders know exactly whether they have placed the highest bid or not. In the sealed-bid auction with no information, bidders do not even know how good their offer really is since they do not know their quality offset.

One behavioral trait that is often observed in the context of uncertainty in experimental and real-world behavior is risk aversion. If a person is risk-averse and exposed to uncertainty, she attempts to lower this uncertainty. In the context of auctions, the implications of a bid are most usually subject to uncertainty. When submitting the bid, the bidder does not know whether he will win the auction. He can, however, increase this winning probability by making his bid more attractive. For a risk-averse bidder, the connected monetary loss has less impact than the gain in winning probability. This means that, for example, in a sealed-bid auction, a risk-averse bidder bids more aggressively than a risk-neutral bidder.

In the setting from above, theory yields a clear prediction for risk-averse bidders: The auctioneer would prefer the sealed-bid, no information setting, since in this auction the ambiguity is twofold: Bidders do not know the bid of their opponents, neither the score of their bid. Indeed, the authors find that revenue-wise, the less informative, sealed-bid format is best for the buyer. This means that if an auctioneer can expect bidders to be risk-averse, and information flows between bidders are not important, she should use a format that incorporates a lot of uncertainty.

Another information that the buyer can choose to withhold from the suppliers is the number of actual bidders in an auction. Consider as an example the situation where only one potential bidder shows up. Then, using an English auction where the price starts high and decreases until the second-last bidder drops out, is not a good idea. In this English auction, the bidder would win the project for the starting price, since from the beginning, he is the only bidder left. Using a first-price auction instead, and not communicating to the bidder the actual number of bidders, might be better for the buyer. In a first-price auction, the theoretically optimal bidding strategy depends on the number of bidders. If our lonely bidder were to believe that there are several competitors, the buyer would achieve a much better price. On the other hand, if there are many potential suppliers, a buyer would prefer to reveal that number in order to further encourage competition. A similar thought is expressed by Subramanian (2010): "a sealed-bid auction makes sense when the number of

potential bidders is fewer than five or six. The non-transparency of the process invites the possibility that bidders will bid against themselves […] an open-outcry auction makes sense when you expect several potential bidders to show up."

But the revelation of the number of bidders must not become a signal in itself in this situation. If bidders can infer the number of competitors from whether the number is announced or not, or from the choice of the auction format, they will adjust their behavior accordingly.

This setting is explored theoretically and experimentally by Fugger, Katok, and Wambach (2017). Their research question is whether the buyer can exploit suppliers' uncertainty about the number of competitors in procurement auctions. In their setting, the buyer first observes the number of suppliers and then chooses between a first-price and a second-price auction. Suppliers do not observe the actual number of bidders but know that either few or many suppliers are participating. Suppliers observe the buyer's format choice and submit bids. They find that buyers behave according to the rule-of-thumb proposed by Subramanian (2010), i.e., buyers prefer first-price auctions if the number of suppliers is small and second-price auctions if it is large. It turns out that in this study the suppliers failed to anticipate that the chosen auction design is indicative about the number of bidders.

We can conclude that while a buyer should always be transparent about the rules of the auction, it can be favorable for her to withhold further information about the details of the market at hand under certain circumstances. But this should not be understood as a general practical conclusion. If, for example, the number of potential suppliers is low, the buyer might prefer to withhold the information, if the number is high, she might favor transparency. But especially in repeated markets, the buyer must be careful not to expose her private information with her decision to reveal or not.

3.4 The Right Auction for the Market at Hand

Rules matter. The design of an auction can change the outcome. Decisions like using an increasing or decreasing price schedule or bidders submitting prices versus them simply accepting or rejecting prices can be crucial in real-life procurement.

How to design the optimal mechanism goes well beyond the scope of this article. This has two reasons. First of all, even in clean, theoretical environments, the optimal mechanism is typically not trivial to find. Second, in practice, each procurement comes with a number of project-specific complexities and challenges that need to be addressed and sometimes imply contradicting recommendations from theory. This makes it often impossible to come to a clear answer to what the optimal design consists of.

Still, it can be helpful to understand the advantages and disadvantages of the most common auction formats. Take, for example, the English auction as described before: The price starts high and decreases for a fixed amount with every tick of the price clock until the second-last bidder drops out. The remaining bidder wins the project for exactly this price. Thus, we classify the English auction into the second-price mechanisms. An English auction can be most suited when a supplier would want to update his bidding strategy as soon as he gets to know private information held by other bidders, e.g.. their estimated efforts required to complete the project. In the case that supplier's bid can be expected to improve, once they receive more information, the English auction might present a good option.

One counterpart to the English auction is the ascending price-ticker auction, the so-called Dutch auction. In the Dutch auction, the price starts low and increases with each tick of the price clock until the first bidder accepts the price, hence a first-price mechanism. This format is a good choice when the number of bidders is relatively small as described before, or when suppliers are expected to bid very aggressively. This can be the case if, e.g., a supplier wants to win a new client or needs to fill his capacity. Another reason to use the Dutch auction is when the auctioneer expects suppliers' cost positions, and therefore fallbacks, to differ significantly. Let us assume, for example, two suppliers have costs of 10$ and 6$ per unit, respectively. In an English auction, the project would be awarded for 10$ while the Dutch auction would yield a price closer to 6$ per unit.

On the other hand, dynamic first-price mechanisms are less suited when the aforementioned information flows are important. In a Dutch auction, as soon as you get information, namely that one of your opponents has won, it is already too late to adapt.

In practice, the situation is typically more complicated. Let us assume a buyer conducts a procurement where she believes an English auction to be a good fit as all suppliers have to cope with uncertainties related to the project. These could for example be the yield of new manufacturing process or the costs required to deliver a turnkey project in a new market segment. If she also has reason to believe that bidders' cost structures differ significantly, e.g., due to different manufacturing locations, she might be confronted with contradicting recommendations. This is why, in practice, auction designers often combine different auction formats into a so-called multi-stage hybrid auction design, where each stage utilizes a specific auction format to address one specific challenge in the procurement.

As a case study, let us assume a buyer wants to procure battery cells for her new electric vehicle program and requires quantities that can only be satisfied by a dedicated factory. Suppliers are coming from different countries. All of them are using different manufacturing concepts and none of them has ever entered mass production for such cells before. At the same time, winning the contract is of strategic importance for every single supplier, as winning such contract would be the first step toward establishing one's own technology as the market standard.

Following the argumentation above, it is not obvious which single auction format would be best suited. The buyer might, therefore, resort to a hybrid auction format. In a first stage, the buyer runs an English auction to determine the two front

running suppliers. An English auction allows each bidder to learn about the other bidders' fallback as they understand at every step of the decreasing price clock that more than one bidder considers the current price level to be reasonable. They might also get to know the number of suppliers who are active at each step if the auctioneer chooses to reveal this information. This auction establishes a market for the buyer's unique requirement in real time as suppliers are competing for the business.

In order to mitigate the downside of the English auction, i.e., only getting to the second-best price, the buyer runs the English auction only until two bidders are left. By doing so, she leverages the advantage of the English auction, i.e., market making, up until the third-last bidder drops out. This leaves two bidders who by then have a much better understanding of what the other contender is willing to accept. If the buyer then switches with the remaining two suppliers to a Dutch auction, she might be able to leverage the advantages of first-price mechanisms, i.e., mitigating the risk of large asymmetries between the fallbacks of the best and second-best bidder.

This simple case study shows how the advantages of different auction formats can be combined into a multi-stage hybrid auction, an aspect that is highly relevant for sourcing managers and buyers.

4 Conclusion

Auctions present a great tool to promote competition, but a buyer should pay close attention to the details of the market at hand. Aspects of the project like its complexity, but also characteristics of the supplier pool like asymmetries or even just the expected number of potential bidders matter when deciding which award mechanism to use.

Broad practical conclusions are difficult, as the properties of the best award mechanism depend crucially on the situation at hand. If a complete design of the project can be drafted and contracted on and the performance of the supplier is easy enough to verify, then an auction provides suppliers with the greatest incentives to lower their prices. If on the other hand, input from the suppliers is crucial while the project is not yet awarded, for example, during the design stage, a negotiation can be favorable to an auction. This is the case for very complex projects where contingencies can be too numerous or unforeseeable to the buyer to include them all in a contract.

Still, setting up an auction with commitment to the auction rules can be a considerable task in an organization, but it can be worth it.

References

Asker, J., & Cantillon, E. (2008). Properties of scoring auctions. *The Rand Journal of Economics, 39,* 69–85.

Bajari, P., McMillan, R., & Tadelis, S. (2008). Auctions versus negotiations in procurement: An empirical analysis. *The Journal of Law, Economics, & Organization, 25*(2), 372–399.

Bulow, J., & Klemperer, P. (1994). *Auctions vs. negotiations* (No. w4608). National Bureau of Economic Research.

Chartered Institute of Procurement and Supply. (2018). http://www.cipssmawards.com/finalists/how-to-nail-a-jellyfish-to-the-wall–man/.

Engel, A., Ganuza, J., Hauk, E., & Wambach, A. (2006). Managing risky bids. In N. Dimitri, G. Piga, & G. Spagnolo (Eds.), *Handbook of procurement* (pp. 322–344). Cambridge: Cambridge University Press. https://doi.org/10.1017/cbo9780511492556.014.

Engelbrecht-Wiggans, R., Haruvy, R. E., & Katok, E. (2007). A comparison of buyer-determined and price-based multi-attribute mechanisms. *Marketing Sci., 26*(5), 629–641.

Fugger, N., Katok, E., & Wambach, A. (2016). Collusion in dynamic buyer-determined reverse auctions. *Management Science, 62*(2), 518–533.

Fugger, N., Katok, E., & Wambach, A. (2017). Exploiting uncertainty about the number of com-petitors in procurement auctions. *Working Paper*.

Gretschko, V., & Wambach, A. (2016). Procurement under public scrutiny: Auctions versus negotiations. *The Rand Journal of Economics, 47*(4), 914–934.

Haruvy, E., & Katok, E. (2013). Increasing revenue by decreasing information in procurement auctions. *Production and Operations Management, 22*(1), 19–35.

Herweg, F., & Schmidt, K. M. (2017). Auctions versus negotiations: The effects of inefficient renegotiation. *The Rand Journal of Economics, 48*(3), 647–672.

Milgrom, P. (2004). *Putting auction theory to work*. Cambridge University Press.

Subramanian, G. (2010). *Negotiauctions: New dealmaking strategies for a competitive marketplace*. New York, NY: WW Norton & Co.

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Purchasing's Role as an Influencer of Business Outcomes

Thomas Nash and Robert Handfield

1 Introduction

This "influence model" to procurement may appear to be simple, but it is not. It requires a different skill set and a careful approach to manage difficult conversations with individual business leaders, and not simply telling people what to do. And because of this, the majority of purchasing organizations are not well versed nor well practiced in using this approach. According to Gartner (Strengthening Procurement's Influence on the Business—March 2019), "*Chief Procurement Officers (CPOs) know the ability to engage and influence senior business leaders is a critical factor in becoming a more strategic function.*" Closing the gap between knowing influence is important, and knowing how to influence stakeholders, is the focus of this chapter. We rely on a number of proven techniques and approaches adopted by the authors, acting as both a Chief Procurement Officer, on the one hand, and educator and consultant to purchasing organizations, on the other. Our insights reflect the fact that transitioning to an influence model has strong potential outcomes, but requires fundamental change, specifically in the way that purchasing operates.

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The first rule of using the "influence model" is that you must first be willing to be influenced yourself. And if you are not, then we would submit you are not likely to be very successful at influencing others if others do not believe they can influence you. Imagine that.

And results can be substantial. According to Gartner (**Strengthening Procurement's Influence on the Business—March 2019**), "*Procurement organizations with more influence enjoy a greater than 400% improvement in savings (compared to those with low influence) while also converting a higher percentage of noncore project proposals*." This outcome appears incredible but attests to the power of this approach. Read on, and you will learn how you can adopt the influence model.

2 Theoretical Origins of the Purchasing Influence Model

Many purchasing managers complain that they do not have access to decision-makers and do not have a significant impact on business strategy. This is related to the concept of "Locus of planning," which has been around for many years. An individual's local of planning refers to the depth of employee involvement in a firm's strategic planning activities (Handfield et al. 2009). A deep locus of planning denotes a high level of employee involvement in the planning process, which is akin to the Japanese style of team-oriented planning (Reid 1989). Integrative devices such as committees, task forces, and integrative personnel bring importance facts to bear upon decisions (Miller and Friesen 1983). Although Schumpeter's (1934) original perception of this quality was to ensure that the people "closest to the customer" would be involved in the planning process, we reverse this conceptualization of the entrepreneurial role to posit that the people "closest to the supplier" should be involved in planning processes (Handfield et al. 2015). Moreover, a deep locus of supply planning legitimizes the active participation of middle and lower-level supply managers in the planning process (Barringer and Bluedorn 1999). This maximizes the diversity of viewpoints and provides a deeper and more diverse mix of views in the strategic planning process (Dutton and Duncan 1987; Judge and Ziethaml 1992).

As purchasing has evolved from its roots, so have the challenges faced by purchasing executives in terms of leadership recognition, talent management, and organizational governance. Modern global enterprises are faced with a massive new set of challenges, including new conditions of volatility, heightened supply risk, complex logistics, keeping up with technology, and the spread of government regulation, not to mention the tremendous strain of man's presence on the earth's natural resources. In contrast to these enormous strategic priorities, the bulk of (so-called *strategic*) activity by purchasing leaders continue to focus on saving cost and "low hanging fruit." Many purchasing functions still largely pursue cost reduction through volume consolidation and leveraging of an organization's total spend, followed by supply base reduction and long-term contracting (Monczka et al. 2010).

Executives recognize that supply management must adopt a more strategic approach that targets performance beyond simple cost savings. To some extent, the field of supply management has become more enamored with strategic sourcing, to the exclusion of the most important party in the supply chain: the internal customer (Chick and Handfield 2014b). As one Chief Procurement Officer we interviewed at a major oil and gas company emphasized:

> Procurement has gotten too hung up on being 'world class.' Procurement is simply a set of tools on a tool belt, but the real wave of change involves understanding the business well enough to apply the tools that will drive the most effective model for each of the operating groups and geographies we are in. We have a strategy that is focused on ticking the boxes around applying the tools. But we are too focused on getting an answer, rather than an outcome that matters to our stakeholders. We want to create nice two by two's to label our suppliers, rather than generating and delivering a coherent strategy that defines how we work with them to meet our business needs.

This characterization of purchasing recognizes a new set of value drivers that go beyond cost savings: understanding internal customer requirements and codifying these requirements into a coherent statement of need that can be understood by the external supply market (Handfield 2013). We term this new capability "*purchasing influence*" in that it enables purchasing to link internal and external parties that are mutually dependent on one another, by creating the ability to influence internal stakeholders. As the primary boundary-spanning interface between the internal and external domains of the enterprise, purchasing has an exclusive mandate to ensure congruency in performance outcomes between the stakeholder's expectations and the suppliers resulting performance. (Handfield 2019). The types of congruent contributions that purchasing is capable of providing include product innovation and technology development (Handfield et al. 1999), knowledge sharing and new process capability development (Dyer and Nobeoka 2000), multi-tier supplier integration (Choi and Yunsook 2002), mitigation of supplier risk (Ellis et al. 2011), supplier performance improvement and capability augmentation (Krause et al. 2000; Krause and Scannell 2002), supplier financial disruption avoidance (Wagner et al. 2009), and sustainable supply chain improvements (Wieland and Handfield 2013). Supply management leaders are unanimous in their call for an evolutionary approach to purchasing transformation, through the improved alignment of internal stakeholder requirements with an emerging and growing global supply base (Handfield 2013; Monczka et al. 2013; Kotabe et al. 2003; Chen et al. 2004). The key to this capability lies in the concept of purchasing influence.

3 Purchasing and Supply Management Leadership in North America

Today's more progressive Purchasing/Supply Management organizations in North America, and across the Global Fortune 500, recognize that getting buy-in from key stakeholders is more successful using the *influence approach*, as opposed to the

command and control model. Research suggests that applying the influence model can result in significant financial performance improvements, as well as improved product and process design, improved supplier quality, and improved response time (Handfield et al. 2009, 2015). In fact, these results point to the fact that the "command and control" style of "telling people what to do" is neither effective nor sustainable in getting things done in any organization. And the simple reason is that using command and control goes against human nature.

As an example, consider how your parents spoke to you, or alternatively, how you speak to your children as a parent. Effective parents know all too well that it is not so much "what" they tell their children, but "how" they convey the message. To put it another way, if a parent commands a child to do something because "I am telling you to do this and you will listen to your father (or mother)," the child would likely comply but not be all that happy about it. On the other hand, if a parent asked their child to do something in a subtler way and they made it seem like it was "their idea," there is a very good chance the child will not only take their advice, but will also likely internalize the "idea" as their own, with their own "heart and mind." Compare this to the opposite of "getting a direct order" and simply going through the motions to comply with an order from a superior or person of authority.

A parent's role is also to set frame conditions and boundaries for a son or daughter and to be a role model. In that regard, another metaphor that may be useful is to think of purchasing as a coach to other business functions (Handfield 2013). Depicting purchasing in a stakeholder coach role has several implications associated with it. First, coaches are expected to act ethically in the best interest of their players. By improving the individuals on a team, and helping them make better business decisions, the entire team (e.g., the organization and its supply chain) will benefit. Second, coaches must often dedicate their time to those players on the "first string." Organizations may have many business functions, but only a handful of these are strategic and merit attention. Purchasing can help key business functions operate at their peak, by helping them condition and work with only the best, most fit suppliers. Supplier management involves knowing which suppliers to keep and which to develop. And finally, coaches must understand the competition and help their players understand what they must do to win. As such, purchasing must continually seek to improve the performance of their key stakeholders and to drive operational excellence in every dimension of their performance.

And of course, influence can only exist if the "influencer" (the one trying to influence others) has established a level of trust and credibility with those he/she is trying to influence. Not surprisingly, such trust and credibility are earned over time. A wise man once said that "Trust develops through a series of small promises kept." There is no rushing the influence model.

4 Why Is the "Influence Model" Fundamental to Successful Purchasing and Business Outcomes?

The simple answer to this question is … because it works.

Stakeholders in any organization normally like to be engaged, and engaged early, particularly when it comes to anything that impinges or impacts their area of responsibility. They feel ownership, and rightly so. If you are going considering making any changes to procurement policy or strategies that will impact the people that report to these business leaders, you had better make them aware of that early and get their approval. That may sound like an obvious statement, and you would be surprised how often this simple step is overlooked by purchasing.

A recent white paper titled Agent of Change—The Chief Procurement Officer and the Transformation of Corporate Procurement'[1] noted the following

> … To institute this procurement transformation successfully, the CPO must become a valued partner and recognized asset who collaborates effectively across the organization. It's less and less about being a master of the purchasing technique today, said Philip Duncan, CPO for Novartis. It's far more about the ability to persuade, to influence, to see the bigger picture and have credibility with the business.

Everyone knows that the best teams are the teams that work well together because they trust one another, and they are singularly focused on the outcome … winning. Having a dictator on the team telling the team what to do is usually not a recipe for success. So why then do so many resort to "command and control?"

There are four reasons that help to explain why individuals have typically resorted to an authoritarian, "command and control" approach to purchasing leadership (Chick and Handfield 2014b; Handfield et al. 2009). These can be put into the category of "Old Thinking."

4.1 Old Thinking

- Purchasing must dictate the rules, as not doing so will surely result in chaos (e.g., there is a fire in the theater and people need to exit to save their lives!)
- It takes too much time for purchasing to explain everything to stakeholders and sell them on the idea, simply telling them what to do which is faster and easier.
- Purchasing has always operated this way, and there is no other operating model that works. (It is all the individual knows, and this is likely because they have never been shown a different way to operate

[1]Spencerstuart.com, July 2010. **Agent of Change—The Chief Procurement Officer and the Transformation of Corporate Procurement**. https://www.spencerstuart.com/-/media/pdf%20files/research%20and%20insight%20pdfs/agent-of-change_01jul2010.pdf.

- Influencing is not something purchasing needs to do. They are granted implicit authority over all third-party spending, and they have the right to act like a "traffic cop" and direct stakeholders. (They do not have the patience to influence individuals, and/or have never spent time learning or developing the required skills to do so.)

In seeking to convince purchasing leaders that the influence model is fundamental to success, it is important to use a rational and logical approach, which we have termed "New Thinking."

- Using influence to drive aligned decision making is a "soft-sell" approach that is compatible with human nature; people want to feel respected and valued. The approach of selling is more effective than telling them what to do.
- People like to be asked for their opinion and their advice before a decision that impacts them is taken. In fact, eliciting ideas from stakeholders may produce new insights that purchasing would never have thought of on their own!
- Faced with change, people like to have options on how they can proceed, and not have options chosen for them on their behalf. Options involve individuals as decision-makers, which leads to better buy-in.
- There are always many ways to do things and seeking individual insights can often generate new approaches that have not been considered yet.
- Generally speaking, winning individuals' "hearts and minds" always produces better outcomes than "begrudging compliance".
- The influence model both respects the individual AND promotes teamwork, as it relies on everyone having a say on the outcome of the process.
- Influence achieves superior outcomes, as it engages individuals to produce new ideas that produce creative and innovative solutions for solving problems. Empirical evidence shows that financial performance improved product design and improved responsiveness all are products of greater stakeholder engagement in the sourcing process (Handfield et al. 2015).

The purchasing influence model is consistent with Maslow's theory on the Hierarchy of Needs (Maslow 1943), in that the approach directly aligns with stakeholders' needs for respect, and for their opinion and decision making to be taken into consideration. And when dealing with senior executives (who are much more likely to be higher up on the pyramid of needs, in the "self-actualization" category), it becomes even more important to treat these individuals with respect and recognition of the value of their insights and opinions. The need to present senior executives with facts and market data can elevate purchasing's level of influence, by demonstrating deep knowledge of the supply market. This occurs when purchasing has a strong supply market intelligence capability and presents tangible options based on research and facts (Handfield et al. 2009, 2015).

This is not to say that all purchasing procedures can be dismissed, as there are many purchasing procedures that must be complied with. This is particularly the case when it comes to the "Procure to Pay" process, which requires individuals to

follow procedures for requisitioning, using approved sources of supply, compliance to existing contracts, approval levels, and following invoicing protocol. However, it is important to emphasize to stakeholders that these procedures are in place to meet financial and accounting requirements that directly influence reporting of financial results. Within the context of following these purchasing procedures, however, one can emphasize that these set the boundaries for creativity and ideation. Purchasing requires stakeholders to follow financial procedures but is willing and in fact encourages "thinking outside the box" when it comes to creative solutions to business problems. Such thinking is consistent with emerging models of corporate cultures which are seeking individuals to break out of their standard ways of thinking and drive toward innovative digital solutions (Handfield 2013).

5 How Does the "Influence Model" Work in Practice?

There is not a single "influence model" that will work in every situation—rather, there are some fundamental principles that executives should use to guide their approach, based on the nature of different problems and individuals at hand. Building influence is clearly a skill that requires development and practice over time; the more practice you have in using the model, the more experienced and knowledgeable you will become on the variety of approaches available to you to apply in different situations. The key, in our experience, is to begin with a generalized approach that we outline here, but to be flexible and creative in figuring out what influence approach may work best based on the response and feedback you receive over time. And then after the encounter, conduct a debrief with a colleague and summarize the lessons learned from the experience. Over time, you will find that a common set of approach will evolve as being most effective, and you will learn when and how to adopt them for future discussions.

The key to influencing others is not simply selling the other party on your idea. Rather, the key is having them *believe it is their idea*. This approach is consistent with the 16th principle of the "Dale Carnegie" method for influencing people which states, "let the other person feel that the idea is his or hers." By doing so, the idea will stick with the person and he or she will take more away from the idea since it is "theirs."[2]

In the same manner, when engaging key stakeholders, if the conclusion you lead the individual to effectively is perceived as their idea, then they will want to move forward with it! This is akin to the idea of the lawyer presenting the data and evidence of a case to a jury. An effective lawyer will present the evidence in such a way that the jury will come to a conclusion, which is where the lawyer hoped they would end up. To repeat General Eisenhower statement, "*the art of motivation is getting people to do what you want them to do because they want to do it*."

[2]Carnegie (2009).

As purchasing practitioners, there are some proven approaches we have identified that can be used to influence others. These are described below, in no particular order. The common element in each of these cases is that the use of evidence, data, and options is provided as the genesis for the decision. In addition, each of these approaches leaves open the possibility of new ideas and suggestions to be offered by stakeholders. Consider the following as a few examples, but there are of course many other situations that will also work well. Each approach is somewhat different, as it embodies a variety of different methods for creating influence over others, as noted below.

Corporate audit. One approach used in some situations is to ask your corporate audit function to come in and examine an area, to recommend any opportunities for improvement. This approach is most aligned with the idea of "complying with the rules," which are set forth in the documented procedures and processes for the financial systems of the organization. The beauty of this approach is that most people in any organization will want to respond positively to corporate audit's recommendations. They recognize it is important to follow the rules, as the results will impact financial outcomes, which must meet Generally Acceptable Accounting Principles criteria adopted by a corporate audit team. As basic as this "influence model" approach is, you would be surprised how often this tool is overlooked. Simple, but powerful. For example, you may ask audit to examine current invoices paid, and check the number of them that are being paid to registered, audited suppliers. Or to check the current set of contracts and determine if any of them are outside of the legal policies instituted by the Corporate Governance Board. In such cases, there will almost surely be findings that can be used to drive an influence model in a direction that can put purchasing in a position to suggest change (Chick and Handfield 2014b). However, as every accountant knows, there is always room for interpretation of the rules for an audit, and purchasing must be willing to work with stakeholders to accomplish the objectives of the audit team, but do it in a way that is not disruptive or negatively impacts operational goals of the business. There is less room for creativity and freedom when it comes to corporate auditing rules, but some adoption to circumstances is also needed.

Evidence-based. A key role of purchasing is to do their homework before presenting an issue to stakeholders. This entails doing additional supply market research (Handfield et al. 2015), developing the business case, and practicing the "pitch" that will be made to stakeholders before actually going into do it. Market intelligence involves collecting information from reliable third-party sources,[3] as well as conducting internal spend analyses, cost models, total cost of ownership models, or other evidence that provides compelling information on the decision and sheds lights on different facts that stakeholders may be unaware of (Chick and Handfield 2014b;

[3]Examples include Beroe Live or ProcurementIQ. The NC State Supply Chain Resource Cooperative has student teams that often will conduct market research studies for specific procurement categories (http://scm.ncsu.edu).

Monczka et al. 2013).[4] This will also elevate purchasing in the opinion of stakeholders, as you are providing them with data and information that they were previously unaware of, that concerns their area of responsibility and their business decisions. This data, if incriminating, has to be presented again with a "soft touch," as the initial reaction of the stakeholder may be that the data is "wrong." If that is stated, then go back and re-check the data. Then present it again! This is particularly important if dealing with a scientific or financial community, such as CFO's, physicians, engineers, or scientists (Dyer and Nobeoka 2000; Choi and Yunsook 2002).

Optioning Stakeholders. Another proven approach to influence a group of stakeholders is to assign that function the responsibility of making decisions for that particular issue, and then providing them with tangible options and proposals on how to proceed. It is also important to present the "pros and cons" of each option, and to develop research/intelligence that supports these criteria. In this manner, purchasing is not perceived as taking charge, but is seen more as a facilitator, a gatherer of the facts, and a type of "internal consultant" to the function calling the shots. Because this function is "in charge," the individuals being influenced are in fact tasked with approving/endorsing proposals and decisions. Purchasing is perceived as simply facilitating the decision-making process, which ultimately is "up to you, the decision-maker." The optioning approach can take many forms, but one that has been particularly effective in our experience involves employing a Stakeholder Advisory Board (SAB).

Stakeholder Advisory Board The purpose of the SAB is for the Business and Corporate Functions (e.g., IT, marketing, legal, finance, risk, audit, etc.) to review and endorse proposed Procurement/Category Strategies to ensure such strategies solve a real business problem, and at the same time, the proposed Strategy/Initiative mitigates risk and maximizes commercial opportunity, all with the aim of improving business performance.

The SAB is primarily employed for the purpose of strategy implementation. Purchasing may assign individuals to conduct their own market analysis, gather the facts, and develop the business case for a given course of action, which is then presented to the SAB as a proposal (Monczka et al. 2013; Chick and Hadnfield 2014a, b). In the context of this book chapter, the important component of influence is to engage the SAB to "approve" the strategy, buy into the roll-out plan, and delegate individuals within their function to work with purchasing to roll out the strategy. Getting the SAB to agree requires a high use of influence skills, the most important of which is the "Evidence-based" model discussed above. By presenting tangible market facts, spend analytics, and market research to the table in the strategy generation stage, purchasing can provide a solid foundation for the strategy implementation.

[4]Examples may include Handfield, R. Procurement Analytics: Enabling the Journey to Value. IBM Research Paper. https://www.ibm.com/blogs/watson-customer-engagement/2016/02/29/procurement-analytics-intelligence-to-drive-more-effective-procurement-strategies/. Handfield (2010).

A critical success factor for a Stakeholder Advisory Board is to ensure you have the right "Board Members" (e.g., senior leaders from the Business and Corporate Functions) sitting on the Board. In addition, it is critical to establish an agreed upon structure and operating protocol for the Board to operate efficiently and effectively. Such a protocol can be set forth in easily understood, documented Board Guidelines that describe the "what, why, how, who, when, and for what result" of the Board. Board members know what to expect during the Board Meeting and are more likely to show up as they know that it will be efficiently and effectively operated using these guidelines. Different members of the executive leadership team may head up the SAB, but generally this will be the Chief Financial Officer, who has direct oversight in many cases over the purchasing function, or the CEO of the Chief Operating Officer in rather technically oriented companies.

The essential element of the SAB concept is that the stakeholders, Business and the Corporate Functions, are in *complete control of making decisions* regarding which Category Strategies, Programs, or Initiatives will be approved. It is clear from the outset that without the SAB's approval, nothing will move forward. In the majority of cases, in our experience, the SAB will agree with the same strategy proposal that the purchasing team is promoting. Here again, the essence of this is ensuring that proper documentation, data, and business intelligence is available to support the category strategy. Although this evidence may not be presented in its entirety during the SAB meeting, it is made available to anyone that wants additional details. The final decision generally involves selecting one of the options proffered by purchasing that works the best for all parties involved, because everyone has had a voice in endorsing the decision. This is a "One Company" approach to Purchasing and Supply Management that ensures all business functions are onboard. If resistance to a strategy is encountered by others in the company, purchasing can point to the approval of the associated stakeholder on the SAB as the rationale for the change. In more and more effective purchasing organizations, the SAB has become the primary if not the only pathway to approval and deployment of any and all purchasing strategies, category strategies, new system deployments or any other major change or investment. The SAB, because it is consulted and asked for their opinion, is often seen as the most effective of the four purchasing influence models used in organizations today (see Fig. 1). While the other approaches may be effective for one-on-one approaches, each organization must decide for themselves what the relative "share" of influence models shown in Fig. 1 should be employed, based on the culture and characteristics of the organization at hand.

Of course, a governance mechanism such as a Stakeholder Advisory Board requires some additional factors that will ensure the maximum success and maximum influence:

- **Business-Led**. This leadership at the Board by the Business reminds everyone that this is "Business Spend and Business Led." Board membership is comprised of senior executives from all major businesses & functions (e.g., IT, HR, Marketing, etc.) as appointed by their President or C-Level.

Fig. 1 Variations of the purchasing influence model (authors' own figure)

- **Business Voice**. Each submittal brought to the Board is presented by the Business or Function as this is their spend and their strategy, as facilitated by Purchasing/Supply Management.
- **Decision-Making Body**. The Board is a decision-making body where decisions are made and therefore each executive carries their President's or C-Level's decision-making authority.
- **Operates Similar to Board of Directors**. Just like any Board of Directors meeting, the Agenda (including submittals) are sent to the Advisory Board Members three days in advance of the Board Meeting as a "briefing book." Similarly, at the end of the Board Meeting, detailed Board Minutes are sent to the Board within 48 h of the Board Meeting.
- **Make it Easy for Executives**. The following are key elements of the Board operating protocol that make it easy for the Business and Function Executives to attend:

  - **Board Meetings Set in Advance**. Meets at 7:45–8:45 am ET 3rd Wed of each month, which is 45 min earlier than normal business work hours that start at 8:30 am ET.
  - **Absence**. If Board Member will be absent, that Board Member has two choices … (1) send delegate but delegate carries President's decision-making authority or (2) be absent and then have 5 business days from date of Minutes to comment. No comment is taken as that Board Member's endorsement of all submittals that were presented at the Board Meeting.

- **Chair of Board**. Ensure the Board Chair has significant "position power" to influence others. And not just influence others as to which decision is the "right decision" but even more basic, be able to influence others to attend the Board Meeting via the Chair's own attendance.

6 Results from the Influence Model

The most important result that emerges from the influence model is improved relationships between purchasing and other business functions, leading to better teamwork and collaboration. Why? Because those being influenced recognize that they have a strong and effective business partner within the purchasing function, who can help them operate and run their area of the business more effectively. By partnering with the business, the purchasing-led team is having a meaningful and measurable improvement on the business.

And the best part of all is that by more deeply engaging teammates via influence, rather than command and control, the results will not simply be a one-time event because someone told them what to do. Instead the results will more likely be sustainable because the hearts and minds of key decision-makers in the organization are at work. When people want to do something, they will typically be much more creative and innovative in seeking solutions to real business problems, and the ensuring results are that much more relevant to the business strategy and outcomes.

References

Barringer, B. R., & Bluedorn, A. C. (1999). The relationship between corporate entrepreneurship and strategic management. *Strategic Management Journal, 20,* 421–444.

Carnegie, D. (2009). *How to win friends and influence people* (p. 180). Simon and Schuster.

Chen, I. J., Paulraj, A., & Lado, A. A. (2004). Strategic Purchasing, supply management, and firm performance. *Journal of Operations Management, 22,* 505–523.

Chick, G., & Handfield, R. (2014a, December 12). Book excerpt: Procurement maturity: Understanding performance versus value. *Supply Chain Management Review*. https://www.scmr.com/article/book_excerpt_procurement_maturity_understanding_performance_versus_value.

Chick, G., & Handfield, R. (2014b). *Procurement's value proposition*. London: Kogan-Page.

Choi, T. Y., & Yunsook, H. (2002). Unveiling the structure of supply networks: Case studies in Honda, Acura, and DaimlerChrysler. *Journal of Operations Management, 20*(5), 469–493.

Dutton, J. E., & Duncan, R. B. (1987). The influence of the strategic planning process on strategic change. *Strategic Management Journal, 8*(2), 103–116.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal, 21*(3), 345.

Ellis, S. C., Shockley, J., & Henrey, R. M. (2011). Making sense of supply disruption risk research: A conceptual framework grounded in enactment theory. *Journal of Supply Chain Management, 47*(2), 65–96.

Handfield, R. (2010, November). Supply market intelligence: Think differently, gain an edge (pp. 42–49). *Supply Chain Management Review*.

Handfield, R. (2013, July). The future of procurement. Research Brief. KPMG Procurement Advisory Group, Houston: KPMG International. https://assets.kpmg/content/dam/kpmg/pdf/2014/11/Delivering-Procurement-Value-O-201310.pdf.

Handfield, R. (2019, November). Shifts in buyer-seller relationships: A retrospective on Handfield and Bechtel (2002). *Industrial Marketing Management, 83*, 194–206.

Handfield, R. B., Ragatz, G. L., Petersen, K. J., & Monczka, R. M. (1999). Involving suppliers in new product development. *California Management Review, 41*(1), 59–82.

Handfield, R., Petersen, K., Cousins, P., & Lawson, B. (2009). An organizational entrepreneurship model of supply management integration and performance outcomes. *International Journal of Operations and Production Management, 29*(2), 100–126.

Handfield, R., Cousins, P., Lawson, B., & Petersen, K. (2013, July). How can supply management really improve performance? A knowledge-based model of alignment capabilities. *Journal of Supply Chain Management, 51*(3), 3–17.

Judge, W. Q., & Ziethaml, C. P. (1992). Institutional and strategic choice perspective on board involvement in the strategic decision process. *Academy of Management Journal, 35,* 766–794.

Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining from vertical partnerships: knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. *Strategic Management Journal, 24*(4), 293–316.

Krause, D. R., & Scannell, T. V. (2002). Supplier development practices: Product- and service-based industry comparisons. *Journal of Supply Chain Management, 38*(2), 13–20.

Krause, D. R., Scannell, T. V., & Calantone, R. J. (2000). A structural analysis of the effectiveness of buying firms' strategies to improve supplier performance. *Decision Sciences, 31*(1), 33–55.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396.

Miller, D., & Friesen, P. H. (1983). Strategy-making and environment: The third link. *Strategic Management Journal, 4*(3), 221–235.

Monczka, R. M., Blascovich, J. D., Markham, W. J., Parker, L. M., & Slaight, T. H. (2010). *Value focused supply: Linking supply to competitive business strategies*. Tempe, AZ: CAPS Research.

Monczka, R. M., Handfield, R. B., Giuniper, L., & Patterson, J. (2013). *Purchasing and supply chain management* (6th ed.). Cincinnati: South-Western.

Reid, D. (1989). Operationalizing strategic planning. *Strategic Management Journal, 10*(6), 553–567.

Schumpeter, J. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Wagner, S., Bode, C., & Koznol, P. (2009). Supplier default dependencies: Empirical evidence from the automotive industry (pp. 198, 150–161). *European Journal of Operational Research*.

Wieland, A., & Handfield, R. (2013, September). The socially responsible supply chain: An imperative for global corporations. *Supply Chain Management Review* (forthcoming).

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Towards Efficient Financial Supply Chains: How to Leverage Inter-organizational Working Capital by Digitalizing the Financial Flows

Lotta Lind and Florian Schupp

1 Introduction and Background

Management of working capital (WC), i.e. inventories, accounts receivable and accounts payable, has become an important topic in many firms, and several large companies, such as Adidas and BMW, have emphasized strict working capital management as an essential element of managing the business. In smaller firms, the topic is even more important due to limited access to external finance (Tran et al. 2017) and the crucial role of efficient working capital management in the growth and long-term survival of small firms (Pais and Gama 2015). In addition to focus on efficient inventory management, the increased focus on WC management has made companies experience pressure to extend their payment terms towards suppliers in order to release cash to be used for strategic investments and growth. At the most, payment terms tie up WC for even 120 days. For this period, many suppliers are forced to turn towards external funding sources in order to cover the expenses of their operations, which increase their financing costs. However, according to previous research (e.g. Kroes and Manikas 2014), the increase of accounts payable at the expense of suppliers benefits the buying company only in the short term. In recent years, financial issues and the management of WC in the supply chain context have also gained increasing attention. This has led to the development of different supply chain finance solutions (e.g. reverse factoring) that aim at win-win situations for buyers, suppliers and financial institutions (Liebl et al. 2016). In reverse factoring, a buyer provides the supplier an access to cash on the buyer's credit rating, while the buyer benefits from the reduced WC by extending the cycle

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time of accounts payable without affecting the cycle time of the accounts receivable of the supplier (Grüter and Wuttke 2017). The financial institutions benefit in terms of interest rate and service fee.

But what if the companies collaborated to release WC from the supply chain without financial institutions? This may sound radical in the reality, where individual companies focus on the attempts to decrease their own WC as much as reasonably possible, but let us forget the real life for a while and elaborate this thought a little further. Supply chain finance services provide a short-term relief, but not without costs. Payment terms between companies are contractual issues that can be negotiated. Would it be possible to find a win-win solution that benefits all supply chain partners? In this chapter, we study collaborative WC management by focusing on trade credit, i.e. accounts receivable and accounts payable. Our hypothesis is that by adjusting and harmonizing payment terms, WC can be released from the supply chain in a way that all its members benefit. The objective of the paper is to develop and test the model for releasing WC through payment term adjustments. The two research questions of the study are as follows: (1) How could the optimization and standardization of payment terms be accomplished in the supply chain? (2) How do the adjustment and standardization of payment terms affect the WC in the supply chain? In this study, we provide an innovative alternative for the payment term extensions of individual companies by introducing a model for collaborative payment term adjustment in the supply chain in order to achieve a win-win situation and release WC from the supply chain for more productive use.

Digitalization plays an important role in our idea, because the possibility of transparent and real-time information enables significant potential for the management of financial flows. Sharing accurate information in the supply chain, setting targets for WC management at the supply chain level and monitoring the realized cycle times in real time are ways by which trust between the supply chain partners could be enhanced and tied-up WC in the supply chain released. This would improve the overall efficiency of the financial supply chain. Figure 1 describes the framework of this study, and it is based on digitalization. Digitalization provides opportunities for more efficient processes and cost savings in the supply chains. The purpose of the WCM platform (Fig. 1) is to combine the WC data from the supply chain actors and provide information for monitoring and managing inter-organizational WC. In this study, we study the potential benefits gained by applying the WCM platform in the supply chain.

2 Research Design

Our study is twofold. First, the model for optimizing the financial flows of working capital in the supply chain is introduced. Second, the model is tested with scenarios in the context of a supply chain by using real-life financial data. The supply chain used as an example in this study represents the automotive industry. Previous research on WC management in the automotive industry has shown that the

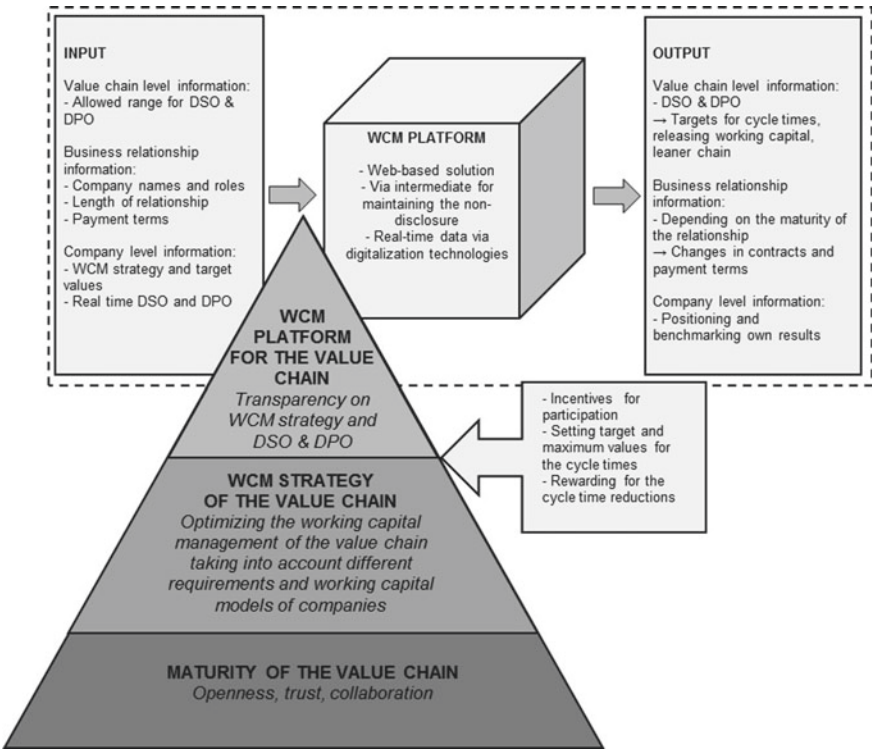

Fig. 1 WCM platform (adapted from Lind et al. 2018)

automotive companies have potential to release WC (Lind et al. 2012; Brandenburg 2016). The results have shown that tightened payment terms required by the suppliers affected the ones provided for customers (Lind et al. 2012). The effect was visible throughout the value chain, as the changes in the cycle times of accounts receivable and accounts payable offset each other. Viskari et al. (2012) observed the connection between WC management and profitability in the automotive industry. Their results showed that a radical reduction in payment terms would improve the profitability of the whole value chain the most. This would require collaborative actions with the value chain partners, which has been emphasized by several studies (e.g. Randall and Farris 2009; Viskari and Kärri 2012), but the results of Vázquez et al. (2016) showed that WC in the automotive sector is not managed in a collaborative way. Even if the academic studies have reported benefits of inter-organizational WC management, the realization of such collaboration in practice is not a simple task. One major barrier in this is trust between the supply chain partners. Payment terms are negotiation issues between the companies, and they are not visible nor controlled at the supply chain level.

In this study, WC is measured by cycle times. We used the following formulas for the cycle times of WC (CCC) and its components:

$$\mathrm{CCC} = \mathrm{DIO} + \mathrm{DSO} - \mathrm{DPO} \tag{1}$$

$$\mathrm{DIO} = \mathrm{Inventories}/\mathrm{Sales} * 365 \tag{2}$$

$$\mathrm{DSO} = \mathrm{Accounts\ receivable}/\mathrm{Sales} * 365 \tag{3}$$

$$\mathrm{DPO} = \mathrm{Accounts\ payable}/\mathrm{Sales} * 365 \tag{4}$$

In the analysis of the cycle times, average values of the observation period were used. This approach provides a more realistic view of the WC level of the companies by balancing the effects of possible exceptional years. In this study, we concentrate on DSO and DPO. DIO is an important element of WC management, but also the component individual companies can most affect by themselves, whereas DSO and DPO are dependent on the supply chain partners.

3 Model for Optimizing the Financial Flows of Working Capital in the Supply Chain

On the basis of the WCM platform (see Fig. 1), we developed a model which can be used to optimize the financial flows of WC in the supply chains by adjusting the cycle times of accounts receivable and accounts payable. The model is illustrated in Fig. 2, and it describes the context in which the WCM platform can be used. The supply chain of the study has four stages that consist of companies operating in the same part of the chain. Except for car manufacturers, it is assumed that companies do not operate in the automotive industry only. Thus, the model considers the shares each company has with the supply chain partners. As described in Fig. 2, the DPO of refined raw material suppliers and the DSO of car manufacturers are out of the scope of the model. This means that in this model, these components remain unchanged. The supply chain of this study cannot affect the cycle times of these WC components, as the refined raw material suppliers as well as the customers of car manufacturers are not included in the study.

When adjusting the DSO and DPO in this study, all companies within the stage will have the same DSO and DPO concerning the sales and purchases with other participants. In other words, the payment terms are harmonized in a way that all companies of the stage have the same payment terms in their business relationships with the companies of the previous stage (suppliers), as well as with the companies of the following one (customers). However, the payment terms may not be the same towards upstream and downstream. As the model represents the supply chain, the new DSO of the suppliers defines and is equal to the new DPO of the customers, and vice versa. It is assumed that all supply chain partners participate in the

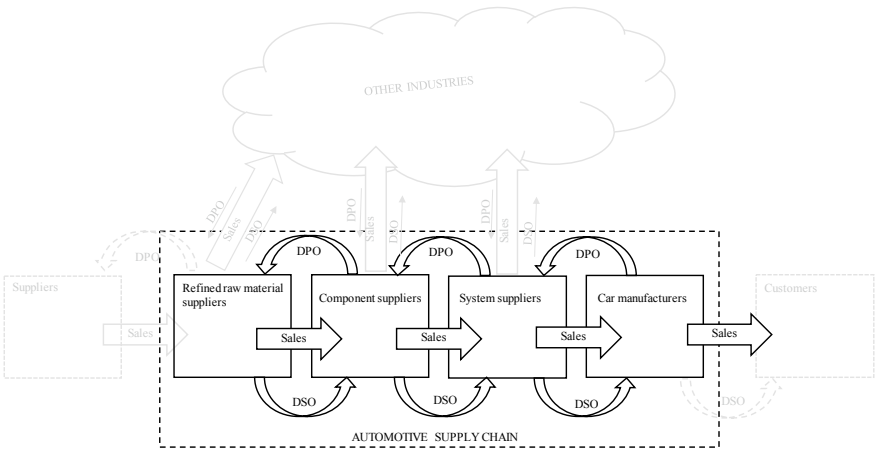

Fig. 2 Model for optimizing the financial flows of WC (authors' own figure)

optimization of the financial flows, and thus, new DSOs and DPOs can be set by the supply chain. The core idea of the model is to find a win-win situation by adjusting the DSOs and DPOs, ceteris paribus. However, with the restrictions concerning the harmonization of the cycle times within the stages, it is assumed that a solution in which every company would be able to "win", i.e. release WC, is not possible: powerful companies that have gained a strong WC position in the supply chain should give up their place in favour of the total supply chain. Therefore, it was necessary to develop a settlement that also motivates these companies to participate in this supply chain wide payment term harmonization. In this study, we calculated a compensation for the companies whose WC increased. The compensation includes the amount of additional tied-up WC with a 15% interest. This is paid by the winning supply chain companies, who pay this in equal share (%) from their released WC. The 15% interest was chosen as an internal interest rate of 10% is used in many industrial companies. We chose 15% to allow for a significant benefit and return on invest for the companies dropping their current WC management strategy, which, in general, has been to prolongate the DPO or shorten the DSO.

4 Case: Managing Financial Flows in an Automotive Supply Chain

The effects of the optimization and standardization of payment terms are analysed in the context of an automotive supply chain. The sample of the study contains 35 companies, and it describes the supply chain of the automotive industry consisting of four consecutive stages from refined raw material suppliers via component and system suppliers to car manufacturers (see Fig. 2). Each stage is represented by

Stage 1: Refined raw material suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
ArcelorMittal	81	20	53	-33	48	61 970	8 137	20 %
Dupont	80	61	50	11	92	26 012	6 528	20 %*
EMS	61	50	22	28	89	1 548	376	20 %*
Evonik	46	46	30	17	63	13 493	2 314	20 %
Lanxess	60	46	33	13	73	8 415	1 683	20 %
Salzgitter	77	59	37	22	99	9 405	2 560	20 %*
ThyssenKrupp	62	46	39	7	70	41 224	7 869	23 %
AVERAGE	67	47	38	9	76	23 153	4 210	

Stage 2: Component suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
Alps	44	64	35	28	72	5 291	1 045	67 %
Austria Microsystems	53	54	30	24	76	426	89	35 %
Bekaert	64	74	39	35	99	3 375	913	45 %
Daetwyler	50	48	20	28	78	1 093	233	60 %*
ElringKlinger	78	66	21	45	123	1 234	415	90 %
Federal Mogul	59	70	43	27	85	5 491	1 285	60 %*
Georg Fischer	63	57	39	18	81	3 117	694	36 %
GKN	51	62	82	-20	31	8 335	713	60 %
Hella	39	50	38	12	51	5 468	770	76 %
Leoni	47	48	63	-16	31	4 007	341	60 %*
Miba	50	55	35	20	70	640	123	60 %*
Nidec	53	84	65	19	72	7 184	1 422	60 %*
Polytec	33	39	28	10	43	547	65	90 %
Rheinmetall	69	82	54	28	97	4 728	1 261	50 %
Saint-Gobain	54	44	52	-9	45	41 603	5 132	20 %
Tyco	24	59	30	30	53	9 058	1 324	60 %*
AVERAGE	52	60	42	18	69	6 350	989	

Stage 3: System suppliers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
BorgWarner	25	64	70	-7	18	5 957	297	75 %*
Bosch	52	65	29	36	88	53 917	13 053	60 %
Continental	33	60	50	10	43	34 062	4 008	60 %
Magna	28	57	52	5	33	25 485	2 337	75 %*
Mahle	44	60	34	26	70	8 106	1 556	75 %
Schaeffler Group	51	55	33	22	73	11 675	2 330	76 %
Valeo	26	50	76	-26	0	12 401	3	87 %
ZF Sachs	38	51	46	5	43	19 456	2 300	93 %
AVERAGE	37	58	49	9	46	21 382	3 235	

Stage 4: Car manufacturers

	DIO	DSO	DPO	DSO-DPO	CCC	Sales (M€)	WC (M€)	Automotive share (%)
BMW	47	12	32	-20	28	78 861	5 918	100 %
Daimler	57	24	29	-5	53	123 632	17 760	100 %
Renault	33	10	59	-49	-16	42 242	-1 905	100 %
VW	57	21	35	-14	43	192 954	23 101	100 %
AVERAGE	49	17	39	-22	27	109 422	11 219	

Note: Automotive shares are exact or estimated figures from the annual reports or company websites.
Shares marked with * are set as typical shares in the stage as no other information was available.

Fig. 3 Current cycle times in the sample according to average figures from 2011 to 2015 (authors' own figure)

4–16 companies. The sample companies were selected by following the approach by the study of Lind et al. (2012), in which the cycle times of WC were studied in the value chain of the automotive industry. The companies of the sample supply chain are provided in Fig. 3. It should be noted that the sample in this study is not an all-inclusive automotive supply chain, but it provides an example and estimate what the cycle times in different parts of the supply chain can be.

The data for the analysis was collected from the official consolidated financial statements of the years 2011–2015. The values for inventories, accounts receivable, and accounts payable, i.e. the components of operational WC, were gathered and used to calculate the cycle times. Additionally, information on the actual shares of companies' sales concerning the automotive industry was gathered by reviewing annual reports and company websites. This was done as all companies in the sample do not operate fully for the automotive industry, and thus, all of their WC is not tied up in this supply chain. For most companies, exact or estimated shares were found from the official sources. For the remaining companies, the typical share of the stage was used in the analysis. Only car manufacturers were considered operating 100% in the automotive industry.

In this section, the analysis has been conducted in two parts. First, the current state of the cycle times of WC in the supply chain is analysed using the financial value chain analysis (Lind et al. 2012). This analysis is used as a basis for the second part of the analysis, where scenarios are used to construct different possibilities for optimizing the WC of the supply chain with payment terms. This has been done by testing different values for the DSO and DPO in our model, and by analysing their effects on the total WC of companies in regard to cycle times as well

as monetary values. We present seven scenarios for the optimization of WC by modifying the trade credit components, i.e. DSO and DPO. The scenarios are introduced in the results section. The target of the payment term optimization in this paper is to find win-win solutions for all supply chain members. Therefore, sharing the benefits of the released WC is considered in the model.

4.1 Current Cycle Times

Figure 3 shows the average WC figures for the observation period and describes the current state of WC management in the sample companies. In addition to the cycle times, the table shows the average sales and WC of companies in Euros, as well as the exact or estimated share of the sales each company has in the automotive industry. DSO-DPO, also known as net trade credit, describes the difference between the cycle times of trade credit components. In typical case, DSO is longer than DPO, i.e. payment terms towards customers are more generous than the payment terms towards suppliers. In case of negative DSO-DPO, a company is in relatively good position as no working capital is tied up in its trade credit components.

The results show that the beginning of the chain ties up relatively more WC, and the CCC gets shorter stage by stage towards downstream. However, when looking at the amount of WC in euros, the tied-up WC of car manufacturers is remarkably higher due to the largest sales volumes. This means that when measured in euros, shortening the CCC by one day releases much more WC in the stage of car manufacturers than in the stage of component suppliers, for example. A closer look at the trade credit components, DSO and DPO, reveals that the differences between the companies and within the stages are remarkable, varying from 12 to 84 days in the DSO and 20 to 76 days in the DPO. In most companies, the DSO is longer than the DPO, which indicates that the payment terms towards customers are usually longer than the ones towards suppliers. However, there are also ten companies that have a negative DSO-DPO. The CCCs of these companies were also among the shortest in their stages, which indicates that they have been successful in their WC management. This kind of WC model is beneficial for the company itself, but not from the perspective of the supply chain as a long DPO is gained by stretching the DSO of the suppliers, and a short DSO requires fast payments from the customer. Thus, this WC model cannot be applied by every company in the supply chain.

4.2 Scenarios

Next, all scenarios and their results are introduced. All scenarios with adjusted DSO and DPO, their effect on the CCCs of companies, the amount of released WC, the amount of compensation paid or received by the company, as well as the eventual benefits of the payment term adjustment in euros, are shown in Appendix. Table 1

Table 1 Summary of the scenarios and findings (table compiled by authors)

Name of the scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	Least losers	Same payment term throughout the chain	Happy upstream	Happy downstream	Long payment terms	Short payment terms	Bringing DSO and DPO closer together
New DSO starting from upstream	30-40-40-(old)	38-38-38-(old)	35-30-30-30-(old)	45-45-35-(old)	50-52-45-(old)	25-30-35-(old)	45-55-60-(old)
New DPO starting from upstream	(old)-30-40-40	(old)-38-38-38	(old)-35-30-30	(old)-45-45-35	(old)-50-52-45	(old)-25-30-35	(old)-45-55-60
Average CCC of the sample (current)	61	61	61	61	61	61	61
Average CCC of the stages (current)	55	55	55	55	55	55	55
Average CCC of the sample (new)	56	54	53	53	53	56	55
Average CCC of the stages (new)	51	50	51	49	48	52	47
CCC Δ (average of the sample)	−4	−7	−7	−8	−8	−5	−5
CCC Δ (average of the stages)	−4	−4	−3	−5	−7	−3	−7
Number of losers	7	7	9	6	10	7	6
Number of winners	28	28	26	29	25	28	29
Released WC in total (M€)	11,616.6	9693.4	983.1	8742.5	19,042.9	5042.2	32,570.7
Released WC of winners (M€)	16,043.3	14,192.3	9053.7	13,450.9	23,083.5	9871.3	35,493.7
Total loss of losers (M€)	−4426.7	−4498.9	−8070.6	−4708.4	−4040.6	−4829.1	−2923.0
Paid to losers (M€)	5090.7	5173.8	9281.2	5414.6	4646.7	5553.5	3361.4
% winners pay from their released WC to losers (%)	31.73	36.45	102.51	40.25	20.13	56.26	9.47

concludes the findings of the scenarios. The idea of the scenarios was to test different options for optimizing the financial flows in the supply chain.

Scenario 1: "The least losers"

The target of the scenario was to adjust the DSOs and DPOs by having as little companies increasing their WC as possible. The adjustment started from the upstream, where we selected 30 days as the new DSO for the automotive industry. This was seen as the best possible reasonable DSO value for the stage, as with this cycle time most companies release WC. The same logic was applied throughout the chain. The results show that Scenario 1 would release WC from the supply chain. Seven companies, all of them originally having a longer DPO than DSO, had to increase their WC.

Scenario 2: "Same payment term through the chain"

Scenario 2 also started from the upstream. The new DSO for refined raw material suppliers, 38 days, was based on the average DPO of these companies. The idea of the scenario was to test the consequences of the whole supply chain applying the same payment term. This scenario released less WC than the first one even if the number of losers was the same. The main reason for this was that the car manufacturers released less WC. From the perspective of the supply chain, it would be beneficial that the car manufacturers, who have the biggest sales volume, would be able to shorten their CCC.

Scenario 3: "Happy upstream"

Scenario 3 also started from the upstream. The aim of this scenario was to set new cycle times, so that it would benefit companies in the upstream—hence the name of the scenario—but still keep realistic DSO and DPO values. Optimization was started by setting 35 days as the new DSO for the refined raw material suppliers. The results of the scenario showed that this option is not reasonable. The scenario released the least WC, and is not applicable, as the compensation to the losers was higher than the WC released by the winners.

Scenario 4: "Happy downstream"

Scenario 4 is the opposite of Scenario 3. As shown by the results of Scenarios 1–3, the supply chain benefits in total if the car manufacturers are able to release WC. Therefore, the adjustment was started from the downstream. The new DPO of the car manufacturers was set to 35 days, which was seen as a realistic option. In this scenario, only six companies had to increase their WC, which was the lowest number so far. However, the amount of released WC was lower than in Scenarios 1 and 2. Even if the payment term adjustments were started from the car manufacturers, they were moderate, and thus did not lead to a remarkable release of WC within the stage. In addition, the compensation required by company Renault was remarkably higher than in Scenarios 1 and 2.

Scenario 5: "Long payment terms"

In Scenario 5, long payment terms starting from the downstream were tested. The new DPO of the car manufacturers was 45 days, which led to remarkable reductions in the CCC for all companies in the stage except for Renault. This scenario released explicitly more WC than the previous ones. However, the number of losers was 10, which is the highest of all scenarios. This scenario causes increases in WC especially for the companies in the upstream.

Scenario 6: "Short payment terms"

Scenario 6 also started from the downstream. In this scenario, shorter DSOs and DPOs were tested. The DPO of car manufacturers was set to 35 days according to the second highest DPO of the stage. This scenario led to the second lowest WC release of the study. This resulted from the remarkable compensations required by the companies in the downstream. However, unlike Scenario 3, all companies gained benefits with this scenario, but the winners had to pay over 56% of their released WC to the losers.

Scenario 7: "Bringing DSO and DPO closer together"

The target of Scenario 7 was to make the difference between the DSO and the DPO shorter in each stage. The adjustment of the cycle times was started from the upstream by setting the new DSO to 45 days. With this value, the CCCs of most companies in the stage remain on the same level or reduce slightly. This scenario differs from the others by focusing on the relation between the DSO and DPO instead of concentrating on the components individually. The results show that this scenario was the most beneficial for the supply chain. It released over 32 billion euro of WC in total, and only six companies increased their WC. Also, the percentage of the released WC paid by the winners was the lowest.

5 Discussion and Conclusions

In this paper, we presented a model for WC optimization through payment term adjustments. Our model provides a solution for the situation where supply chain partners decide to collaborate in terms of financial flows of WC. The proposed solution enables accomplishing the optimization and standardization of payment terms in the supply chain. The idea was tested with real-life financial figures in the context of an automotive supply chain, which was used as an example in our study. The analysis of the current cycle times of WC in the automotive industry showed that the cycle times of WC were longer in the upstream supply chain. However, shortening the cycle time of WC by one day releases more WC in the downstream supply chain due to a higher sales volume. The results of the scenario analysis showed that win-win situations (i.e. companies gaining financial benefits from the released WC of the supply chain) can be achieved by collaborating in terms of

payment term adjustment and standardization within the supply chain. However, this was not possible without a compensation system that was included in our model. The most beneficial option was to bring the DSO and DPO closer together in all stages of the supply chain. This would release a remarkable amount of WC.

Our study tested the model for optimizing the financial flows in the context of an automotive supply chain. In real life, changing the established supply chains practices might be challenging, and the radical adjustment of WC might be difficult to achieve as it requires changes in the mindset of professionals and in their business approach. Instead of automotive or other traditional industries, maybe it could be easier to set up the WC management system in a collaborative way and pilot our proposal from the beginning on. Therefore, this kind of digital WC management on supply chain level would be excellent opportunity especially for start-up companies and supply chains. It requires alternative ways of thinking about financing, comprehensive supply chain views and trust in the chain.

In the beginning of this chapter, the role of digitalization was mentioned as one of the cornerstones of our model. Of course, payment term adjustments as such do not require new digital solutions. However, our study takes an initial step towards a practical solution for monitoring the financial flows in supply chains, and this creates the need for digitalization. By using the new technologies enabled by digitalization, a tool for managing WC in the supply chains could be developed. Trust between the supply chain partners is the main barrier for this kind of collaborative system: participants should be able to ensure that "all the players are playing for the team", i.e. following the jointly agreed payment terms in the supply chain. However, it should be carefully designed to ensure a certain anonymity and security within the system. Even if the system could provide visibility and transparency to the financial flows in the supply chain, it should be planned in a way that participants can trust the system as well as each other. Blockchain technology, which is being largely being developed in the financial services sector, may provide a revolutionary solution for this, as potentially, it might become a record for all transactions (Iansiti and Lakhani 2017). Also, the legal aspects need to be considered when making a more detailed requirement specification for the system. Participants are required to enter fairly sensitive data into the system, such as payment terms and sales and purchase volumes with other participants, which may be a legal issue as well.

It was discussed earlier in this section that in reality, adapting this kind of collaborative approach to working capital might be difficult in the established, traditional automotive supply chain. However, if we play with the idea and imagine that automotive companies became interested in the collaborative management of financial flows, how should the implementation of such a system, as described in this paper, be accomplished? What would be the best way to have as many participants from the supply chain as possible? Of course, it depends on the position of the initiator. In the first tier (i.e. system suppliers), one possibility is to start the negotiations with one's own suppliers and their suppliers. Once they agree to participate, negotiations with one car manufacturer could be started, and the car manufacturer, in turn, would use its negotiation power to involve other system

suppliers. As discussed above, the system could also be tested with a completely new business and new supply chain. As they would not have established practices that require changes, they could directly adapt to the collaborative WC management practices and serve as a demonstration of the benefits of the system to others.

5.1 Future Research

Our paper presented model for the collaborative management of financial flows in the supply chain context, which offers avenues for future research as well. The authors suggest future research regarding the development of the solution to be conducted in the following areas: (1) supply chain visibility as a prerequisite for the tool implementation, (2) the limiting factors of such a WC management platform, e.g. legal restrictions or frame conditions, (3) testing and further development of the application with pilot companies and (4) a common WC management strategy for the pilot companies' supply chains, including motivation for participation. Additionally, it should be noted that WC management is not only about the management of trade credit, but inventory management is also an essential element in it. The following phase in the planning of such a system is to ensure that the corresponding material flow keeps up with the new, more efficient financial flow.

Appendix: Results of Different Scenarios

		Current		Scenario 1: "Least losers"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	30	22	53	53	2	−345.5		397.4	51.8
	DuPont	61	50	30	55	50	50	−6	448.7	142.4		306.3
	EMS	50	22	30	46	22	22	−4	16.9	5.4		11.5
	Evonik	46	30	30	43	30	30	−3	120.7	38.3		82.4
	Lanxess	46	33	30	43	33	33	−3	73.8	23.4		50.4
	Salzgitter	59	37	30	53	37	37	−6	149.3	47.4		101.9
	ThyssenKrupp	46	39	30	42	39	39	−4	420.3	133.4		286.9
Component suppliers	Alps	64	35	40	48	30	32	−12	176.9	56.1		120.8
	Austria Microsystems	54	30	40	49	30	30	−5	5.6	1.8		3.8
	Bekaert	74	39	40	58	30	35	−11	102.9	32.7		70.3
	Daetwyler	48	20	40	43	30	26	−11	32.3	10.2		22.0
	ElringKlinger AG	66	21	40	43	30	29	−32	106.5	33.8		72.7
	Federal Mogul	70	43	40	52	30	35	−10	150.9	47.9		103.0
	Georg Fischer	57	39	40	51	30	36	−3	24.6	7.8		16.8
	GKN	62	82	40	49	30	51	18	−406.7		467.7	61.0
	Hella	50	38	40	43	30	32	−2	24.6	7.8		16.8
	Leoni	48	63	40	43	30	43	15	−169.6		195.0	25.4
	Miba	55	35	40	46	30	32	−6	10.5	3.3		7.2

(continued)

(continued)

		Current		Scenario 1: "Least losers"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Nidec	84	65	40	57	30	44	−5	107.9	34.2		73.7
	Polytec	39	28	40	40	30	30	0	0.7	0.2		0.4
	Rheinmetall	82	54	40	61	30	42	−9	119.5	37.9		81.6
	Saint-Gobain	44	52	40	43	30	48	4	−426.2		490.1	63.9
	Tyco	59	30	40	48	30	30	−12	293.2	93.0		200.2
System suppliers	Schaeffler Group	55	33	40	44	40	38	−17	532.7	169.0		363.7
	Continental	60	50	40	48	40	44	−6	578.7	183.6		395.1
	Bosch	65	29	40	50	40	35	−22	3234.9	1026.5		2208.5
	Mahle	60	34	40	45	40	39	−19	427.2	135.5		291.6
	ZF Sachs	51	46	40	41	40	40	−5	270.3	85.8		184.5
	Valeo	50	76	40	41	40	45	23	−776.7		893.2	116.5
	BorgWarner	64	70	40	46	40	48	5	−79.8		91.8	12.0
	Magna	57	52	40	44	40	43	−4	287.0	91.1		196.0
Car manufacturers	BMW	12	32	12	12	40	40	−8	1705.8	541.3		1164.5
	Daimler	24	29	24	24	40	40	−11	3842.8	1219.3		2623.4
	VW	21	35	21	21	40	40	−5	2778.1	881.5		1896.6
	Renault	10	59	10	10	40	40	19	−2222.0		2555.3	333.3
								Total	11,616.6	5090.7	5090.7	11,616.6

		Current		Scenario 2: "Same payment term through the chain"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	38	23	53	53	4	−617.2		709.8	92.6
	Dupont	61	50	38	57	50	50	−5	334.6	122.0		212.6
	EMS	50	22	38	48	22	22	−2	10.1	3.7		6.4
	Evonik	46	30	38	45	30	30	−2	61.6	22.5		39.1
	Lanxess	46	33	38	44	33	33	−2	36.9	13.4		23.4
	Salzgitter	59	37	38	55	37	37	−4	108.1	39.4		68.7
	ThyssenKrupp	46	39	38	44	39	39	−2	212.5	77.5		135.0
Component suppliers	Alps	64	35	38	46	38	37	−19	274.0	99.9		174.1
	Austria Microsystems	54	30	38	48	38	33	−8	9.7	3.5		6.2
	Bekaert	74	39	38	58	38	38	−16	144.6	52.7		91.9
	Daetwyler	48	20	38	42	38	31	−17	50.3	18.3		31.9
	ElringKlinger AG	66	21	38	41	38	36	−41	136.9	49.9		87.0
	Federal Mogul	70	43	38	51	38	40	−16	241.1	87.9		153.2
	Georg Fischer	57	39	38	50	38	39	−6	55.4	20.2		35.2
	GKN	62	82	38	48	38	56	12	−269.7		310.2	40.5
	Hella	50	38	38	41	38	38	−9	138.4	50.5		88.0
	Leoni	48	63	38	42	38	48	9	−103.7		119.3	15.6
	Miba	55	35	38	45	38	37	−12	21.1	7.7		13.4
	Nidec	84	65	38	56	38	49	−11	226.0	82.4		143.6
	Polytec	39	28	38	38	38	37	−9	14.1	5.2		9.0

(continued)

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		Current		Scenario 2: "Same payment term through the chain"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	38	60	38	46	−14	184.3	67.2		117.1
	Saint-Gobain	44	52	38	43	38	50	2	−198.2		228.0	29.7
	Tyco	59	30	38	47	38	35	−18	442.1	161.2		280.9
System suppliers	Schaeffler Group	55	33	38	42	38	37	−17	532.7	194.2		338.5
	Continental	60	50	38	47	38	43	−6	578.7	211.0		367.8
	Bosch	65	29	38	49	38	34	−22	3234.9	1179.3		2055.6
	Mahle	60	34	38	43	38	37	−19	427.2	155.7		271.4
	ZF Sachs	51	46	38	39	38	39	−5	270.3	98.5		171.8
	Valeo	50	76	38	40	38	43	23	−776.7		893.2	116.5
	BorgWarner	64	70	38	44	38	46	5	−79.8		91.8	12.0
	Magna	57	52	38	43	38	41	−4	287.0	104.6		182.4
Car manufacturers	BMW	12	32	12	12	32	38	−6	1273.7	464.3		809.4
	Daimler	24	29	24	24	29	38	−9	3165.3	1153.9		2011.4
	VW	21	35	21	21	35	38	−3	1720.8	627.3		1093.5
	Renault	10	59	10	10	59	38	21	−2453.5		2821.5	368.0
								Total	9693.4	5173.8	5173.8	9693.4

		Current		Scenario 3: "Happy upstream"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	35	23	53	53	3	−515.3		592.6	77.3
	Dupont	61	50	35	56	50	50	−5	377.4	386.9		−9.5
	EMS	50	22	35	47	22	22	−3	12.6	12.9		−0.3
	Evonik	46	30	35	44	30	30	−2	83.8	85.9		−2.1
	Lanxess	46	33	35	44	33	33	−2	50.7	52.0		−1.3
	Salzgitter	59	37	35	54	37	37	−5	123.6	126.7		−3.1
	ThyssenKrupp	46	39	35	44	39	39	−3	290.4	297.7		−7.3
Component suppliers	Alps	64	35	30	41	35	35	−22	322.6	330.7		−8.1
	Austria Microsystems	54	30	30	45	35	32	−10	11.7	12.0		−0.3
	Bekaert	74	39	30	54	35	37	−18	165.4	169.5		−4.2
	Daetwyler	48	20	30	37	35	29	−20	59.2	60.7		−1.5
	ElringKlinger AG	66	21	30	34	35	34	−45	152.1	155.9		−3.8
	Federal Mogul	70	43	30	46	35	38	−19	286.2	293.4		−7.2
	Georg Fischer	57	39	30	47	35	38	−8	70.8	72.5		−1.8
	GKN	62	82	30	43	35	54	9	−201.2		231.4	30.2
	Hella	50	38	30	35	35	36	−13	195.4	200.3		−4.9
	Leoni	48	63	30	37	35	46	6	−70.8		81.4	10.6
	Miba	55	35	30	40	35	35	−15	26.3	27.0		−0.7
	Nidec	84	65	30	51	35	47	−14	285.0	292.2		-7.2
	Polytec	39	28	30	31	35	34	−14	20.9	21.4		−0.5

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		Current		Scenario 3: "Happy upstream"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	30	56	35	44	−17	216.6	222.1		−5.4
	Saint-Gobain	44	52	30	41	35	49	1	−84.3		96.9	12.6
	Tyco	59	30	30	42	35	33	−21	516.6	529.5		−13.0
System suppliers	Schaeffler Group	55	33	30	36	30	31	−17	532.7	546.1		−13.4
	Continental	60	50	30	42	30	38	−6	578.7	593.3		−14.5
	Bosch	65	29	30	44	30	29	−22	3234.9	3316.2		−81.3
	Mahle	60	34	30	37	30	31	−19	427.2	437.9		−10.7
	ZF Sachs	51	46	30	31	30	31	−5	270.3	277.1		−6.8
	Valeo	50	76	30	33	30	36	23	−776.7		893.2	116.5
	BorgWarner	64	70	30	38	30	40	5	−79.8		91.8	12.0
	Magna	57	52	30	37	30	35	−4	287.0	294.3		−7.2
Car manufacturers	BMW	12	32	12	12	30	30	2	−454.8		523.0	68.2
	Daimler	24	29	24	24	30	30	−1	455.6	467.0		−11.4
	VW	21	35	21	21	30	30	5	−2508.3		2884.5	376.2
	Renault	10	59	10	10	30	30	29	−3379.4		3886.3	506.9
								Total	983.1	9281.2	9281.2	983.1

		Current		Scenario 4: "Happy downstream"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	45	25	53	53	5	−854.9		983.1	128.2
	Dupont	61	50	45	58	50	50	−3	234.9	94.5		140.3
	EMS	50	22	45	49	22	22	−1	4.1	1.7		2.5
	Evonik	46	30	45	46	30	30	0	9.8	4.0		5.9
	Lanxess	46	33	45	46	33	33	0	4.6	1.9		2.7
	Salzgitter	59	37	45	56	37	37	−3	72.0	29.0		43.0
	ThyssenKrupp	46	39	45	46	39	39	0	30.6	12.3		18.3
Component suppliers	Alps	64	35	45	51	45	42	−19	274.0	110.3		163.7
	Austria Microsystems	54	30	45	51	45	35	−8	9.7	3.9		5.8
	Bekaert	74	39	45	61	45	42	−16	144.6	58.2		86.4
	Daetwyler	48	20	45	46	45	35	−17	50.3	20.2		30.0
	ElringKlinger AG	66	21	45	47	45	43	−41	136.9	55.1		81.8
	Federal Mogul	70	43	45	55	45	44	−16	241.1	97.1		144.1
	Georg Fischer	57	39	45	53	45	41	−6	55.4	22.3		33.1
	GKN	62	82	45	52	45	60	12	−269.7		310.2	40.5
	Hella	50	38	45	46	45	43	−9	138.4	55.7		82.7
	Leoni	48	63	45	46	45	52	9	−103.7		119.3	15.6
	Miba	55	35	45	49	45	41	−12	21.1	8.5		12.6
	Nidec	84	65	45	60	45	53	−11	226.0	91.0		135.0
	Polytec	39	28	45	44	45	43	−9	14.1	5.7		8.4

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		Current		Scenario 4: "Happy downstream"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	45	64	45	49	−14	184.3	74.2		110.1
	Saint-Gobain	44	52	45	44	45	51	2	−198.2		228.0	29.7
	Tyco	59	30	45	51	45	39	−18	442.1	178.0		264.1
System suppliers	Schaeffler Group	55	33	35	40	45	42	−24	774.3	311.7		462.6
	Continental	60	50	35	45	45	47	−12	1138.7	458.4		680.3
	Bosch	65	29	35	47	45	38	−28	4121.2	1659.0		2462.2
	Mahle	60	34	35	41	45	42	−27	593.7	239.0		354.7
	ZF Sachs	51	46	35	36	45	45	−14	766.0	308.4		457.7
	Valeo	50	76	35	37	45	49	14	−481.1		553.3	72.2
	BorgWarner	64	70	35	42	45	51	−3	42.6	17.1		25.4
	Magna	57	52	35	41	45	47	−12	810.7	326.4		484.4
Car manufacturers	BMW	12	32	12	12	35	35	−3	625.5	251.8		373.7
	Daimler	24	29	24	24	35	35	−6	2149.2	865.1		1284.0
	VW	21	35	21	21	35	35	0	134.9	54.3		80.6
	Renault	10	59	10	10	35	35	24	−2800.7		3220.8	420.1
								Total	8742.5	5414.6	5414.6	8742.5

		Current		Scenario 5: "Long payment terms"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	50	26	53	53	6	−1024.7		1178.4	153.7
	Dupont	61	50	50	59	50	50	−2	163.6	32.9		130.7
	EMS	50	22	50	50	22	22	0	−0.1		0.1	0.0
	Evonik	46	30	50	47	30	30	1	−27.1		31.2	4.1
	Lanxess	46	33	50	47	33	33	1	−18.5		21.2	2.8
	Salzgitter	59	37	50	57	37	37	−2	46.3	9.3		36.9
	ThyssenKrupp	46	39	50	47	39	39	1	−99.2		114.1	14.9
Component suppliers	Alps	64	35	52	56	50	45	−18	254.6	51.3		203.4
	Austria Microsystems	54	30	52	53	50	37	−8	8.9	1.8		7.1
	Bekaert	74	39	52	64	50	44	−15	136.2	27.4		108.8
	Daetwyler	48	20	52	50	50	38	−16	46.7	9.4		37.3
	ElringKlinger AG	66	21	52	53	50	47	−39	130.8	26.3		104.5
	Federal Mogul	70	43	52	59	50	47	−15	223.1	44.9		178.2
	Georg Fischer	57	39	52	55	50	43	−6	49.2	9.9		39.3
	GKN	62	82	52	56	50	63	13	−297.1		341.7	44.6
	Hella	50	38	52	52	50	47	−8	115.7	23.3		92.4
	Leoni	48	63	52	50	50	55	11	−116.9		134.5	17.5
	Miba	55	35	52	53	50	44	−11	19.0	3.8		15.1
	Nidec	84	65	52	65	50	56	−10	202.4	40.7		161.6
	Polytec	39	28	52	51	50	48	−8	11.4	2.3		9.1

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		Current		Scenario 5: "Long payment terms"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	52	67	50	52	−13	171.3	34.5		136.8
	Saint-Gobain	44	52	52	45	50	52	2	−243.8		280.4	36.6
	Tyco	59	30	52	55	50	42	−17	412.3	83.0		329.3
System suppliers	Schaeffler Group	55	33	45	47	52	47	−22	701.8	141.3		560.6
	Continental	60	50	45	51	52	51	−10	970.7	195.4		775.3
	Bosch	65	29	45	53	52	43	−26	3855.3	776.1		3079.3
	Mahle	60	34	45	49	52	48	−24	543.8	109.5		434.3
	ZF Sachs	51	46	45	45	52	52	−12	617.3	124.3		493.0
	Valeo	50	76	45	46	52	55	17	−569.8		655.3	85.5
	BorgWarner	64	70	45	50	52	57	0	5.8	1.2		4.7
	Magna	57	52	45	48	52	52	−9	653.6	131.6		522.0
Car manufacturers	BMW	12	32	12	12	45	45	−13	2786.1	560.8		2225.2
	Daimler	24	29	24	24	45	45	−16	5536.3	1114.5		4421.9
	VW	21	35	21	21	45	45	−10	5421.3	1091.3		4330.0
	Renault	10	59	10	10	45	45	14	−1643.4		1889.9	246.5
								Total	19,042.9	4646.7	4646.7	19,042.9

		Current		Scenario 6: "Short payment terms"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	25	21	53	53	1	−175.7		202.1	26.4
	Dupont	61	50	25	54	50	50	−7	519.9	292.5		227.4
	EMS	50	22	25	45	22	22	−5	21.1	11.9		9.2
	Evonik	46	30	25	42	30	30	−4	157.7	88.7		69.0
	Lanxess	46	33	25	42	33	33	−4	96.8	54.5		42.4
	Salzgitter	59	37	25	52	37	37	−7	175.1	98.5		76.6
	ThyssenKrupp	46	39	25	41	39	39	−5	550.2	309.5		240.7
Component suppliers	Alps	64	35	30	41	25	28	−16	225.5	126.9		98.6
	Austria Microsystems	54	30	30	45	25	28	−7	7.7	4.3		3.3
	Bekaert	74	39	30	54	25	33	−13	123.7	69.6		54.1
	Daetwyler	48	20	30	37	25	23	−14	41.3	23.2		18.1
	ElringKlinger AG	66	21	30	34	25	25	−36	121.7	68.5		53.2
	Federal Mogul	70	43	30	46	25	32	−13	196.0	110.3		85.7
	Georg Fischer	57	39	30	47	25	34	−5	40.0	22.5		17.5
	GKN	62	82	30	43	25	48	15	−338.2		388.9	50.7
	Hella	50	38	30	35	25	28	−5	81.5	45.9		35.7
	Leoni	48	63	30	37	25	40	12	−136.7		157.2	20.5
	Miba	55	35	30	40	25	29	−9	15.8	8.9		6.9
	Nidec	84	65	30	51	25	41	−8	166.9	93.9		73.0
	Polytec	39	28	30	31	25	25	−5	7.4	4.2		3.2

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		Current		Scenario 6: "Short payment terms"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	30	56	25	39	−12	151.9	85.4		66.4
	Saint-Gobain	44	52	30	41	25	47	3	−312.2		359.1	46.8
	Tyco	59	30	30	42	25	27	−15	367.7	206.8		160.8
System suppliers	Schaeffler Group	55	33	35	40	30	31	−13	411.8	231.7		180.1
	Continental	60	50	35	45	30	38	−3	298.8	168.1		130.7
	Bosch	65	29	35	47	30	29	−19	2791.8	1570.6		1221.2
	Mahle	60	34	35	41	30	31	−15	343.9	193.5		150.4
	ZF Sachs	51	46	35	36	30	31	0	22.4	12.6		9.8
	Valeo	50	76	35	37	30	36	27	−924.5		1063.2	138.7
	BorgWarner	64	70	35	42	30	40	9	−141.0		162.2	21.2
	Magna	57	52	35	41	30	35	0	25.2	14.2		11.0
Car manufacturers	BMW	12	32	12	12	35	35	−3	625.5	351.9		273.6
	Daimler	24	29	24	24	35	35	−6	2149.2	1209.1		940.1
	VW	21	35	21	21	35	35	0	134.9	75.9		59.0
	Renault	10	59	10	10	35	35	24	−2800.7		3220.8	420.1
								Total	5042.2	5553.5	5553.5	5042.2

		Current		Scenario 7: "Bringing DSO and DPO closer together"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
Refined raw material suppliers	ArcelorMittal	20	53	45	25	53	53	5	−854.9		983.1	128.2
	Dupont	61	50	45	58	50	50	−3	234.9	22.2		212.6
	EMS	50	22	45	49	22	22	−1	4.1	0.4		3.8
	Evonik	46	30	45	46	30	30	0	9.8	0.9		8.9
	Lanxess	46	33	45	46	33	33	0	4.6	0.4		4.2
	Salzgitter	59	37	45	56	37	37	−3	72.0	6.8		65.2
	ThyssenKrupp	46	39	45	46	39	39	0	30.6	2.9		27.7
Component suppliers	Alps	64	35	55	58	45	42	−12	176.9	16.8		160.2
	Austria Microsystems	54	30	55	54	45	35	−5	5.6	0.5		5.1
	Bekaert	74	39	55	65	45	42	−11	102.9	9.7		93.2
	Daetwyler	48	20	55	52	45	35	−11	32.3	3.1		29.2
	ElringKlinger AG	66	21	55	56	45	43	−32	106.5	10.1		96.4
	Federal Mogul	70	43	55	61	45	44	−10	150.9	14.3		136.6
	Georg Fischer	57	39	55	56	45	41	−3	24.6	2.3		22.3
	GKN	62	82	55	58	45	60	18	−406.7		467.7	61.0
	Hella	50	38	55	54	45	43	−2	24.6	2.3		22.3
	Leoni	48	63	55	52	45	52	15	−169.6		195.0	25.4
	Miba	55	35	55	55	45	41	−6	10.5	1.0		9.5
	Nidec	84	65	55	66	45	53	−5	107.9	10.2		97.7
	Polytec	39	28	55	53	45	43	0	0.7	0.1		0.6

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		Current		Scenario 7: "Bringing DSO and DPO closer together"								
		DSO	DPO	DSO (automotive)	DSO (total)	DPO (automotive)	DPO (total)	Δ CCC	WC released (M€)	Compensation paid (M€)	Compensation received (M€)	Benefit (M€)
	Rheinmetall	82	54	55	69	45	49	−9	119.5	11.3		108.2
	Saint-Gobain	44	52	55	46	45	51	4	−426.2		490.1	63.9
	Tyco	59	30	55	57	45	39	−12	293.2	27.8		265.4
System suppliers	Schaeffler Group	55	33	60	59	55	50	−13	411.8	39.0		372.8
	Continental	60	50	60	60	55	53	−3	298.8	28.3		270.5
	Bosch	65	29	60	62	55	44	−19	2791.8	264.4		2527.4
	Mahle	60	34	60	60	55	50	−15	343.9	32.6		311.3
	ZF Sachs	51	46	60	59	55	54	0	22.4	2.1		20.3
	Valeo	50	76	60	59	55	58	27	−924.5		1063.2	138.7
	BorgWarner	64	70	60	61	55	59	9	−141.0		162.2	21.2
	Magna	57	52	60	59	55	54	0	25.2	2.4		22.8
Car manufacturers	BMW	12	32	12	12	60	60	−28	6026.9	570.8		5456.1
	Daimler	24	29	24	24	60	60	−31	10,617.1	1005.5		9611.6
	VW	21	35	21	21	60	60	−25	13,350.9	1264.4		12,086.5
	Renault	10	59	10	10	60	60	−1	92.6	8.8		83.9
								Total	32,570.7	3361.4	3361.4	32,570.7

References

Brandenburg, M. (2016). Supply chain efficiency, value creation and the economic crisis—An empirical assessment of the European automotive industry 2002–2010. *International Journal of Production Economics, 171*(3), 321–335.

Grüter, R., & Wuttke, D. A. (2017). Option matters: valuing reverse factoring. *International Journal of Production Research, 55*(22), 6608–6623.

Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review, 96*(1), 118–127.

Kroes, J. R., & Manikas, A. S. (2014). Cash flow management and manufacturing firm financial performance: A longitudinal perspective. *International Journal of Production Economics, 148,* 37–50.

Liebl, J., Hartmann, E., & Feisel, E. (2016). Reverse factoring in the supply chain: Objectives, antecedents and implementation barriers. *International Journal of Physical Distribution & Logistics Management, 46*(4), 393–413.

Lind, L., Kärri, T., Monto, S., Pirttilä, M., & Schupp, F. (2018). The effect of digitalization is measurable—How transparency on the CCC creates momentum for working capital management? In F. Schupp & H. Wöhner (Eds.), *Digitalisierung im Einkauf*. Germany: Springer Gabler.

Lind, L., Pirttilä, M., Viskari, S., Schupp, F., & Kärri, T. (2012). Working capital management in the automotive industry: financial value chain analysis. *Journal of Purchasing and Supply Management, 18*(2), 92–100.

Pais, M. A., & Gama, P. M. (2015). Working capital management and SMEs profitability: Portuguese evidence. *International Journal of Managerial Finance, 11*(3), 341–358.

Randall, W. S., & Farris, M. T. (2009). Supply chain financing: Using cash-to-cash variables to strengthen the supply chain. *International Journal of Physical Distribution & Logistics Management, 39*(8), 669–689.

Tran, H., Abbott, M., & Yap, C. J. (2017). How does working capital management affect the profitability of Vietnamese small- and medium-sized enterprises? *Journal of Small Business and Enterprise Development, 24*(1), 2–11.

Vázquez, X. H., Sartal, A., & Lozano-Lozano, L. M. (2016). Watch the working capital of tier-two suppliers: a financial perspective of supply chain collaboration in the automotive industry. *Supply Chain Management: An International Journal, 21*(3), 321–333.

Viskari, S., & Kärri, T. (2012). A model for working capital management in the inter-organisational context. *International Journal of Integrated Supply Management, 7* (1/2/3), 61–79.

Viskari, S., Lind, L., Kärri, T., & Schupp, F. (2012). Using working capital management to improve profitability in the value chain of automotive industry. *International Journal of Services and Operations Management, 13*(1), 42–46.

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The Importance of Being Confident: Evidence from a Supply Chain Experiment

Alessandro Ancarani, Carmela Di Mauro, Giulia Crocco, and Florian Schupp

1 Introduction

A growing number of studies in operations management suggest that psychological traits and individual cognition affect decisions taken in the business sphere (Bendoly et al. 2010), among which supply and supply chain management (Kaufman et al. 2009). To illustrate, at least since Sterman (1989), empirical research carried out through controlled human experiments has shown that the well-known "bullwhip effect" in supply chains is due to the cognitive under-weighting of goods in the pipeline. More recent studies in the field have focused, among others, on the impact of individual personality traits (Strohhecker and Größler 2013), intelligence (Narayanan and Moritz 2015), and aversion to uncertainty (Ancarani et al. 2013), showing that they are significant predictors of both individual and supply chain performance.

Since this research stream is still in the making, little attention has been devoted so far in operations and supply chain research to other broad psychological traits that cut across diverse cognitive domains such as task planning, performance monitoring, performance evaluation (Schraw et al. 1995).

One of these traits is individual self-confidence, which can be described as a feeling or consciousness of one's power or of reliance on one's circumstances. Previous research has shown that higher confidence is significantly and positively correlated with greater accuracy in diverse tasks (Kleitman and Stankov 2007; Stankov and Crawford 1997). In addition, more confident individuals emerge as being more risk-taking and entrepreneurial, exhibit positive attitude towards

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competition, participate in more networks, and are more actively involved in cooperative interactions (Pirinsky 2013). Finally, teams benefit from having an optimistic agent as leader (Wang et al. 2014). Hence, confidence not only reflects individual ability but could also be an important resource leading to better job performance.

Although supply chain research has not ignored the "confidence" of decision makers, it has focused on the negative side of self-confidence, i.e. the overestimation of one's ability, performance, and the underestimation of the variability of a possible outcome. In this light, research has highlighted the negative consequences for inventory and purchasing management of being overconfident (Ancarani et al. 2016; Ren and Croson 2013). Conversely, the potential positive aspects of self-confidence, intended as self-motivation and optimism, have so far escaped the attention of the operations management literature. In supply management problems, self-confidence may have important implications, since it may affect supplier selection processes and negotiations, inventory and material management, and generally the degree of risk-taking in the management of the supply chain.

The aim of this study is to investigate how self-confidence affects decision makers' choice of order quantities and levels of inventory, to analyse the ensuing supply chain costs within a multi-echelon, multi-period supply chain. Using supply chain experiments, forty purchasing and supply management professionals from a large multinational were invited to participate in a business game simulating a multi-echelon serial supply chain. Participants were assigned to different supply chains on the base of being either low or high self-confident individuals. Their inventories, order quantities, and costs were observed and related to their self-confidence levels.

Findings suggest that high-confident players do not anchor on current demand but rather prefer to work on a target stock. On the contrary, low-confident players follow observed demand closely when choosing their order quantity and gave rise to higher oscillations in orders and inventory.

The chapter is organised as follows: Section 2 reviews the existing psychological and managerial literature on the concept of self-confidence, highlighting applications in purchasing and supply management. Section 3 presents the experimental study design and realisation. Results are reported in Sect. 4, while Sect. 5 presents a discussion of implications for management.

2 Literature Background

The concept of confidence or self-confidence points to a comparison between actual and perceived knowledge (or information, ability, performance) of an individual. Diverse disciplines, such as psychology, finance, business economics, and strategic management, have investigated the drivers, manifestations, and consequences of self-confidence (Picone et al. 2014).

In psychology, confidence is generally investigated with respect to specific tasks and assessed by the correlation between ex-ante perception of knowledge (or prediction of performance in the task) and actual knowledge or performance. Kleitman and Stankov (2007) and Stankov and Crawford (1997) provide evidence that higher confidence in a task is significantly and positively correlated with greater accuracy in diverse tasks. Although these findings could suggest that confidence is task-related, other psychometric studies show that confidence ratings elicited from a variety of tasks tend to correlate and define a single factor (Stankov and Crawford 1997), thus suggesting the existence of a general self-confidence trait that approximates human abilities (Kleitman and Stankov 2007).

In this direction, some studies do not investigate confidence in specific tasks but assess whether people feel sure about their views or opinions about themselves or others in everyday activities. These opinions do not have a correct answer at the time of testing and, indeed, correct answers may never become available or be difficult to ascertain. Kleitman and Stankov (2007) show that these generic "sureness" scores are positively correlated with traditional in-task confidence ratings and, in turn with cognitive abilities and meta-cognitive abilities, such as awareness of cognitive resources available for planning, degree of cognitive monitoring of task performance, ex-post cognitive evaluation of performance.

In strategic management studies, self-confidence has emerged as a desirable leadership characteristic (Luthans et al. 2001). Indirect evidence on the value of self-confidence for organizational performance comes from the finding that advisors who express more confidence earn greater trust and engender more confidence in those receiving their advice (Sniezek and Van Swol 2001) and from the fact that companies are willing to pay a premium to more confident managers (Khurana 2002). Finally, leadership studies suggest that confident managers are able to benefit the organizations they manage (Chemers et al. 2000; Flynn and Staw 2004).

Most of the attention of business research on the concept of confidence has focused on the *biased* aspects, i.e. on overconfidence or *hubris* (Hayward and Hambrick 1997). Overconfidence has turned out to be one of the cognitive biases more frequently encountered in managerial behaviour (Malmendier and Tate 2005). For instance, overconfidence leads to overtrading behaviour in the stock market (Odean 1998), to the use of long-term, as opposed to short-term debt (Ben-David et al. 2013), to imprecision of forecast (Hribar and Yang 2016), and to excessive risk-taking (Li and Tang 2010; Simon and Houghton 2003).

In operations management, there is emerging evidence that overconfidence is generally tied to mistakes that maybe costly for individuals and organizations. Ren and Croson (2013) have found that overconfidence can explain the typical pattern of over/under ordering in single-echelon single-period newsvendor problems. Ancarani et al. (2016) have explored the effects of overconfidence in inventory management in multi-echelon supply chains, showing that overconfident individuals exhibit higher costs, incur more backlogs, and increase the risk of a supply chain breakdown. In the supply management field, Kaufmann et al. (2009) and Hada and Grewal (2013) suggest that purchasing managers trained to carry out risk assessment and to apply formal models tend to be overconfident.

None of these studies have looked at how the self-confidence of the supply chain manager in its everyday work activities is correlated to work performance. Therefore, currently, there is no evidence on how this general psychological trait extends to the work sphere and on how it correlates with other individual characteristics that may be of relevance for work-related outcomes.

3 Study Design and Implementation

3.1 The Decision Task and the Business Game

The focus in the empirical analysis of individual self-confidence was on order quantities and on inventory decisions within the supply chain. The business game known as the "beer game" (Forrester 1958; Sterman 1989) was adopted to exemplify a multi-echelon supply chain operating in a multi-period setting and used as the decision context for the human experiment. In the version of the game implemented in this study, each supply chain was made up of four echelons in charge of producing and distributing beer: factory, distributor, wholesaler, and retailer. Each human player was assigned to a specific role within the chain and was in contact only with the closest downstream and upstream echelon. Every echelon had a single downstream customer and a single upstream supplier. The decision task consisted of placing an order in each period of the game in order to meet customer demand. Each period, an external customer, played by the software used to implement the game, placed a demand that was observable only by the retailer. Participants have to balance costs of carrying over inventory from one period of the game to the next with shortage costs that arise when inventory is insufficient to satisfy customer's demand.

The beer game has been used extensively in research and for educational purposes to gain lessons on the benefits of an integrated approach to the management of supply chains and on the costs of foregoing coordination. The general pattern observed is fluctuations of orders and turbulence along the supply chain as result of variations in demand. The most notable phenomenon observed in the game is order variance amplification as one climbs up the layers of the supply chain, known as the bullwhip effect. The higher variance of orders observed in the upper levels of the chain is generally associated with higher costs for the echelons involved and for the chain as a whole. Therefore, the game illustrates how the dynamics of a complex system are often unpredictable even to the most experienced managers or buyers, because of the impossibility of full coordination with the other members of the chain.

The set-up of the game used in this study involved a normally distributed external demand with mean equal to 100 and standard deviation equal to 20 units. Each order sent upstream entailed a constant information lag equal to one period, while the transportation time from the supplier to the buyer was stochastic and uniformly distributed in the interval (1, 2, 3) periods. Stochastic lead times allow for

order crossovers, a feature increasingly characterising global supply chains (Disney et al. 2016). Each tier had unlimited storage capacity. Each unit in inventory had a cost per period equal to 0.5 euro while shortage costs were equal to one euro per unit in shortage.

In each period of the game, players' task was to place an order upstream. All echelons simultaneously chose their order quantity for the period, which could not be modified once it was introduced in the software recording decisions. Participants were involved in two repetitions of the game, each lasting 35 periods. The first repetition allowed players to gather hands-on experience. The decisions and results of the second repetition were recorded and are analysed in the following. During the game, communication among players was strictly forbidden in order to mimic an uncoordinated supply chain. Players were instructed that their goal was to minimise the overall costs, i.e. inventory plus backlog costs, of their chain. Therefore, they were asked to achieve supply chain cost minimisation, while relying only on local information, i.e. echelon inventory (Cachon and Zipkin 1999).

In the Appendix to this chapter, Figure 1 summarises the game design, while Figure 2 shows the screenshot used to elicit participants' responses and the information available concerning the history of the game.

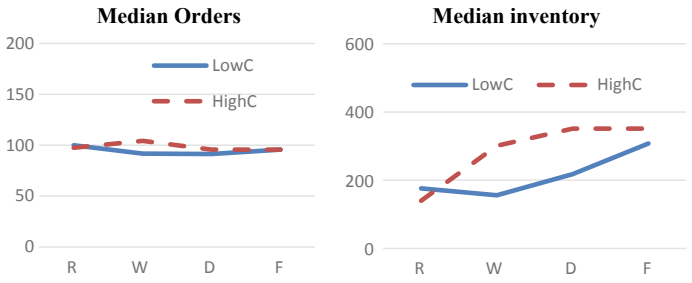
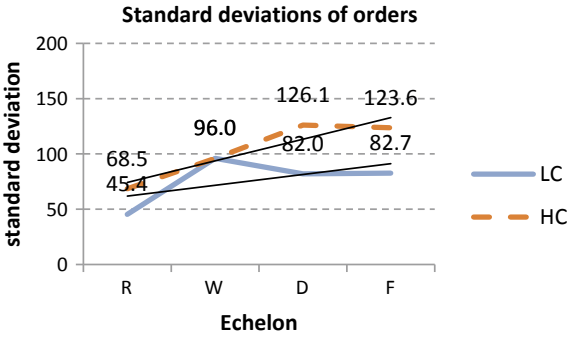


Fig. 1 Median orders and inventories (authors' own figure)

Fig. 2 Bullwhip effect (authors' own figure)



3.2 Self-confidence Measures

In order to measure self-confidence, we used a scale made up of four items and drawn from the World Values Survey, a cross-country project coordinated by the Institute for Social Research of the University of Michigan (www.worldvaluessurvey.org) (Pirinsky 2013). The four items (measured on a five-point Likert scale) were meant to identify the degree of absolute self-confidence, i.e. the way individuals perceive their own abilities, relative self-confidence, i.e. how they evaluate their abilities relative to others, and their optimism, i.e. how positively they feel about future outcomes. These three nuances match the three typologies of confidence identified in the confidence literature, namely calibration (the estimation of the variance of a relevant measure affecting performance), placement (better-than-average effect), and estimation (optimism about performance or chances of success) (Moore and Healy 2008).

The four items allowed building a composite measure of confidence with five levels (0, 0.25, 0.50, 0.75, and 1). A score of 1 indicated that the rater had a score at least equal to four on all four items of the scale; 0.75 indicated that the rater had a score at least equal to four on three items of the scale; 0.50 indicated that the rater had a score at least equal to four on two items; 0.25 indicated that the rater had a score at least equal to four on only one item; zero indicated that the rater never had a score at least equal to four. Hence, a composite score equal to one captured self-confidence in all four dimensions (absolute, relative, optimism), while a score of zero stood for self-confidence in no dimension.

In order to clearly separate the impact of self-confidence on behaviour in the inventory management game, purchasing and supply management professionals exhibiting either high self-confidence with an overall score >0.5 or low self-confidence with an overall score <0.5 were invited to take part in the beer game. Twenty low-confidence (LC) and twenty high-confidence (HC) individuals accepted to participate in the game. LC individuals were randomly assigned to LC chains (five chains), while HC individuals were randomly assigned to HC chains (five chains). Hence, each chain in the experiment was homogeneous in terms of composition, at least as far as self-confidence was concerned, and the experiment allowed to contrast differences in ordered quantities and inventory decisions by high (respectively low) self-confident individuals and chains. Figure 1 illustrates the distribution of beer game participants according to their degree of self-confidence. Average self-confidence individuals were not involved in the test in order to make the difference in the composition of the two types of chains more salient. Orders, standard deviation of orders, inventory holdings, backlogs, and costs were compared between the two groups of chains.

4 Results

4.1 Orders and Inventory: Descriptive Results

Figure 1 shows median orders (left-hand side) and median inventory (right-hand side) for all echelons. Median order is around the mean value of external demand (100 pieces) irrespective of the degree of self-confidence. This finding suggests that the provision of partial information to all echelons (namely point-of-sale demand distribution parameters) led to a strong anchoring effect on the theoretical mean of the distribution. Interestingly, this anchoring effect holds for all echelons and not only for the retailer who is in closer contact with the external customer. This result is in line with Croson and Donohue (2003), whose findings suggest that supply chain members use POS data when they are available.

The median inventory holdings are lower for LC players than they are for HC players, except for the lowest echelon. In particular, given the demand and lead time parameters, the median inventory held by HC wholesalers, distributors, and factories (≥ 300) accounts for a service level higher than 99%, while the median service level offered by LC chains is lower. However, the null hypothesis that the median inventory holdings are statistically equal for the two types of chains cannot be rejected.

The variability of orders measured by the order standard deviation (Fig. 2) shows that for all echelons except the wholesaler, the standard deviation is higher for HC players. The tendency lines show that HC chains also exhibit a slightly higher amplification of the variability of orders across echelons (bullwhip effect). Irrespective of self-confidence, median standard deviation of orders is significantly larger than the standard deviation of external customer demand (20), suggesting that the median player does not adopt a simple strategy of passing through demand received from the customer to its supplier (Sterman 1989). This is true also for retailers, who are the only actors in the chain who observed external demand in each period.

4.2 Costs

Figure 3 reports median total costs (upper panel) for each period of the game for HC and LC chains and backlog costs (lower panel) across the game.

The upper panel shows that LC chains (solid line) exhibit higher costs than HC in the first half of the game and lower costs in the latter part. A one-tail paired t-test of mean costs per period shows that costs of HC chains are statistically larger than costs of LC chains ($p < 0.042$). Mean costs per period are equal to 1665 for HC and 1449 for LC, a difference of around 15%. The lower panel in Fig. 3 shows that the HC chains exhibit lower backlog costs. The one-tailed paired t-test applied to the comparison of mean period backlog costs shows that these are statistically lower for

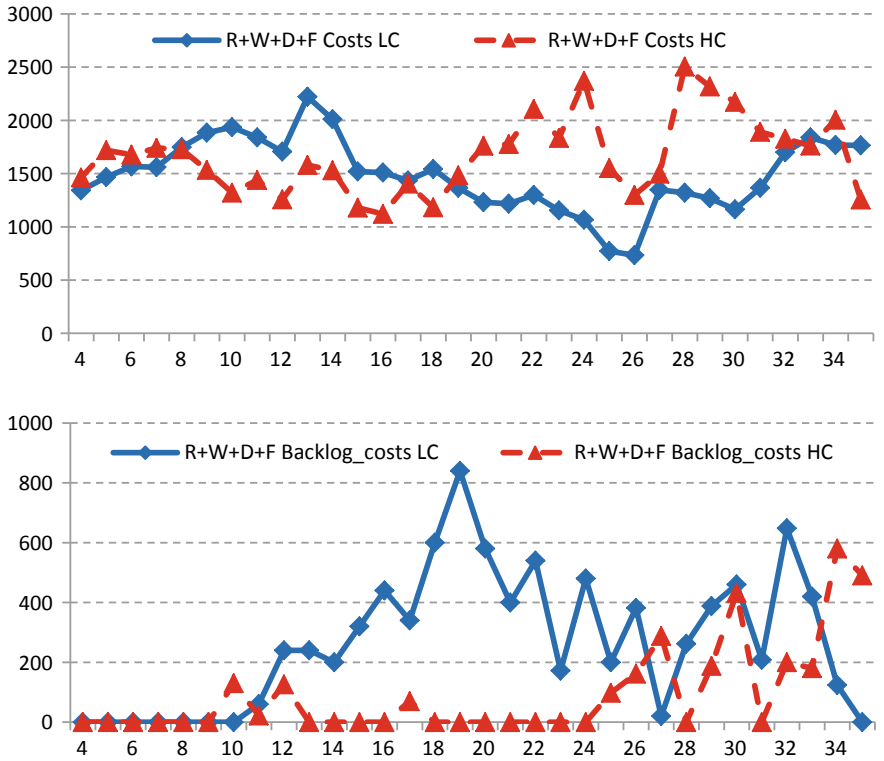


Fig. 3 Median total costs (upper panel) and backlog costs (lower panel) (authors' own figure)

HC chains ($p < 0.000$) with a mean backlog cost equal to 92.69 for HC chains and 267.63 for LC chains.

4.3 Model Estimation

With the aim to identify the decision model for order quantity at each echelon, a dynamic regression model was estimated (Eq. 1) for each echelon of the chain:

$$\begin{aligned}\text{Order}(it) = \text{Max}\{0, \alpha\,\text{Demand}(it) + \beta[\text{Target Inventory}(i) \\ - \text{Inventory on Hand}(it)] - \gamma\text{Pipeline}(it)\}\end{aligned} \quad (1)$$

where:

i = ith player in echelon considered (retailer, wholesaler, distributor, factory)
t = tth period of the game, t = 1, …, 35.

The model follows Croson and Donohue (2003) and Croson et al. (2014) and assumes that the order quantity depends on downstream demand at time t, on the difference between the desired target inventory level and inventory on hand, and goods in transit in the pipeline. The coefficient α indicates the weight assigned to customer demand when choosing the order quantity and thus captures "demand chasing" effects, β indicates the speed of adjustment of inventory on hand to the target stock, while γ indicates the degree to which players keep the work in progress into account when choosing the order quantity. When β tends to one, this indicates immediate adjustment, i.e. within one period. According to Sterman (1989), the goods in transit tend to be underestimated by the decision maker when choosing the order quantity (γ tends to zero), leading to inflated orders and inventory, higher variability of orders, and general supply chain instability. The above equation was estimated separately for HC and LC players, in order to understand whether the decision model followed by low-confidence and high-confidence players was different and in which respects.

Results (Table 1) show that LC players tend to anchor on current demand when choosing order quantities, as indicated by a coefficient for Demand(t) closer to one for LC chains for all echelons except the retailer. Full anchoring on demand would have been signalled by a coefficient equal to one. The similarity of the size of coefficients for the retailer under the two conditions depends on the fact that this echelon is the only to have access to POS demand, as explained above. Since the retailer observes external demand, anchoring on demand is plausible irrespective of the self-confidence score.

The coefficient for Inventory(t), i.e. inventory on hand, is fairly small for both LC and HC players and close to zero, although it is higher for HC players. This result indicates that, although both LC and HC players adjust orders slowly following a reduction in inventory on hand, HC players replenish inventories faster than LC players. As indicated by the higher value of the constant term, HC players prefer to work on higher target stock with respect to LC. We also observe that the target stock is higher for upstream echelons, which reflects the fact that higher echelons have to cope with greater oscillations of demand.

Finally, looking at the impact of lagged orders and goods in the pipeline, while both LC and HC players keep into account previous periods' orders, lags 3 and 4 tend to be ignored by HC players.

5 Managerial Implications

Prior operations and management studies have focused on the consequences of a self-confidence level that exceeds actual performance, showing that overconfidence in managerial settings leads to wrong forecasts and excessive risk-taking. This paper has investigated whether a general attitude of self-confidence, characterised by reliance on own abilities in absolute terms and with respect to others, and by a

Table 1 Determinants of order quantities—low and high self-confident players by role (table compiled by authors)

Expl. Vbl.	Retailer		Wholesaler		Distributor		Factory	
	HC	LC	HC	LC	HC	LC	HC	LC
Demand(t)	0.89	0.69	0.5	0.85	0.33	0.97	0.33	0.89
	*0.2***	*0.46*	*0.06***	*0.19***	*0.08***	*0.06***	*0.08***	*0.06***
Inventory(t)	−0.29	−0.06	−0.12	−0.01	−0.14	0.07	−0.11	−0.04
	*0.03***	*0.02***	*0.03***	*0.01*	*0.03***	*0.04*	*0.02***	*0.02*
Order(t − 1)	0.26	0.13	0.15	0.61	0.21	−0.18	0.21	0.23
	*0.06***	*0.06***	*0.06***	*0.06***	*0.06***	*0.05***	*0.06***	*0.05***
Order(t − 2)	−0.07	0.26	0.19	0.59	0.21	0.05	0.08	−0.07
	0.06	*0.06***	*0.06***	*0.07***	*0.06***	*0.05*	*0.06*	*0.05*
Order(t − 3)	−0.08	−0.04	−0.01	−0.29	−0.07	−0.14	0.11	0.18
	0.07	*0.06*	*0.07*	*0.08***	*0.07*	*0.06***	*0.07*	*0.05***
Order(t − 4)	0.06	0.12	−0.02	−0.15	−0.09	0.23	−0.15	0.09
	0.06	*0.06***	*0.07*	*0.07***	*0.07*	*0.05***	*0.06***	*0.05*
Target inventory (constant)	38.14	17.86	45.08	19.31	100.53	120.48	118.47	3.98
	27.02	*54.43*	*16.43****	*59.48*	*20.73****	*56.02***	*23.57****	*84.41*

Standard deviations in italics, *** significant at 99% level, ** significant at 95% level

perception of optimism, is associated with superior performance in an inventory management task within a serial supply chain.

The supply chain business game implemented in this study was meant to simulate turbulent environments, in which customer demand swings are substantial, and suppliers' lead times are unreliable. This characteristic of the game marks a significant difference with respect to the "standard" game played in executive and student simulations, which generally involves a simplified environment with uncertainty in customer demand but constant delivery time (Sterman 1989). Indeed, today's business systems encompass enormous complexity, and executives must often steer global supply chains that exhibit significant supply-side risks. Therefore, this study was meant to capture this facet of uncertainty in supply chains.

Our analysis, which builds upon results in experimental psychology, has revealed that the self-confidence score is significantly related to differentiated behaviour in inventory management. Specifically, LC players have lower inventory holdings across the game, which lead to greater backlogs and to a lower customer service level. Their decision model involves chasing the current customer demand closely when choosing the order quantity. This behaviour suggests a short-sighted, short-term decision horizon, which ends up creating backlogs. However, costs per period tend to be lower in LC chains than in HC chains.

Unlike LC players, HC players do not anchor on customer demand when choosing the order quantity but work on a target stock. Inventories are replenished to the target stock more swiftly as indicated by the higher coefficient of inventory on hand. Average inventory holdings are higher, especially in the middle leg of the game, leading to low and infrequent occurrence of backlogs. Goods still in the pipeline significantly affect order quantities more often than for HC, but differences are not as clear-cut as for other explanatory variables. Overall, self-confident decision makers guarantee a smooth flow of goods across the channel, and better customer service, albeit at extra cost for the chain.

These findings suggest a number of observations that may find application in the inventory management area:

Observation 1—There is a trade-off between guaranteeing the smooth flow of goods across the supply chain and therefore managing the risk of supply interruption and costs. The decisions of self-confident individuals appear to be focused on the former, while the decisions of low-confidence decision makers seem to put more emphasis on cost reduction. Should our results be confirmed by larger-scale studies, this would imply that the self-confidence of the inventory manager is crucial in affecting this trade-off and therefore in influencing firm's costs and customer satisfaction.

Observation 2—Vis-a-vis a lower handling cost per period (about 15%), the inventory management strategy followed by low-confidence decision makers generates significantly lower service levels. By anchoring on current demand, low self-confidence players tend to "react hard", generating turbulence in the system through higher backlogs. Hence, low self-confident individuals may be unfit to

manage new and uncertain situations characterised by high risk of supply disruption, unless previously trained. As a corollary to this, high-confidence players that work by constantly adjusting inventory to the target stock are better fit to handle turbulent situations.

Observation 3—The way self-confident teams achieve a better service level is not by avoiding stock-outs altogether but by allowing for a moderate risk of stock-out, suggesting that high self-confidence is also tied to the ability to manage risk.

Finally, the self-confidence score emerges as a good proxy of chain performance and may be used by management to approximate subordinates' self-esteem, belief in own capabilities, and motivation. In this respect, results bear relevance for processes of human resource selection and for training programs aimed at "de-biasing" incorrect attitudes (Kaufmann et al. 2009).

6 Limitations and Future Research Directions

Results from this small scale supply chain experiment have given insights into the relation between perceived confidence and performance in managing inventory across the chain. However, some limitations, which future research may address, must be acknowledged. First, the small sample size has severely limited our ability to undertake hypothesis testing based on the comparison between low and high self-confidence chains. Next, results refer to chains that exhibit extreme values (either low or high) of self-confidence and do not include individuals exhibiting an average self-confidence level. Finally, the analysis has not investigated the relation between other characteristics that are typically related to self-confidence, such as personality traits and demographics, and inventory management.

Overcoming these limitations generates a rich future research agenda. First, we plan to undertake larger-scale experiments that include treatment effects that allow testing how high/low-confident individuals react to different scenarios in terms of volatility of demand and costs. To date, most beer game experiments have been carried out using a standard ratio for stock-out cost to inventory holding costs equal to 2. However, in several industries, this ratio may be unrealistically low. In addition, according to the buyer–supplier power relation, stock-outs may entail a loss of reputation for the supplier and a potential loss of business. Another extension of the research that goes in the direction of collecting a larger sample includes recruiting participants and running the experiment on the Web. This extension would permit collecting information from a larger set of companies, thereby allowing the incorporation of a treatment effect for industry or company culture.

Next, it would be of interest to explore the performance of supply chain teams that are diverse in terms of the self-confidence of their members. Given that a full exploration of the performance impact of different combinations of self-confidence

in a multi-echelon chain would require a large number of experimental data points, human experiments could be augmented with computer simulation experiments.

Third, since the experiment has been conducted in a setting that does not allow coordination among supply chain echelons, it would be of interest to compare this set-up with a chain in which coordination is allowed. Providing players with coordination opportunities would allow the exploration of whether an optimisation strategy that complements both, limiting inventory and no backlog, can be achieved.

Finally, it would be interesting to explore whether outcomes for the two groups depend on the incentive provided in the experiment, specifically the goal to minimise supply chain costs. Comparison of results with a new experimental treatment in which the objective is to minimise the own echelon's costs would allow assessing whether in the current experiment players are actually able to use "system thinking" and optimise for the entire chain.

Appendix

See Figs. 4 and 5.

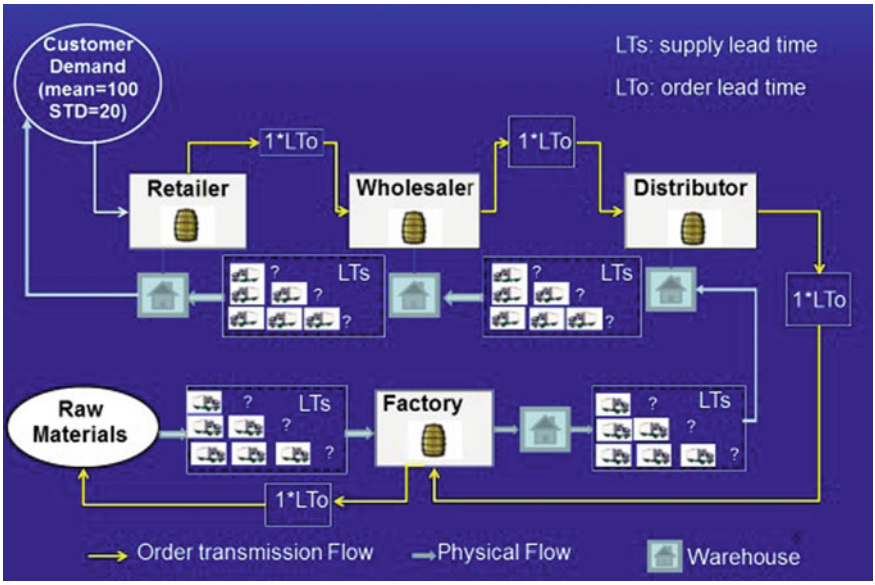
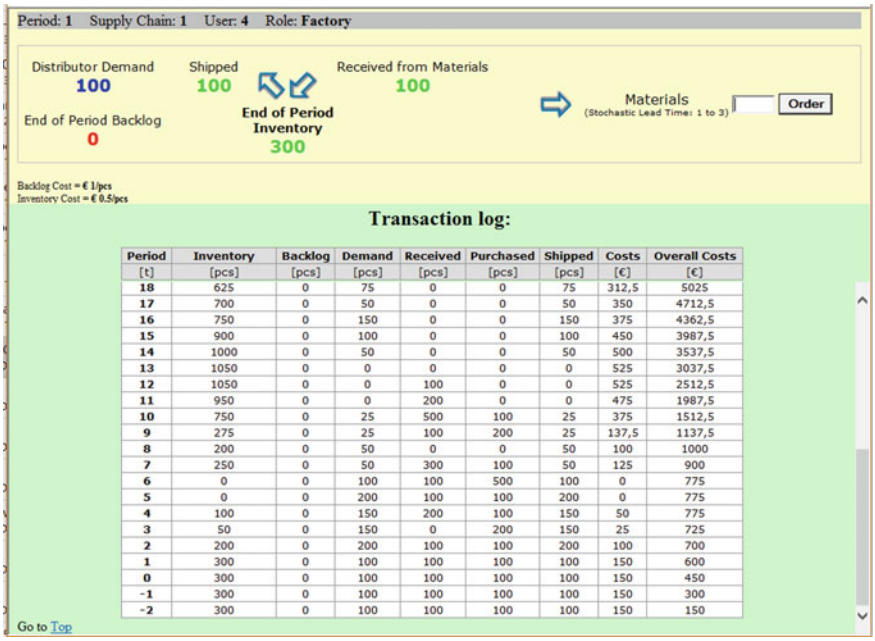


Fig. 4 Game design (authors' own figure)



Period	Inventory	Backlog	Demand	Received	Purchased	Shipped	Costs	Overall Costs
[t]	[pcs]	[pcs]	[pcs]	[pcs]	[pcs]	[pcs]	[€]	[€]
18	625	0	75	0	0	75	312,5	5025
17	700	0	50	0	0	50	350	4712,5
16	750	0	150	0	0	150	375	4362,5
15	900	0	100	0	0	100	450	3987,5
14	1000	0	50	0	0	50	500	3537,5
13	1050	0	0	0	0	0	525	3037,5
12	1050	0	0	100	0	0	525	2512,5
11	950	0	0	200	0	0	475	1987,5
10	750	0	25	500	100	25	375	1512,5
9	275	0	25	100	200	25	137,5	1137,5
8	200	0	50	0	0	50	100	1000
7	250	0	50	300	100	50	125	900
6	0	0	100	100	500	100	0	775
5	0	0	200	100	100	200	0	775
4	100	0	150	200	100	150	50	775
3	50	0	150	0	200	150	25	725
2	200	0	200	100	100	200	100	700
1	300	0	100	100	100	100	150	600
0	300	0	100	100	100	100	150	450
-1	300	0	100	100	100	100	150	300
-2	300	0	100	100	100	100	150	150

Fig. 5 Screenshot of data available to participants (authors' own figure)

References

Ancarani, A., Di Mauro, C., & D'Urso, D. (2013). A human experiment on inventory decisions under supply uncertainty. *International Journal of Production Economics, 142*(1), 61–73.

Ancarani, A., Di Mauro, C., & D'Urso, D. (2016). Measuring overconfidence in inventory management decisions. *Journal of Purchasing & Supply Management, 22,* 171–180.

Bendoly, E., Croson, R., Goncalves, P., & Schultz, K. (2010). Bodies of knowledge for research in behavioral operations. *Production & Operations Management, 19*(4), 434–452.

Ben-David, I., Graham, J. R., & Harvey, C. R. (2013). Managerial miscalibration. *The Quarterly Journal of Economics, 128*(4), 1547–1584.

Cachon, G. P., & Zipkin, P. H. (1999). Competitive and cooperative inventory policies in a two-stage supply chain. *Management Science, 45*(7), 936–953.

Chemers, M. M., Watson, C. B., & May, S. T. (2000). Dispositional affect and leadership effectiveness: A comparison of self-esteem, optimism, and efficacy. *Personality and Social Psychology Bulletin, 26*(3), 267–277.

Croson, R., & Donohue, K. (2003). Impact of POS data sharing on supply chain management: An experimental study. *Production and Operations management, 12*(1), 1–11.

Croson, R., Donohue, K., Katok, E., & Sterman, J. (2014). Order stability in supply chains: Coordination risk and the role of coordination stock. *Production and Operations Management, 23*(2), 176–196.

Disney, S. M., Maltz, A., Wang, X., & Warburton, R. D. (2016). Inventory management for stochastic lead times with order crossovers. *European Journal of Operational Research, 248*(2), 473–486.

Flynn, F. J., & Staw, B. M. (2004). Lend me your wallets: the effects of charismatic leadership on external support for an organization. *Strategic Management Journal, 25,* 309–330.

Forrester, J. W. (1958). Industrial dynamics. A major breakthrough for decision makers. *Harvard Business Review, 36*(4), 37–66.
Hada, M., & Grewal, R. (2013). Purchasing managers' perceived bias in supplier-selected referrals. *Journal of Supply Chain Management, 49*(4), 81–95.
Hayward, M. L., & Hambrick, D. C. (1997). Explaining the premiums paid for large acquisitions: Evidence of CEO hubris. *Administrative Science Quarterly, 42*(1), 103–127.
Hribar, P., & Yang, H. (2016). CEO overconfidence and management forecasting. *Contemporary Accounting Research, 33,* 204–227. https://doi.org/10.1111/1911-3846.12144.
Kaufmann, L., Michel, A., & Carter, C. R. (2009). Debiasing strategies in supply management decision-making. *Journal of Business Logistics, 30*(1), 85–106.
Khurana, R. (2002). The curse of the superstar CEO. *Harvard Business Review, 80*(9), 60–66.
Kleitman, S., & Stankov, L. (2007). Self-confidence and metacognitive processes. *Learning and Individual Differences, 17*(2), 161–173.
Li, J., & Tang, Y. (2010). CEO hubris and firm risk taking in China: The moderating role of managerial discretion. *Academy of Management Journal, 53*(1), 45–68.
Luthans, F., Luthans, K. W., Hodgetts, R. M., & Luthans, B. C. (2001). Positive approach to leadership (PAL) implications for today's organizations. *Journal of Leadership Studies, 8*(2), 3–20.
Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *Journal of Finance, 60*(6), 2661–2700.
Moore, D., & Healy, P. J. (2008). The trouble with overconfidence. *Psychological Review, 115*(2), 502–517.
Narayanan, A., & Moritz, B. B. (2015). Decision making and cognition in multi-echelon supply chains: An experimental study. *Production and Operations Management, 24*(8), 1216–1234.
Odean, T. (1998). Volume, volatility, price, and profit when all traders are above average. *Journal of Finance, 53*(6), 1887–1934.
Picone, P. M., Dagnino, G. B., & Miná, A. (2014). The origin of failure: A multidisciplinary appraisal of the hubris hypothesis and proposed research agenda. *Academy of Management Perspectives, 28*(4), 447–468.
Pirinsky, C. (2013). Confidence and economic attitudes. *Journal of Economic Behavior & Organization, 91,* 139–158.
Ren, Y., & Croson, R. (2013). Overconfidence in newsvendor orders: An experimental study. *Management Science, 59*(11), 2502–2517.
Schraw, G., Dunkle, M. E., Bendixen, L. D., & Roedel, T. D. (1995). Does a general monitoring skill exist? *Journal of Educational Psychology, 87*(3), 433.
Simon, M., & Houghton, S. M. (2003). The relationship between overconfidence and the introduction of risky products: Evidence from a field study. *Academy of Management Journal, 46*(2), 139–149.
Sniezek, J. A., & Van Swol, L. M. (2001). Trust, confidence, and expertise in a judge-advisor system. *Organizational Behavior and Human Decision Processes, 84*(2), 288–307.
Stankov, L., & Crawford, J. D. (1997). Self-confidence and performance on tests of cognitive abilities. *Intelligence, 25*(2), 93–109.
Sterman, J. (1989). Modelling managerial behaviour: misperceptions of feedback in a dynamic decision making experiment. *Management Science, 35*(3), 321–339.
Strohhecker, J., & Größler, A. (2013). Do personal traits influence inventory management performance?—The case of intelligence, personality, interest and knowledge. *International Journal of Production Economics, 142*(1), 37–50.
Wang, J., Zhuang, X., Yang, J., & Sheng, J. (2014). The effects of optimism bias in teams. *Applied Economics, 46*(32), 3980–3994.

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Prospects of Purchasing—An Evaluation Model for Data Mining Approaches for Preventive Quality Assurance

Frank Straube, Anna Lisa Junge, and Tu Anh Tran Hoang

1 Introduction

The terms purchasing, procurement, and sourcing are often not distinguished in a clear manner. Purchasing means in our definition the transactional function or activity of buying needed goods or services including placing and processing purchase orders. Procurement covers the broad range of processes that are associated with an organization's desire to obtain the necessary goods and services. This concerns among others supplier selection, pricing negotiations, and contract management. Strategic sourcing is the transformational process performed at a high organizational level. It examines the whole supply network, its linkages, and how they impact procurement and purchasing decisions such as risk management (Wallace and Xia 2014). This contribution deals with aspects relating to purchasing and procurement. It intends to conceptualize an evaluation model for data mining approaches for purchasing with a focus on preventive quality assurance. In the following, the term purchasing is used encompassing procurement aspects as well.

2 Current Trends in Logistics and Their Impact on Purchasing

One main trend impacting logistics is the ongoing digital transformation leading to Industry and Logistics 4.0. Digital transformation describes the change of value-added processes on the company level through the further development of

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existing and implementation of new digital technologies, adjustments of corporate strategies on the basis of new digitalized business models as well as the acquisition of the necessary competencies and qualifications. Pursued objectives are increased flexibility and productivity within the company while at the same time focusing on customers and their needs for digital products and services (Kersten et al. 2017). The way toward Industry and Logistics 4.0 is based on enabling transparency, forecasting capability, and autonomous systems (Schuh et al. 2016). These three steps build on each other, whereas this contribution focuses on the second one. Digital transformation encompasses and affects four dimensions including technologies and systems, organization and processes, management and people, and business models (Pellengahr et al. 2016). The new possibilities offered by digital transformation in logistics pose new requirements for purchasers: In any case, it is important to understand technologies and systems and to use them correctly and, as a result, to recognize potential and changes concerning information management. The second perspective refers to people and their personal abilities and skills. The number of purchasers will probably decrease, but they will have to have well-founded specialist knowledge in order to fulfill their strategic role. The third perspective talks about the processes and their management and organization. These must be freed from non-value-adding activities and extended across several functional areas. The fourth perspective focuses on new business models that are difficult to incorporate into the rigid process patterns of existing companies. New market potentials must be quickly identified and innovatively implemented in order to exploit the resulting competitive advantages (Pellengahr et al. 2016; Hofmann and Städter 2007).

Bienhaus and Hadud (2018) state that artificial intelligence, big data, and Internet of Things are key dimensions for future automated and autonomous operative activities in procurement and purchasing. This will free human capacities for more strategic initiatives. Transparency will increase the level of trust, but face-to-face meetings will prevail as a mean to build up trust and relationships.

Figure 1 shows the status quo of the use of supply chain analytics in purchasing. 62% of participating experts from industry already have supply chain analytics applications in place for purchasing, and retail is second with 47%.

A prerequisite for allowing meaningful insights based on data for purchasing is a suitable data mining approach. The vision of applying data mining for preventive quality assurance is that the production processes of suppliers are automatically monitored. This enables to identify defects and failures in advance and to adapt maintenance intervals of machinery accordingly. Ultimately, the application of data mining in purchasing will lead to an improvement in quality along the value chain as well as timely optimization and better alignment of actors. Current challenges for leveraging analytics in logistics are technological integration, trust issues, and legal insecurities. One of the main challenges will be to design preventive quality assurance in a way that mutually benefits supplier and customer. This will require a balance between data sharing and protecting individual pursuit of profit. In the following, an approach to assess the most suitable data mining methodology in purchasing for binary classification in preventive quality assurance is presented.

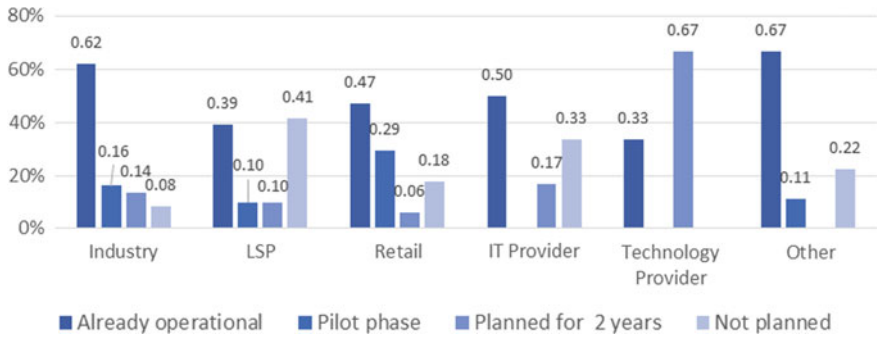

Fig. 1 Status quo of applying data analytics in purchasing; LSP = logistics service provider, IT = information technology, N = 120 (Junge et al. 2019)

3 An Evaluation Model for Data Mining in Purchasing

Data mining is defined as the application of algorithms for data pattern recognition (Fayyad et al. 1996b). Other terminologies are knowledge extraction or information discovery, but in statistics and data analysis, the terminology data mining prevails. The complete data mining process according to Han et al. (2011) consists of seven steps:

1. Data Cleaning: In this step, inconsistent, irrelevant, and noisy data are removed in order to avoid distortions. In addition, disruptive factors are eliminated and missing values are added.
2. Data Integration: To obtain new relevant data, data from various sources are integrated and combined.
3. Data Selection: The data relevant for the analysis is selected from the database. The aim is to achieve an effective number of variables.
4. Data Transformation: The data is transformed, scaled, and aggregated for the appropriate application of data mining. This serves the correct and effective execution of the algorithm. The data sets must also be divided into two partial data sets. One consists of training variables, with which the algorithm is trained (training or validation phase) and one serves for the general classification.
5. Data Mining: In this step, the actual data mining process takes place, in which an algorithm is applied to discover meaningful patterns in representative form. The found patterns and information are visualized depending on the method. In addition, potential conflicts with the current state of knowledge are identified and resolved.
6. Pattern Evaluation: The relevant patterns for the application case are identified. Based on this, the patterns found by data mining are analyzed in more detail and can be applied.

7. Knowledge Presentation: The findings are implemented in the current or other fields of application for further actions and presented to other interests. The knowledge gained from the data mining process is improved in terms of efficiency and accuracy.

Goals of data mining are confirmation of hypotheses and the discovery of patterns for a descriptive and/or predictive purpose (Fayyad et al. 1996b, p. 85). The focus here lies on predictive pattern recognition. This is achievable by applying data mining tools to databases and extracting parameters and information (Trebar and Lotric 2005, p. 108). Different techniques for data mining exist, namely classification, regression, clustering, aggregating, dependency modeling, link analysis, and sequence analysis (Fayyad et al. 1996a, b, c). First, there is a need to define which data mining method is applicable to the existing problem. In our case for the preventive quality assurance, the target variable is the part condition, faulty or free of defects, so it is a classification problem, more specifically, it is a binary classification. Second, a concrete data mining method has to be chosen. For classification purposes, concrete data mining methods are already established such as decision trees, artificial neural networks, support vector machines, and k-nearest neighbors, which subsequently are briefly presented.

3.1 Decision Trees

Decision trees are rule-induced procedures and are very popular due to their simplicity and their comparatively low computing power requirements. Each variable of the data set is considered individually and arranged hierarchically in a tree. The nodes represent the variables that are to be classified and the edges correspond to a value or a series of values that the variable can assume (Maione et al. 2016; Phyu 2009). The classification of the variables is based on the root node. They are sorted according to their characteristic values. The comprehensibility of decision trees is one of the method's greatest strengths. It is easy to understand why a variable was classified in a certain class, but pruning is necessary being a disadvantage of decision trees (Phyu 2009). Decision trees can be used to determine the optimal number of suppliers in the presence of risks (Berger et al. 2004).

3.2 Artificial Neural Networks (ANN)

Artificial neural networks are inspired by the human brain. They represent an abstraction of the neurons and their connections, which transmit the nerve impulses. This model is based on the data processing and learning capacity of the biological brain and transfers these properties to the artificial networks (Maione et al. 2016). The special feature is that the connected nodes can communicate parallel to each other and the weighting of the connections can be modified. This allows neural networks to learn directly from the test variables without having to provide a

solution to the problem (Chen and Du 2009). There are two types of learning processes in neural networks: supervised learning and unsupervised learning, whereas supervised learning is used more frequently. In supervised learning, the input and output patterns are known and are applied to the network during the training phase. According to some training examples, in the case of a classification, the network should then assign the transformation between the input and output signals of a class to the pattern it presents. The aim is to map a general model between the input and output values. In unsupervised learning, there is an input pattern, but no output pattern. The goal here is to create a model that recognizes regularities in the training phase (Chen and Du 2009; Craven and Shavlik 1997). One of the disadvantages of a neural network is the long learning time. Due to the fact that a neural network usually reads and processes a node in the next level into one or more other nodes, and the classification process is located between both the structure of the graphs and the weighting of the links, it is difficult to comprehend. Classification rules can thus only be inadequately derived. To bring one's own knowledge and experience about the treated subject area into the neural network also proves to be difficult (Lu et al. 1996). An exemplary application for ANN in supply chain management is optimizing and managing a company's order cycle leading to reduced levels of goods purchased and storage costs (Sustrova 2016).

3.3 Support Vector Machines (SVM)

SVM are among the most precise and robust data mining algorithms and do not require a large number of training variables. Efficient training methods for SVM can also be developed very quickly. In addition, SVM can be performed in any number of dimensions (Wu et al. 2007). SVM are mainly limited to the binary classification of variables and aim to find the best classification function between the two selected classes. It looks for a boundary in a hyperplane that separates the two decision types from each other and draws a line between both options. The best way to do this is geometrically. The boundary should be large enough to exactly separate the two classification types so that prediction errors can be avoided (Maione et al. 2016). Therefore, it is best to maximize the boundary between the classes as much as possible in order to be able to make general but precise statements. SVM sometimes promise the best classification result in terms of their precision in training data, but still leave enough room for the correct classification of future data (Wu et al. 2007). Guosheng and Guohong (2008) compared methods for supplier selection and found that SVM are the best method for their respective case.

3.4 k-Nearest Neighbor (kNN)

kNN is a simple method based on learning by analogy. Each test variable is represented as a point in an n-dimensional space and groups of objects are searched, which are closest to the test variables. Proximity is usually understood to be the

Euclidean distance between the variables (Phyu 2009). The choice of the distance measurement has, however, a large influence on the result. In addition to the Euclidean distance, scaling must also be taken into account to prevent one attribute from outweighing the others due to its high scaling. To classify an object, a pattern is first searched for in the distance in the k training variables during the learning phase. In the actual classification, the distance of the new object to the *k* training variables is calculated and the smallest possible distance, i.e., the nearest neighbor is determined. Using the distance pattern, the new object can be assigned to a class. With this method, the classes are only created when a new variable has to be assigned, instead of defining a model from the outset which determines the assignment in classes before variables are assigned as, for example, with decision trees. The training variables are stored completely and can, therefore, cause high costs through computing power. Such models are also faster in the training phase, but slower in the actual classification because the calculations are made there. With kNN, each attribute is equally important, which can lead to confusion if there is a high number of irrelevant attributes in the data set. However, more weight can be assigned to individual objects in the training data set in order to differentiate these objects classified as more reliable from less reliable objects (Phyu 2009; Wu et al. 2007). Akhbari et al. (2014) showed that the kNN method can be used and applied to predict manufacturing rates and effectively increases the combined profit in supply chains.

Based on the introduction of the four data mining methods suitable for classification, an evaluation model for finding the best data mining method in purchasing is developed. To this end, suitable evaluation criteria must first be found for the evaluation, which consist of the requirements for a data mining method itself on the one hand and the requirements from purchasing on the other. A method is suitable if it meets the requirements arising from the evaluation framework. The aim of an evaluation framework is to evaluate the various data mining methods in a useful way so that meaningful and accurate conclusions can be drawn when they are applied in the area of purchasing. In the special case of this work, a binary classification is applied to find out when a part produced by the supplier is faulty before or during production.

Based on a literature analysis, 15 requirements and sub-requirements for data mining methods were identified relating to the first four steps of the data mining process by Han et al. (2011):

- Cost effectiveness
- Compatibility with different software
- Accuracy of forecast
  - Handling of irrelevant features
  - Automatic learning of feature relationships

- Learning time training
  - Scaling
  - Overfitting
- Learning time forecast
  - Handling of outliers
  - Handling of missing values
- Comprehensibility
- Data protection and security
- Handling of small and large number of variables

For an assessment of the respective importance of the criteria, an alignment with the requirements for purchasing takes place. The requirements for purchasing serve for weighting the data mining criteria. Purchasing requirements can be clustered into three groups: first, the classical key performance indicators such as quality, cost, and time, second, hard- and software, and third, the four clusters resulting from the dimensions of Industry 4.0 for purchasing, which are technology, management and people, process management, and business models (Pellengahr et al. 2016). Figure 2 shows the interrelation of the data mining and purchasing requirements.

For obtaining a weighting of the criteria, the mentioning of the data mining criteria is counted. This leads to the following weighting of the criteria displayed in Table 1. Handling of small and large number of variables as criteria is not derived from purchasing requirements. For weighting the respective data mining criteria, the number of mentions in Fig. 2 is counted and then depicted in Table 1.

After defining and weighting the criteria, the individual data mining methods must now be examined more closely. In the following, the individual methods are described with regard to their advantages and disadvantages and the highlighted criteria are also discussed. The criteria are considered on a qualitative basis based on literature.

Compatibility has rarely been investigated in the literature. The reason for this is that data analysis programs such as KNIME and RapidMiner are compatible with each of the four data mining methods and also provide instructions for their implementation. KNIME and RapidMiner are common programs for the evaluation of data and for the implementation of data mining. Both programs have the advantage that they can be downloaded free of charge—in some cases, however, with restrictions. This means that no differentiation can be made between the data mining methods in terms of compatibility.

The second criteria in weighting are the comprehensibility of the method and the forecast learning duration. The kNN method, decision trees, and SVM are the best comprehensible of the presented data mining methods. Above all, kNN can be understood very well due to the simple principle. All three methods can be represented graphically in an easy way, so that their approach and the decision path are

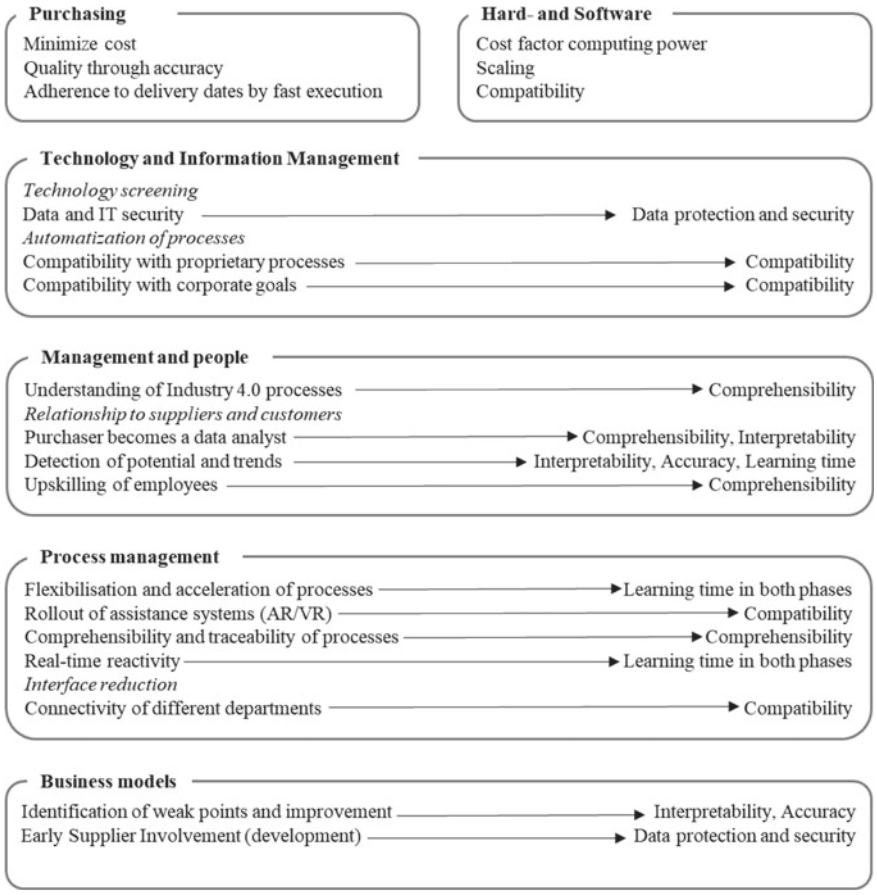

Fig. 2 Derivation for weighting the criteria (authors' own figure)

clearly legible. For neural networks, on the other hand, the greatest weakness is the comprehensibility of the model. With particularly complex models, the steps and algorithms can only be explained with great difficulty, if at all, making the result difficult to understand. The subsequent finding of possible errors or weaknesses in the model is therefore hardly feasible with neural networks compared to the other methods.

Decision trees and neural networks can show good results in the learning duration in the prognosis phase. The learning time of kNN depends on the selected "*k*" but tends to be longer because the training phase is included in the prognosis phase. However, if "*k*" is chosen well, the learning duration may be shorter in the forecast phase as well. This means in practice that different "*k*"s need to be tested and according to the obtained results and the prediction quality "*k*" is chosen. The SVM forecast phase is also very fast and, above all, very simple. New values

Table 1 Weighting of data mining criteria (table compiled by authors)

Data mining criteria	Number of mentions (weighting factor)
Compatibility	5
Comprehensibility	4
Learning time forecast	4
Handling of outliers	–
Handling of missing values	–
Learning time training	3
Scaling	–
Overfitting	–
Interpretability	3
Accuracy	3
Handling of irrelevant features	–
Automatic learning of feature relationships	–
Cost effectiveness	2
Data protection and security	2
Total	26

only have to be entered into the coordination data system, which was previously delimited and divided into classes. In most cases, an assignment is therefore unambiguously and very quickly possible, whereby SVM can show the shortest forecast duration. However, the number of variables and the research environment must also be taken into account.

Outliers and missing values must also be included in the learning duration of the forecast phase. Outliers can be found in any data record and cannot necessarily be avoided by the algorithm alone. This means that every data mining method is affected by this problem. However, outliers in each method can be identified at different speeds and are difficult to eliminate in different ways. With kNN and SVM, outliers are immediately recognizable due to their unique visualization and can, therefore, be removed quickly. Decision trees automatically clean up the data set of outliers by pruning the tree. Missing values, on the other hand, are less positively received. For example, SVM cannot handle missing values at all and therefore require a cleanup. However, there are already numerous methods for eliminating missing values, so that these should no longer be a major problem apart from increased time and effort. For decision trees and kNN methods, there are already numerous techniques that do not require missing values to be replaced (Barak and Modarres 2015). Therefore, these methods can handle them better. Neural networks, on the other hand, have major problems with outliers and missing values. Here, additional time must be invested in order to eliminate these problems in advance.

The next criteria according to the weighting are learning duration during the training phase, interpretability, and accuracy. The kNN method clearly provides the best results for the learning duration during the training phase. Because the training process is partially or completely shifted to the forecast phase, the training duration

is only very short or is omitted completely. kNN only has to deal with the preprocessing of the variables. But SVM can also handle the training of the variables quickly, since only a small amount of data is required for this and must, therefore, be processed. Decision trees and above all neural networks, on the other hand, react relatively slowly. With decision trees, delays occur while the tree is being pruned. With neural networks, the result of the network is compared with the target result for each example. Any errors or discrepancies found are traced back across the entire network.

For the learning period in the training phase, problems with scaling and overfitting must be included. When it comes to scaling, decision trees, and kNN have advantages over SVM and neural networks, as they can easily bypass scaling by their method of operation. For decision trees, scaling through continuous testing does not play a major role, and for kNN the Euclidean distance is mainly relevant. With neural networks and SVM, on the other hand, it is important to perform a uniform and complete scaling, which can take a lot of time. With overfitting, on the other hand, each of the methods has more or less problems. Decision trees and neural networks are particularly susceptible to overfitting and therefore require time-consuming preparatory work in order to avoid problems and distortions caused by overfitting. With kNN, problems with overfitting only occur if "k" is too large. This is found out when different "k"s are tested and the results are compared. In this case, the problem can be avoided more quickly. SVM are not as sensitive as decision trees or neural networks, but they are also not insensitive. Problems can also occur with SVM, but they are easier to circumvent.

The interpretability of the result is similar to the comprehensibility of the model itself. SVM and kNN can score particularly well here as well, since the result is very clear, especially when displayed graphically and is therefore easy to interpret. Decision trees also achieve well interpretable results. However, it also emerged that the results are partly inefficient or those general problems can occur during the prognosis phase, so that interpretation becomes more difficult and further investigations will be necessary. For neural networks, interpretation and understanding of the method may be difficult, as it is unclear where the results come from.

It can be difficult to differentiate between the different methods with regard to the accuracy of the prediction, since each method can deliver good performance under the right conditions. However, it can be seen from the literature that the neural networks with their accuracy and marksmanship generate excellent results and are very reliable. The high accuracy due to the complex approach was often regarded as the greatest strength of this method. Also kNN and SVM delivered good results with high accuracy in comparison with linear regressions or decision trees. In the literature, they are also distinguished as accurate methods with good performance. Decision trees, on the other hand, often performed worse in comparison with the methods examined in this paper. They can also achieve exact results, but strongly depending on the data used.

For the general accuracy of the prognosis, the independent recognition of irrelevant features and the automatic recognition of feature relationships are also considered. Here, too, the neural networks provide the best result in both cases.

They belong to the few methods that automatically include both features and can thus deliver a more realistic and better result. Decision trees also have the possibility to automatically recognize feature references and to include them in the decision-making process. The independent recognition of irrelevant features, however, cannot cover decision trees. The kNN method, on the other hand, does not consider either of the two criteria, whereby either a less realistic result than with neural networks can be obtained or a preliminary work must take place, in order to include these parameters. SVM, in turn, can identify irrelevant features but are not able to recognize feature relationships independently.

Two other important criteria, which have been given the lowest weighting, are cost minimization and data security and data protection. The costs depend on the computing power required by the method. The neural networks clearly have the greatest computing power, since their algorithms are so complex that they are usually not traceable. According to this, the computing power and the resulting costs are higher than with most other methods. With SVM and kNN, it is difficult to say where these methods stand. Both require far less computing power than neural networks, but can also consume a lot of computing capacity if, for example, the number of parameters is very high. Their cost factor, therefore, depends on the conditions under which the methods are performed. Nevertheless, both methods are cheaper than neural networks. Decision trees are always inexpensive, since only test queries take place instead of complicated calculations. Although they require more power as the number of variables increases, they remain cheaper than the other methods.

With regard to data protection and data security, security also depends on the interaction with the software used. For this reason, data mining methods cannot be distinguished from each other on the basis of their security. One option would be the correlation between complexity and data security and protection, whereby the protection factor increases with increasing complexity due to increasingly difficult interpretation by third parties. However, this has not yet been confirmed.

In addition, the unweighted criterion of feasibility must be included with the number of variables. kNN can handle a few variables very well and obtain reliable results. Even with a higher number of variables, this method can generate good results but takes much more time. SVM also produces very good results with only a few variables. However, the results when applying SVM worsen with an increasing number of variables. Therefore, SVM should at best only be used for a small number of variables. Neural networks can handle both many and a few variables well. As the number of variables increases, the model becomes very complicated and more difficult to understand. Decision trees can only handle a limited number of input variables, otherwise, the tree tends to overfitting. The results are summarized in the following table.

In order to be able to make a statement as to which of the data mining methods presented is best suited for purchasing requirements, the unweighted criterion of dependence on the number of variables must first be addressed again. The literature often mentions the extent to which methods can or cannot handle a high or low number of variables. However, there is no concrete indication as to when a number is classified as “high” or “low”, since each source has a different assessment in this

respect. In none of the sources examined could a concrete figure be determined. In this contribution, therefore, up to five variables are classified as a low number and a use of 50 variables or more is classified as a particularly high number. With a small number of input variables (five or less), all methods can produce good results and do not have major problems. SVM are particularly suitable for a small number of variables. The other methods do not suffer from any limitations, so it is difficult to differentiate between them. As the number of variables increases, each method has more and more problems. Thus, SVM become worse with increasing number and kNN needs more time and computing power. With a high number of variables, i.e., more than 50, it is recommended to use decision trees, kNN or neural networks. For decision trees, however, it must be observed whether the tree still tends to overfitting despite the pruning, otherwise, it is well suited. The performance of kNN is not limited, only the execution time and the computing capacity requirements increase. Therefore, with a high number of variables, it must be estimated whether the application of kNN is still worthwhile from a cost point of view. Neural networks, which require high computing power anyway and are difficult to comprehend, can, however, still pursue their task cleanly and precisely without major restrictions with many input variables. Neural networks are, therefore, particularly, suitable for working with many variables.

As a last step, the weighting as displayed in Table 1 is applied to the findings of Table 2. Therefore, one point is given for each "+" multiplied with the weighting. For each "−" one point is subtracted. "++" and "—" are counted double accordingly. Half points are added for "0/+" and subtracted for "0/−". No points are given for "0" (depends on k counts as "0"). Table 3 shows the results after applying the weighting, one time without and one time including the sub-requirements.

Table 2 Evaluation model for data mining methods (table compiled by authors)

Data mining criteria	Decision trees	ANN	SVM	kNN
Compatibility	+	+	+	+
Comprehensibility	+	–	+	+
Learning time forecast	+	+	+	Depends on *k*
Handling of outliers	+	–	+	+
Handling of missing values	+	–	+	+
Learning time training	–	—	+	++
Scaling	+	–	–	+
Overfitting	+	+	0	Depends on *k*
Interpretability	0	–	+	+
Accuracy	0/–	++	+	+
Handling of irrelevant features	+	+	+	–
Automatic learning of feature relationships	0/–	+	–	–
Cost effectiveness	+	–	0/+	0/+
Data protection and security	0	0	0	0

++ very good; + good; 0 neutral; – insufficient; — bad

Table 3 Assessment of the evaluation model (table compiled by authors)

	Score without subordinate criteria	Score including subordinate criteria
Decision trees	10.5	15.25
ANN	0	−4
SVM	23	21.5
kNN	22	24.5

Overall, it is clearly evident that neural networks are by far the most unsuitable under the purchase-related weighting. Their poor score is already recognizable without taking the subordinate data mining criteria into account, but worsens even further with them. Decision trees, on the other hand, are stable and well suited for the application of data mining in purchasing. With regard to their data mining-specific criteria, decision trees perform particularly well, making them particularly easy to implement. However, the SVM and kNN seem to be the most suitable methods in terms of purchasing weighting. While the SVM performs better than kNN without considering the subordinate characteristics, the best method of the presented evaluation framework is kNN for the total score. Both methods are ideally suited for use in purchasing. It should also be mentioned that SVM scores are increasingly worse as the number of variables included in the analysis increases.

The evaluation framework is subject to critical examination of the literature provided and does not cover all existing approaches to data mining methods. Therefore, not all possible scenarios and aspects can be included, which could possibly lead to a different result. In order to partially compensate for any gaps that may have arisen, the evaluation framework should be applied in practice and identify additions or improvements for the evaluation of data mining methods.

For the application in practice, the following steps have to be taken into account: first a suitable pilot case needs to be chosen followed by the identification of one or more suppliers for the project. The data acquisition, which is not part of the previously described data mining approach, has to be carried out. In practice, this often poses problems as data might not be available in a sufficient quality (time period, classification, and representativeness). Once data is available, data understanding encompassing description, evaluation regarding quality and validity, finding solutions for missing and erroneous data, and data preparation meaning having data in the format apt for the software that is to be used for data mining are the subsequent steps. The modeling building upon the presented data mining evaluation approach results in the choice of the suitable data mining method. RapidMiner or KNIME is suitable software. During the test phase data mining methods that seem to be best suited according to the presented evaluation approach are implemented and the results are compared, e.g., for kNN and SVM. In case of the binary classification to detect faulty and error-free parts, the predictive quality is represented by the percentage of correctly predicted parts according to and depending on the chosen variables. The next step is the evaluation of the results and the deployment of the results (e.g., integration in business processes and knowledge diffusion) including an assessment of the project's success and identification of possible improvements.

4 Conclusion and Future Prospects

The evaluation of data mining approaches for preventive quality assurance, meaning to distinguish parts and products being faulty or error-free, based on findings in literature shows that SVM and kNN are the best-suited methods for binary classification. However, it has to be considered that different weighting and the introduction of company-specific requirements can of course change that result. Data availability and number of variants also play an important role when evaluating the best data mining method. Application in practice will deliver further findings. First, companies need to collect data to be able to apply algorithms. Second they need to adapt their organizational structures. Bienhaus' and Haddud's (2018) survey about the future of procurement indicates that organizations are aware of these requirements but most of them have not yet defined new roles, appropriate actions, and capabilities. They need to provide training, hire employees who already have the necessary skills and define a common mind-set and attitude (Bienhaus and Haddud 2018). The right people equipped with suitable tools in purchasing and procurement can improve quality, time, and cost in purchasing and can hence deliver a new value dimension in logistics.

References

Akhbari, M., Zare Mehrjerdi, Y., Khademi Zare, H., & Makui, A. (2014). A novel continuous KNN prediction algorithm to improve manufacturing policies in a VMI supply chain. *International Journal of Engineering, IJE Transactions B: Applications, 27*(11), 1681–1690.

Barak, S., & Modarres, M. (2015). Developing an approach to evaluate stocks by forecasting effective features with data mining methods. *Expert Systems with Applications, 42,* 1325–1339. https://doi.org/10.1016/j.eswa.2014.09.026.

Berger, P. D., Gerstenfeld, A., & Zeng, A. (2004). How many suppliers are best? A decision-analysis approach. *Omega, 32,* 9–15. https://doi.org/10.1016/j.omega.2003.09.001.

Bienhaus, F., & Haddud, A. (2018). Procurement 4.0: Factors influencing the digitisation of procurement and supply chains. *Business Process Management Journal, 24*(4), 965–984. https://doi.org/10.1108/bpmj-06-2017-0139.

Chen, W. S., & Du, Y. K. (2009). Using neural networks and data mining techniques for the financial distress. *Expert Systems with Applications, 36,* 4075–4086. https://doi.org/10.1016/j.eswa.2008.03.020.

Craven, M. W., & Shavlik, J. W. (1997). Using neural networks for data mining. *Future Generation Computer Systems, 13*(21), l–229. https://doi.org/10.1016/s0167-739x(97)00022-8.

Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996a). From data mining to knowledge discovery in databases. *AI Magazine, 17*(3), 37–54. https://doi.org/10.1609/aimag.v17i3.1230.

Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996b). Knowledge discovery and data mining: towards a unifying framework. In *KDD'96 Proceedings of the Second International Conference on Knowledge Discovery and Data Mining,* 82–88.

Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996c). The KDD process for extracting useful knowledge from volumes of data. *Communications of the ACM, 39*(11), 27–34. https://doi.org/10.1145/240455.240464.

Guosheng, H., & Guohong, Z. (2008). Comparison on neural networks and support vector machines in suppliers' selection. *Journal of Systems Engineering and Electronics, 19*(2), 316–320. https://doi.org/10.1016/S1004-4132(08)60085-7.

Han, J., Pei, J., & Kamber, M. (2011). *Data mining: concepts and techniques*. Amsterdam: Elsevier.

Hofmann, M., & Städter, U. K. (2007). Integriertes Prozessmanagement als Basis für nachhaltige Spitzenleistungen im automobilen Einkauf. In F. J. Gercia Sannz, et al. (Eds.), *Die Automobilindustrie auf dem Weg zur globalen Netzwerkkompetenz* (pp. 323–338). Berlin Heidelberg: Springer.

Junge, A. L., Verhoeven, P., Reipert, J., & Mansfeld, M. (2019). In F. Straube (Ed.), *Pathway of digital transformation in logistics*. Universitätsverlag Technische Universität Berlin. Berlin. https://doi.org/10.14279/depositonce-8502.

Kersten, W., Schröder, M., & Indorf, M. (2017) Potenziale der Digitalisierung für das Supply Chain Risikomanagement: Eine empirische Analyse. In S. Mischa, et al. (Eds.), *Betriebswirtschaftliche Aspekte von Industrie 4.0* (pp 47–74). Springer Fachmedien Wiesbaden.

Lu, H., Setiono, R., & Liu, H. (1996). Effective data mining using neural networks. *IEEE Transactions on Knowledge and Data Engineering, 8*(6), 957–961. https://doi.org/10.1109/69.553163.

Maione, C., de Paula, E. S., Gallimberti, M., Batista, B. L., Campiglia, A. D., Barbosa, F., Jr., et al. (2016). Comparative study of data mining techniques for the authentication of organic grape juice based on ICP-MS analysis. *Expert Systems with Applications, 49,* 60–73. https://doi.org/10.1016/j.eswa.2015.11.024.

Pellengahr, K., Schulte, A. T., Richard, J., & Berg, M. (2016). In I. M. L. Fraunhofer, & BME (Eds.), *Einkauf 4.0—Digitalisierung des Einkaufs*. Frankfurt, Dortmund.

Phyu, T. N. (2009). Survey of classification techniques in data mining. In *Proceedings of the International MultiConference of Engineers and Computer Scientists, IMECS 2009, Hong Kong* (Vol. 1).

Sustrova, T. (2016). An artificial neural network model for a wholesale company's order-cycle management. *International Journal of Engineering Business Management, 8,* 1–6. https://doi.org/10.5772/63727.

Schuh, G., Jordan, F., Maasem, C., & Zeller, V. (2016). Industrie 4.0: Implikationen für produzierende Unternehmen. In Gassmann, O., Sutter, P. (Eds.), *Digitale Transformation im Unternehmen gestalten. Geschäftsmodelle, Erfolgsfaktoren, Handlungsanweisungen, Fallstudien. Hanser, München* (pp. 39–58).

Trebar, M., & Lotrič, U. (2005). Predictive data mining on rubber compound database. In B. Ribeiro, R. F. Albrecht, A. Dobnikar, D. W. Pearson, & N. C. Steele (Eds.), *Adaptive and natural computing algorithms* (pp. 108–111). Vienna: Springer.

Wallace, W. L., & Xia, Y. L. (2014). *Delivering customer value through procurement and strategic sourcing: A professional guide to creating a sustainable supply network*. Pearson Education.

Wu, X., Kumar, V., Quinlan, J. R., Ghosh, J., Yang, Q., Motoda, H., et al. (2007). Top 10 algorithms in data mining. *Knowledge and Information Systems, 14,* 1–37. https://doi.org/10.1007/s10115-007-0114-2.

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Ethical Purchasing—Knowledge- and Person-Related Inhibitors to Consumption of Fair Fashion

Marlene M. Hohn and Christian F. Durach

1 Introduction

How the apparel we wear is produced has changed substantially within the last couple of decades (Arnold and Hartman 2005). Formerly, clothing for the European market was mainly produced by European companies with rather integrated supply chains, while nowadays, apparel on display in stores has travelled across the world and through various firms along the supply chains of big fashion retailers. For example, more than 60% of the apparel imported to Germany in 2016 came from Asian countries (Center for International Development 2018). In addition, an industry-wide development towards ever shorter fashion cycles and decreasing apparel quality has emerged with some retailers now presenting around 20 seasons per year (Ferdows et al. 2015). This "fast fashion" trend has led apparel firms to increase the flexibility of their supply chains while at the same time decrease the production costs. A common way to achieve this is by outsourcing the labour-intensive production of apparel. Such outsourcing efforts, many times to companies in less observable and regulated markets, often result in a vast deterioration of working conditions for factory personnel (Crane and Matten 2010). In response to these practices, a niche for apparel that withstands the dominant market logics and their consequences has developed. So-called "fair-trade fashion" is produced without "sweatshop" conditions, i.e., without child or forced labour, excessive working hours or inappropriately low wages (Shaw et al. 2006).

However, despite many consumers' opposition towards the working conditions in conventional clothing production, fair-trade fashion still represents only a small fraction of products on the apparel market. In Germany, the market share of

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clothing sold under the "fairtrade" label (Germany's most prominent fair-trade certification) amounted to only 0.12% in 2016 (German Federal Statistical Office 2017; TransFair e.V. 2016). The present study aims to identify reasons for this discrepancy by asking which factors moderate the translation of positive attitudes towards buying fair-trade fashion into actual purchasing behaviour.

The remainder of this paper is organised as follows: first, the literature on attitude–behaviour inconsistencies in ethical consumption will be reviewed with a special interest in fair-trade and ethical fashion purchasing research. Next, 11 hypotheses concerning knowledge- and person-related factors that are argued to moderate said relationship are presented. The remaining parts detail the research method used, the results obtained and the implications that can be drawn from these.

2 The Attitude–Behaviour Relationship

Starting in the 1960s, scholars have challenged the notion of a strong relationship between attitudes and behaviours of individuals. Until today, an extensive body of the literature has emerged that attests to a difference between what people say and what they do. One research area, in which this phenomenon is very visible, is ethical consumerism. The discrepancy between consumers' positive attitudes towards ethical product alternatives on the one hand and their ongoing conventional purchasing behaviour has often been termed the "attitude–behaviour gap" or the A-B gap (Bray et al. 2011; Carrigan and Attalla 2001; Sudbury and Böltner 2011).

Researchers have addressed the A-B gap in many fields of ethical consumerism, e.g., in green (Johnstone and Tan 2015; Lu et al. 2015) and fair-trade consumption (Chatzidakis et al. 2007; Rode et al. 2008), consumption reduction (e.g., Pereira Heath and Chatzidakis 2012), and more generally, ethical consumption (Auger and Devinney 2007; Bray et al. 2011). Further, the impact of corporate social responsibility, i.e., voluntary actions by corporate actors that further the greater societal good (Boulstridge and Carrigan 2000; Sen and Bhattacharya 2001), and the effect of unethical corporate conduct on consumer purchasing (Folkes and Kamins 1999; Ingram et al. 2005) were analysed in this regard.

Following the growing media attention for the social and environmental issues in apparel mass manufacturing, the A-B gap in ethical clothing consumption has received special attention from scholars. Subfields of research include green fashion purchasing (Niinimäki 2010), "sweatshop" avoidance (Dickson 2001; Hassan et al. 2016), fair-trade fashion purchasing (Shaw et al. 2006) and the broader field of ethical fashion consumption (Jägel et al. 2012; Joergens 2006). The common ground of all these studies is that the attitude of a person towards avoiding unethical apparel or towards ethical fashion choices does only partially translate into corresponding purchasing behaviour. Drawing from these contributions, we develop the first hypothesis as the starting point for our analysis:

H1: The relationship between a person's attitude and his or her purchasing behaviour concerning fair-trade fashion is positive but small.

In the following, several additional hypotheses will be formulated that describes how various factors influence the relationship assumed in H1.

3 Inhibitors to Translating Attitudes into Behaviour

Resulting from the overwhelming evidence for the A-B gap in ethical consumption, scholars have aimed to provide explanations. One important approach that has been used in previous studies relating to this research domain is Izek Ajzen's "theory of planned behaviour" (Carrington et al. 2010; Chatzidakis et al. 2016; Shaw et al. 2007). This theory states that in addition to behaviour-specific attitudes, individual perceptions of behavioural control as well as prevalent subjective norms influence a person's behaviour. Hence, the A-B gap is explained by stressing the importance of influencing factors that are internal to the individual and/or context dependent. However, while Ajzen's theory is mainly used to understand *how* these determinants affect one's behaviour, the aim of the present research is to study *which* specific factors are influencing the A-B relationship in fair-trade apparel purchasing.

To enable a more thorough analysis, the current study focusses on two categories of inhibitors, namely knowledge- and person-related factors (Fig. 1). The first group pertains to the readily mentioned issue of consumer awareness and information availability (Bray et al. 2011; Carrigan and Attalla 2001) and will be addressed in the hypotheses H2–H5. The second category focusses on factors that are either intrinsic to the consumer or that are dependent on his or her relationship with others (H6–H12).

4 Knowledge-Related Factors

Somewhat separate from the other constructs in this category, the first inhibitor researched in this study is consumers' awareness of the social issues in apparel production. Previous studies indicate that consumers seem to have good knowledge

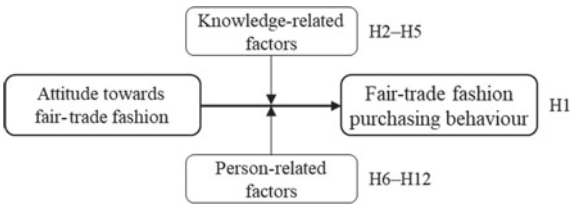

Fig. 1 Model for regression analysis (authors' own figure)

(Dickson 1999; Sudbury and Böltner 2011). However, uncertainties exist concerning the scale of the problems and how to avoid supporting the continuance of these unsustainable practices (Harris et al. 2016; Hassan et al. 2016). As being knowledgeable about the social impacts of conventional consumer goods production has been directly linked to fair-trade purchasing (Andorfer and Liebe 2012), the following hypothesis is proposed:

H2: The less a person is aware of the social issues in conventional clothing production, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

Previous research has indicated that consumers are often not very knowledgeable about the existing alternatives to conventional consumption (Bray et al. 2011; Papaoikonomou et al. 2011). While it is easy for consumers to name firms that have been called out for ethical transgressions like child labour scandals or oil spills, they are seldom able to recall companies that are known for their ethical conduct (Boulstridge and Carrigan 2000; Carrigan and Attalla 2001). However, to reach an informed purchasing decision, consumers need to be aware of the seals that signify fair-trade clothing and need to know brands and retailers for such fashion. Otherwise, they might make wrong assumptions about the available range of ethical apparel (Harris et al. 2016; Hassan et al. 2016) and could, in turn, refrain from looking for a fair-trade alternative as they believe to be unable to find what they are looking for. Drawing from what the previous literature has indicated, the following three knowledge-related hypotheses are developed:

H3: The fewer seals for fair-trade fashion a person knows, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

H4: The fewer brands and retailers for fair-trade fashion a person knows, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

H5: The less a person knows about the existing range of products in the fair-trade fashion segment, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

5 Person-Related Factors

The decision to buy fair-trade clothing is very complex. Not only does it require an active assessment of one's ethical attitudes but also requires additional effort as fair-trade fashion is by far not as easily accessible as conventional clothing. The following paragraphs will present several inhibitors that are dependent on the individual consumer and his or her values, beliefs and social environment. Building on these, seven additional hypotheses are formulated.

The added value a customer receives from buying fair-trade apparel is only implicit as fair-trade clothing is not healthier or more durable than comparable mainstream products. Also, for most consumers hardly any gain can be drawn from wearing fair-trade fashion brands in front of others as these niche-market labels are rather unknown to society. As a result, a person's willingness to translate his or her positive attitude towards fair-trade fashion into purchasing behaviour is strongly influenced by person-specific factors that might either support or inhibit ethical purchasing.

Many consumers only start reflecting on their consumption behaviour when they are affected by the consequences of their action either directly or through empathic feelings (Bray et al. 2011; Carrigan and Attalla 2001). Thus, a person's inclination to buy socially responsible will depend on how intense he or she perceives the social problems in the apparel industry as a moral issue.

H6: The stronger a person's perception of moral intensity of the social issues in conventional clothing production, the more will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

Further, qualitative studies by Sudbury and Böltner (2011) as well as Pereira Heath and Chatzidakis (2012) have shown that research participants are quick to point to other players in the consumer goods industry when it comes to answering who is responsible for changing how clothing is made. This tendency to deny one's own role in this matter might explain why many consumers do not consider purchasing fair-trade clothing despite opposing to current production conditions. Additionally, Pereira Heath and Chatzidakis (2012) identified a low level of perceived self-efficacy, i.e., low perception of effectiveness to influence the environment and to change something (Bandura 1977), as a reason for the A-B gap. This individual character trait is defined as the degree to which a person believes that he or she is capable of adapting his or her own behaviour (see Gallagher 2012 for a description of the concept). This trait has previously been analysed with respect to consumer boycotting behaviour by Sen and Bhattacharya (2001). Their results hint at a positive relationship between high perceived self-efficacy and proactive ethical consumer behaviour.

H7: The greater a person's inclination to deny his or her responsibility for changing the precarious production conditions in clothing production, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

H8: The greater a person's perception of self-efficacy, the more will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

In some studies, consumers described feelings of hypocrisy, i.e., a dissonance of own believes and own actions, when being inconsistent concerning their choice between conventional and ethical products (Johnstone and Tan 2015; Szmigin et al. 2009). This need to either completely limit oneself to buying ethical products or to

consequently refrain from it is problematic for fair-trade fashion purchasing. As such apparel presents only a niche segment, it seems unrealistic that consumers will be able to completely refrain from buying conventional clothing. Hence:

H9: The more a person aspires to be consistent in the choice between fair-trade and conventional apparel, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

A large amount of research has established around the idea that ethical product claims can be understood as an additional product feature which consumers may or may not factor in when making a purchase. For apparel consumption, this means that aside from the production conditions of clothing, factors like price, design, quality and brand will influence the purchasing decision. Thus, one potentially relatively dominant reason for the attitude–behaviour gap may rest in ethical concerns that are trumped by more traditional purchasing criteria. This has been indicated for ethical consumerism in general (Papaoikonomou et al. 2011; Boulstridge and Carrigan 2000) and specifically concerning ethical fashion purchasing (Harris et al. 2016; Dickson 2005), leading to the following hypothesis.

H10: The more importance a person places on traditional purchasing criteria when purchasing fashion, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

Lastly, findings by Shaw and colleagues indicate that individuals' purchasing behaviour is strongly influenced by their social environment. Their focus on group-based studies revealed that some consumers are supported in their ethical apparel consumption by friends, family and colleagues while others are not (Shaw and Clarke 1999). For the latter, fair-trade fashion purchasing is devalued by their immediate social environment and sometimes even openly criticised (Shaw and Tomolillo 2004). Especially for young consumers, it is of great importance to wear clothing that is in line with social expectations. The inability to fulfil these expectations through buying fair-trade fashion places a significant burden on fashion-oriented, young consumers (Carrigan and Attalla 2001; Shaw et al. 2006). In addition, the fast fashion trend impressively shows the perceived need of individuals to constantly change their wardrobe which contradicts ethical apparel consumption (Sudbury and Böltner 2011). Thus, we argue:

H11: The less a person's social environment supports his or her intentions to buy fair-trade fashion, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

H12: The more fashion oriented a person is, the less will his or her positive attitudes towards fair-trade fashion translate into corresponding purchasing behaviour.

6 Method

An online survey of consumers was used to test the study hypotheses. Consumer surveys, though not free from criticism, allow for time- and cost-efficiency as well as complete anonymity of the participants which reduces socially desirable responding tendencies, a bias that is especially problematic in ethical consumption research (Auger and Devinney 2007). The survey was conducted in Germany and circulated in June–July 2017 via several social media platforms, and thus, the data set can be described as a volunteer sample.

In total, 498 complete datasets were obtained of which 447 were usable. The majority of respondents is female (79% of participants), has undergone higher education (92%), is 35 years old or younger (87%) and has a monthly disposable income lower than 1.300 € (75%). While this sample is not sufficiently representative of the general German population, it can be considered representative of an important consumer group for fashion retail as the market for women's fashion is typically larger than the men's or children's sector and young consumers represents the most important target group for fashion retailers (KPMG et al. 2015).

The survey-constructs were operationalised by making use of scales and items from previous research wherever possible. For most constructs, multiple rating scale items were used, and their internal consistency was assessed by calculating Cronbach's alpha values (Table 1). To ensure construct validity, all pre-existing items were adapted to pertain specifically to fair-trade fashion consumption. Still, not all Cronbach's alpha values obtained for the relevant constructs are satisfying.

Table 1 Construct operationalisation (table compiled by authors)

H	Construct	Description	Type	CA	Based on
1	Attitude towards fair-trade fashion	Measures the respondent's attitude towards fair-trade fashion	MIM	0.829	Chatzidakis et al. (2016), Pelsmacker and Janssens (2007) and new items
	Fair-trade fashion purchasing behaviour	Measures the actual purchasing behaviour of respondents concerning fair-trade fashion	Single item	–	Chatzidakis et al. (2016)
2	Awareness of social issues	Measures how well the respondent is informed about the social problems in conventional apparel production	MIM	0.717	Dickson (2001, 2016)
3	Knowledge about fair-trade seals for fashion	How many seals for fair-trade fashion does the respondent know?	MC	–	9 seals listed by German ministry of Economic Cooperation and Development
4	Knowledge about fair-trade fashion brands/retailers	How many retailers/brands for fair-trade fashion does the respondent know?	MC	–	List of 9 brands and 9 retailers (gathered via Google search)

(continued)

Table 1 (continued)

H	Construct	Description	Type	CA	Based on
5	Knowledge about existing range of fair-trade fashion	How knowledgeable is the respondent about the existing range of fair-trade fashion?	MIM	0.684	New items
6	Perceived moral intensity of social issues	How strongly does the respondent feel that the social issues in conventional apparel production are a moral concern?	MIM	0.714	Jones (1991) as in Singhapakdi et al. (1999) (5 of the 6 items were used)
7	Denial of responsibility	Measures the extent to which a respondent sees actors other than himself/herself responsible for the social issues in conventional clothing production	ROQ	–	Newly developed list of industry actors
8	Perceived self-efficacy	Measures the respondent's belief in his or her capability to change his or her behaviour	MIM	0.776	Beierlein et al. (2013)
9	Importance of consistency	How much importance does the respondent attribute to making a consistent decision for or against purchasing fair-trade fashion?	MIM	0.490	New items
10	Non-supportive social environment	How strongly does the respondent feel that his/her friends, colleagues and family oppose buying fair-trade fashion?	MIM	0.493	Chatzidakis et al. (2016) and new item
11	Fashion orientation	How much importance does the respondent place on being fashionable/wearing the "right" clothes?	MIM	0.650	New items
12	Importance of traditional purchasing criteria	How important is the fair-trade attribute in comparison with factors like quality or price when purchasing fashion?	ROQ	–	Newly developed list of product attributes

Note *H* hypothesis; *CA* Cronbach's alpha for standardised items; *MIM* multiple rating items; *MC* multiple-choice question; *ROQ* rank order question

Results below the 0.5 threshold were obtained in two cases, i.e., "importance of consistency" and "non-supportive social environment". However, following Wieland et al. (2017), critical items were not omitted based on their importance for construct validity. The remaining constructs were operationalised by making use of rank order and multiple-choice questions. Following the conceptual development of hypothesis 1, regression analysis was used to test the proposed relationship. For hypotheses H2–H12, interaction moderation analysis was conducted in order to

test the moderating influence of the potential inhibiting factors on the original relationship between individuals' attitudes towards fair-trade fashion and their respective purchasing behaviour (H1).

7 Results

This study lends further support to the existence of an A-B gap in fair-trade fashion purchasing. On the one hand, participants are very positive towards fair-trade fashion (Ø construct value = 4.23 on 5 pt. scale). On the other hand, only 6.5% of the respondents purchase such fashion on a regular basis. Interestingly, 76.7% of participants have at least bought fair-trade fashion once. Setting this value into relation to the marginal market share of below 1% for fair-trade fashion could point to a limitation in sample representativeness. Still, the A-B gap is clearly apparent, allowing for further analysis.

Results from the moderation analyses are given in Tables 2, 3 and 4. Significant interaction effects could not be found in any of the models tested, as the non-significant values for the multiplication term IV × MV indicate. This shows that the inhibitors tested in this model do not influence how the attitudes of a person towards fair-trade fashion are translated into purchasing behaviour. Therefore, only hypothesis 1 (H1) is supported while all moderation hypotheses H2 to H12 need to be rejected. The results question the applicability of moderator models for the analysis of the A-B gap in fair-trade fashion purchasing. However, as a step towards the interaction models, the direct influence of the constructs on fair-trade fashion buying behaviour was analysed, i.e., the inhibitor-constructs were added to the regression model as additional independent variables, as Fig. 2 depicts. Finding significant direct effects of the inhibitor-constructs on the dependent variable would indicate that these inhibiting factors change a person's purchasing behaviour independent from that person's attitude towards fair-trade fashion. The results gained thereby offer valuable insights and are thus presented in the following.

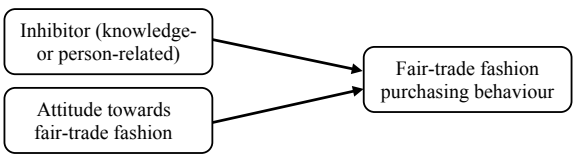

Fig. 2 Regression model with inhibitors as independent variables (authors' own figure)

7.1 Knowledge-Related Factors

The regression analysis for testing H2 did not yield any significant results. Construct values show, however, that consumers are aware of the social issues in conventional clothing production (Ø construct value = 3.6 on 5 pt. scale). Still, this awareness does not coincide with fair-trade fashion purchasing behaviour. Concerning H3, the results obtained show a significant positive correlation between individual knowledge about fair-trade seals for fashion and fair-trade fashion purchasing behaviour, as stated in Table 2. The best-known seal in this study was one that is also used for other consumer goods like fresh fruit. Thus, it seems that fair-trade fashion awareness is only part of a broader knowledge about the existence of fair-trade alternatives for consumer goods. Hence, further research should take a closer look at whether fair-trade fashion consumption is embedded in a more general inclination of consumers to opt for fair-trade alternatives in their purchasing behaviour.

The results of testing H5, i.e., the importance of a person's knowledge about the existing range of fair-trade fashion, support a similar argument. Again, a strong correlation between a person's knowledge about the existing range of fair-trade fashion and his or her purchasing behaviour is found. However, individuals can only make informed purchases if they are provided with all necessary information. In this study, 53.4% of respondents were unable to identify any brand or retailer for fair-trade fashion. Thus, most consumers are rather uninformed concerning this fashion alternative.

Table 2 Regression results of knowledge-related factors incl. moderating variables (table compiled by authors)

Variables entered	Awareness of social issues				Knowledge about fair-trade seals for fashion			
	β	R^2	ΔR^2	n	β	R^2	ΔR^2	n
IV	0.274***	0.075	–	446	0.274***	0.075	–	446
IV	0.262***	0.081	0.006	446	0.277***	0.146	0.071	446
MV	0.077				0.270***			
IV	0.267***	0.081	0.006	446	0.230***	0.146	0.071	446
MV	0.078				0.269***			
IV × MV	0.027				0.010			
Variables entered	Knowledge about fair-trade fashion retailers/brands				Knowledge about existing range of fair-trade fashion			
	β	R^2	ΔR^2	n	β	R^2	ΔR^2	n
IV	0.274***	0.075	–	446	0.274***	0.075	–	446
IV	0.179***	0.216	0.141	446	0.215***	0.206	0.131	446
MV	0.388***				0.366***			
IV	0.158***	0.220	0.145	446	0.219***	0.207	0.132	446
MV	0.423***				0.366***			
IV × MV	−0.071				0.032			

Note *IV* independent variable; *MV* moderating variable; β standardised coefficients
***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$

7.2 Person-Related Factors

The regression models for H6 and H7 did not produce any significant results. Hence, this research proposes that a person's fair-trade fashion consumption behaviour is not influenced by how intense he or she perceives the social issues in fashion production as a moral concern or by how much this person sees himself or herself responsible for bringing change to the situation. It is noteworthy, though, that consumers do in fact find themselves quite responsible (Ø rank position = 2.78 on 1–7 ranking), opposing to what other scholars have found (Pereira Heath and Chatzidakis 2012).

However, the second statement by these two scholars concerning the influence of an individual's perceived self-efficacy is supported. Regression results show a small positive effect. Thus, the more a person believes in his or her capability to make purchasing decisions for oneself, the more fair-trade clothing does that person buy.

Surprisingly, another positive relationship was found between a person's need for consistency in his or her choice between conventional and fair-trade clothing and that person's fashion purchasing behaviour; see Table 3 for regression results. It seems that the wish to choose consistently is not a hindering factor but instead a characteristic of fair-trade fashion consumers. This supports what other scholars have proposed: the ethical consumer exists and is willing to sacrifice by giving up old consumption habits to follow his or her ethical beliefs.

The regression analysis for testing the influence of the importance an individual assigns to traditional product attributes on his or her buying behaviour yields strong

Table 3 Regression results of person-related factors incl. moderating variables (table compiled by authors)

Variables entered	Perceived moral intensity				Denial of responsibility			
	β	R^2	ΔR^2	n	β	R^2	ΔR^2	n
IV	0.274***	0.075	–	446	0.274***	0.075	–	446
IV	0.286***	0.069	−0.006	282	0.278***	0.077	0.002	439
MV	−0.066				0.011			
IV	0.281***	0.070	−0.005	282	0.278***	0.077	0.002	439
MV	−0.069				0.013			
IV × MV	−0.013				0.017			
Variables entered	Perceived self-efficacy				Importance of consistency			
	β	R^2	ΔR^2	n	β	R^2	ΔR^2	n
IV	0.274***	0.075	–	446	0.274***	0.075	–	446
IV	0.272***	0.083	0.008	446	0.286***	0.137	0.062	406
MV	0.092*				0.218***			
IV	0.265***	0.085	0.010	446	0.280***	0.139	0.064	406
MV	0.097*				0.222***			
IV × MV	0.036				0.054			

Note *IV* independent variable; *MV* moderating variable; β standardised coefficients
***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$

Table 4 Regression results of person-related factors incl. moderating variables (cont'd) (table compiled by authors)

Variables entered	Importance of traditional purchasing criteria				Non-supportive social environment			
	β	R^2	ΔR^2	n	β	R^2	ΔR^2	n
IV	0.274***	0.075	–	446	0.274***	0.075	–	446
IV	0.166***	0.238	0.163	446	0.220***	0.261	0.186	271
MV	−0.418***				−0.407***			
IV	0.166***	0.238	0.163	446	0.236***	0.264	0.163	271
MV	−0.418***				−0.407***			
IV × MV	−0.001				−0.061			
Variables entered	Fashion orientation							
	β	R^2	ΔR^2	n				
IV	0.274***	0.075	–	446				
IV	0.269***	0.088	0.013	446				
MV	−0.116*							
IV	0.273***	0.089	0.014	446				
MV	−0.113*							
IV × MV	0.025							

Note *IV* independent variable; *MV* moderating variable; β standardised coefficients
***$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$

results. A direct effect is visible which triples more than the explanatory power of the overall model ($\Delta R^2 = 0.163$). This supports that for many participants traditional purchasing criteria do in fact outweigh ethical considerations.

For the last two direct effects tested, significant results were again found. While fashion orientation has a small negative impact ($\Delta R^2 = 0.013$), a person's social network plays a very dominant role in the development of fair-fashion purchasing behaviour ($\Delta R^2 = 0.186$). These results support the notion that the symbolic function of fashion is indeed a very important purchasing criterion (Carrigan and Attalla 2001; Sudbury and Böltner 2011). As fair-trade fashion is not well known and thus does only convey intended information about the wearer to a few ethically interested people, it cannot fulfil the same communicative needs as conventional brand clothing. A person's apparel consumption behaviour is, therefore, strongly dependent on his or her social environment which can either be supportive or inhibiting to fair-trade fashion purchasing behaviour depending on their own ethical consumption orientation.

8 Conclusion

The aim of this study was to further our understanding of the A-B gap by analysing eleven factors regarding their influence on individual fair-trade fashion purchasing behaviour. Making use of self-reports, the results of this study are prone to the

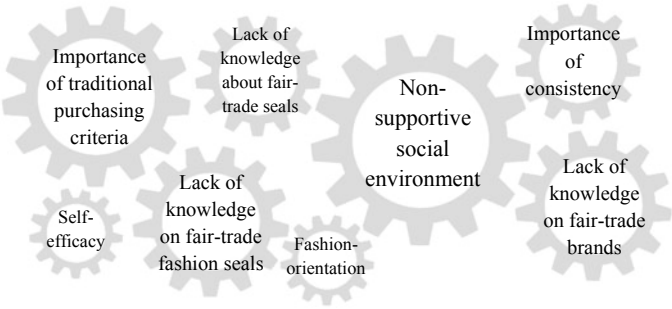

Fig. 3 Inhibitors to fair-fashion consumption (authors' own figure)

social desirability bias, i.e., the tendency of survey respondents do not give purely honest answers but those that are in line with societal expectations. This response distortion is seen as a major problem in studies on ethical consumption (Auger and Devinney 2007). However, allowing for complete anonymity by conducting the survey online is likely to have minimised this effect.

Young German consumers are highly aware of the social problems in the fashion industry. Despite this, fair-trade fashion has not yet made it onto their consumption agenda as purchasing such fashion happens rather sporadically or not at all. This study has identified several reasons for this—Fig. 3 depicts these hindering factors and their relative importance. General knowledge levels on the fair-trade fashion available are very low and thus inhibit a corresponding purchasing behaviour. Therefore, fair-trade fashion brands and retailers as well as other interested parties like non-governmental organisations or consumer activist groups should shift their work from creating awareness about the issue to making the existing alternatives better known. Only if opting for the fair-trade alternative is not seen as an unbearable limitation in choice, quality or price will ethical fashion find its way into the shopping bags of the everyday consumer. This is additionally supported by the finding that for fashion consumers traditional product criteria come first.

Secondly, as apparel consumption is strongly influenced by a person's association with his or her social network, fair-trade fashion retailers should consider this in their communication strategy. By creating a brand for their goods, they may increase the signalling effect that wearing this fashion will have on a person's social surrounding. In addition, findings indicate that fair-fashion consumers aim to stick with their alternative consumption strategy—once a consumer has made the conscious decision to buy fair-trade fashion, he or she will do so repeatedly. Such strong commitment of individuals presents a great opportunity for retailers of fair-trade fashion. As social influences play a paramount role in apparel purchasing decisions, committed consumers will be a strong influence on the fair-trade fashion buying behaviour of their social environment.

References

Andorfer, V. A., & Liebe, U. (2012). Research on fair-trade consumption—A review. *Journal of Business Ethics, 106*(4), 415–435.

Arnold, D. G., & Hartman, L. P. (2005). Beyond sweatshops. Positive deviancy and global labour practices. *Business Ethics: A European Review, 14*(3), 206–222.

Auger, P., & Devinney, T. M. (2007). Do what consumers say matter? The misalignment of preferences with unconstrained ethical intentions. *Journal of Business Ethics, 76*(4), 361–383.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215.

Beierlein, C., Kemper, C. J., Kovaleva, A., & Rammstedt, B. (2013). Short scale for measuring general self-efficacy beliefs (ASKU). *Methods, Data, Analyses, 7*(2), 251–278.

Boulstridge, E., & Carrigan, M. (2000). Do consumers really care about corporate responsibility? Highlighting the attitude-behaviour gap. *Journal of Communication Management, 4*(4), 355–368.

Bray, J., Johns, N., & Kilburn, D. (2011). An exploratory study into the factors impeding ethical consumption. *Journal of Business Ethics, 98*(4), 597–608.

Carrigan, M., & Attalla, A. (2001). The myth of the ethical consumer—Do ethics matter in purchase behaviour? *Journal of Consumer Marketing, 18*(7), 560–578.

Carrington, M. J., Neville, B. A., & Whitwell, G. J. (2010). Why ethical consumers don't walk their talk. Towards a framework for understanding the gap between the ethical purchase intentions and actual buying behaviour of ethically minded consumers. *Journal of Business Ethics, 97*(1), 139–158.

Center for International Development. (2018). Atlas of Economic Complexity. German Apparel Import 2016. http://atlas.cid.harvard.edu/explore/?country=61&partner=undefined&product=160&productClass=HS&startYear=undefined&target=Product&tradeDirection=import&year=2016. Last accessed January 28, 2019.

Chatzidakis, A., Hibbert, S., & Smith, A. P. (2007). Why people don't take their concerns about fair-trade to the supermarket. The role of neutralisation. *Journal of Business Ethics, 74*(1), 89–100.

Chatzidakis, A., Kastanakis, M., & Stathopoulou, A. (2016). Socio-cognitive determinants of consumers' support for the fair-trade movement. *Journal of Business Ethics, 133*(1), 95–109.

Crane, A., & Matten, D. (2010). *Business ethics: Managing corporate citizenship and sustainability in the age of globalization* (3rd ed.). Oxford: Oxford University Press.

de Pelsmacker, P., & Janssens, W. (2007). A model for fair-trade buying behaviour. The role of perceived quantity and quality of information and of product-specific attitudes. *Journal of Business Ethics, 75*(4), 361–380.

Dickson, M. (2005). Identifying and profiling apparel label users. In R. Harrison, D. S. Shaw, & T. Newholm (Eds.), *The ethical consumer* (pp. 155–171). Thousand Oaks, London: SAGE.

Dickson, M. A. (1999). US consumers' knowledge of and concern with apparel sweatshops. *Journal of Fashion Marketing and Management: An International Journal, 3*(1), 44–55.

Dickson, M. A. (2001). Utility of no sweat labels for apparel consumers. Profiling label users and predicting their purchases. *Journal of Consumer Affairs, 35*(1), 96–119.

Dickson, M. A. (2016). Personal values, beliefs, knowledge, and attitudes relating to intentions to purchase apparel from socially responsible businesses. *Clothing and Textiles Research Journal, 18*(1), 19–30.

Ferdows, K., Machuca, J. A. D., & Lewis, M. (2015). Zara: The world's largest fashion retailer, Case study (Reference no. 615-059-1).

Folkes, V., & Kamins, M. (1999). Effects of information about firms' ethical and unethical actions on consumers' attitudes. *Journal of Consumer Psychology, 8*(3), 243–259.

Gallagher, M. W. (2012). Self-efficacy. In V. S. Ramachandran (Ed.), *Encyclopedia of human behavior* (2nd ed., pp. 314–320). Oxford: Elsevier Academic Press.

German Federal Statistical Office [Destatis]. (2017). "Jahresstatistik im Handel - Unternehmen, Beschäftigte, Umsatz und weitere betriebs- und volkswirtschaftliche Kennzahlen im Handel. Deutschland, Jahre, Wirtschaftszweige. https://www-genesis.destatis.de/genesis/online/data;jsessionid=9AE832BE1FC5DF5360C6A28BD2E8FFC4.tomcat_GO_1_1?operation=abruftabelleAbrufen&selectionname=45341-0001&levelindex=1&levelid=1503423746603&index=1. Last accessed August 22, 2017.

Harris, F., Roby, H., & Dibb, S. (2016). Sustainable clothing. Challenges, barriers and interventions for encouraging more sustainable consumer behaviour. *International Journal of Consumer Studies, 40*(3), 309–318.

Hassan, L. M., Shiu, E., & Shaw, D. (2016). Who says there is an intention-behaviour gap? Assessing the empirical evidence of an intention-behaviour gap in ethical consumption. *Journal of Business Ethics, 136*(2), 219–236.

Ingram, R., Skinner, S. J., & Taylor, V. A. (2005). 'Consumers' evaluation of unethical marketing behaviors. The role of customer commitment'. *Journal of Business Ethics, 62*(3), 237–252.

Jägel, T., Keeling, K., Reppel, A., & Gruber, T. (2012). Individual values and motivational complexities in ethical clothing consumption. A means-end approach. *Journal of Marketing Management, 28*(3–4), 373–396.

Joergens, C. (2006). Ethical fashion. Myth or future trend? *Journal of Fashion Marketing and Management: An International Journal, 10*(3), 360–371.

Johnstone, M.-L., & Tan, L. P. (2015). Exploring the gap between consumers' green rhetoric and purchasing behaviour. *Journal of Business Ethics, 132*(2), 311–328.

Jones, T. M. (1991). Ethical decision making by individuals in organizations. An issue-contingent model. *The Academy of Management Review, 16*(2), 366.

KPMG, IFH, & BTE. (2015). Fashion 2025—Studie zur Zukunft des Fashion-Markts in Deutschland. http://www.mitteldeutschland.com/sites/default/files/uploads/2016/01/28/kpmgfashion2025-studiezurzunkunftdesfashion-marktsindeutschland.pdf. Last accessed August 14, 2017.

Lu, L.-C., Chang, H.-H., & Chang, A. (2015). Consumer personality and green buying intention. The mediate role of consumer ethical beliefs. *Journal of Business Ethics, 127*(1), 205–219.

Niinimäki, K. (2010). Eco-clothing, consumer identity and ideology. *Sustainable Development, 18*(3), 150–162.

Papaoikonomou, E., Ryan, G., & Ginieis, M. (2011). Towards a holistic approach of the attitude behaviour gap in ethical consumer behaviours. Empirical evidence from Spain. *International Advances in Economic Research, 17*(1), 77–88.

Pereira Heath, M. T., & Chatzidakis, A. (2012). 'Blame it on marketing'. Consumers' views on unsustainable consumption. *International Journal of Consumer Studies, 36*(6), 656–667.

Rode, J., Hogarth, R. M., & Le Menestrel, M. (2008). Ethical differentiation and market behavior. An experimental approach. *Journal of Economic Behavior & Organization, 66*(2), 265–280.

Sen, S., & Bhattacharya, C. B. (2001). Does doing good always lead to doing better? Consumer reactions to corporate social responsibility. *Journal of Marketing Research, 38*(2), 225–243.

Shaw, D., & Clarke, I. (1999). Belief formation in ethical consumer groups. An exploratory study. *Marketing Intelligence & Planning, 17*(2), 109–120.

Shaw, D., Hogg, G., Wilson, E., Shiu, E., & Hassan, L. (2006). Fashion victim. The impact of fair-trade concerns on clothing choice. *Journal of Strategic Marketing, 14*(4), 427–440.

Shaw, D., Shiu, E., Hassan, L., Bekin, C., & Hogg, G. (2007). Intending to be ethical. An examination of consumer choice in sweatshop avoidance. *Advances in Consumer Research, 34,* 31–38.

Shaw, D., & Tomolillo, D. (2004). Undressing the ethical issues in fashion. A consumer perspective. In M. Bruce, C. Moore, & G. Birtwistle (Eds.), *International retail marketing: A case study approach* (1 Aufl., pp. 141–154). s.l.: Elsevier Professional.

Singhapakdi, A., Vitell, S. J., & Franke, G. R. (1999). Antecedents, consequences, and mediating effects of perceived moral intensity and personal moral philosophies. *Journal of the Academy of Marketing Science, 27*(1), 19–36.

Sudbury, L., & Böltner, S. (2011). Fashion marketing and the ethical movement versus individualist consumption. Analyzing the attitude behaviour gap. *European Advances in Consumer Research, 9,* 163–168.

Szmigin, I., Carrigan, M., & McEachern, M. G. (2009). The conscious consumer. Taking a flexible approach to ethical behaviour. *International Journal of Consumer Studies, 33*(2), 224–231.

TransFair e.V. (2016). Wandel durch Handel - Jahres- und Wirkungsbericht 2015/16. https://www.fairtrade-deutschland.de/fileadmin/DE/newsimport/Presse2016/2016_pressemappe_jahres_pk/transfair_jahres_wirkungsbericht_2015_2016.pdf. Last accessed August 21, 2017.

Wieland, A., Durach, C. F., Kembro, J., & Treiblmaier, H. (2017). Statistical and judgmental criteria for scale purification. *Supply Chain Management: An International Journal, 22*(4), 321–328.

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Reframing Buyer–Supplier Relationships: Deep, Sticky, Transient and Gracious

Yusoon Kim and Thomas Choi

For many buying firms, how to effectively manage the multitude of suppliers remains an important and challenging agenda. The existing body of literature offers buyer–supplier relationship typologies that are straightforward and easy to apply in practice. Among those, the most prevalent classification scheme for buyer–supplier relationships may be the cooperative–adversarial dichotomy (Carter et al. 1998; MacDuffie and Helper 2003; Monczka et al. 1998).

The conventional wisdom says that a cooperative relationship is synonymous with closely tied partnership, and an adversarial relationship is equated with arm's length transaction (e.g., Jap 1999; Wilson 1995). Building on this literature, we submit that today's complex landscape of buyer–supplier relationships calls for an expanded typology of buyer–supplier relationships. In today's hypercompetitive and fast-shifting business environments, companies employ more subtle and sophisticated strategies in navigating their external relations. For example, just because two companies, as a buyer and a supplier, seem to maintain a cooperative relationship does not necessarily mean that they are closely coupled in their operations. Likewise, a pair of highly interdependent buyer and supplier may not necessarily hold a positive attitude toward each other. We see similar patterns in individual-level relationships; two people working together all the time do not necessarily have a cooperative relationship. Perhaps, as in a bad marriage, two people can be operationally tied together, while harboring grudges against each other.

As we explain in this chapter, in buyer–supplier relational settings, a cooperative and adversarial relationship is really *different* from a closely tied and arm's length

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relationship, respectively. To put it differently, there are two distinctive relational aspects that come into play in combination in or within a firm's strategies and actions toward its external partners. Theoretically, the aforesaid cooperative–adversarial dichotomy model is limited to capturing just what we describe as "*relational posture"* in buyer–supplier relationships. To expand the prevailing framework, we put forth and incorporate another intrinsically different relational aspect—what we label as "*relational intensity*." Consequently, in our expanded relationship typology framework, as depicted in Fig. 1, we consider concurrently two theoretically distinct relational dimensions: *relational posture* and *relational intensity*. In an earlier article published in the *Journal of Supply Chain Management*, we offer an analytical demonstration of the orthogonality of the two relationship dimensions (Kim and Choi 2015).

The relational posture (i.e., cooperative–adversarial) dimension, building on the conventional typology, captures two relational parties' affective attitudes and behavioral motives toward each other (Dyer and Singh 1998; Johnston et al. 2004). The newly added relational intensity (i.e., closely tied—arm's length) dimension addresses interfirm operational coupling and transactional volumes. That is, it reflects the degree of economic interdependence between two exchange partners (Dyer and Nobeoka 2000; Hinings et al. 2003). Our expanded relationship typology as such integrates the two theoretically non-overlapping dyadic dimensions with different

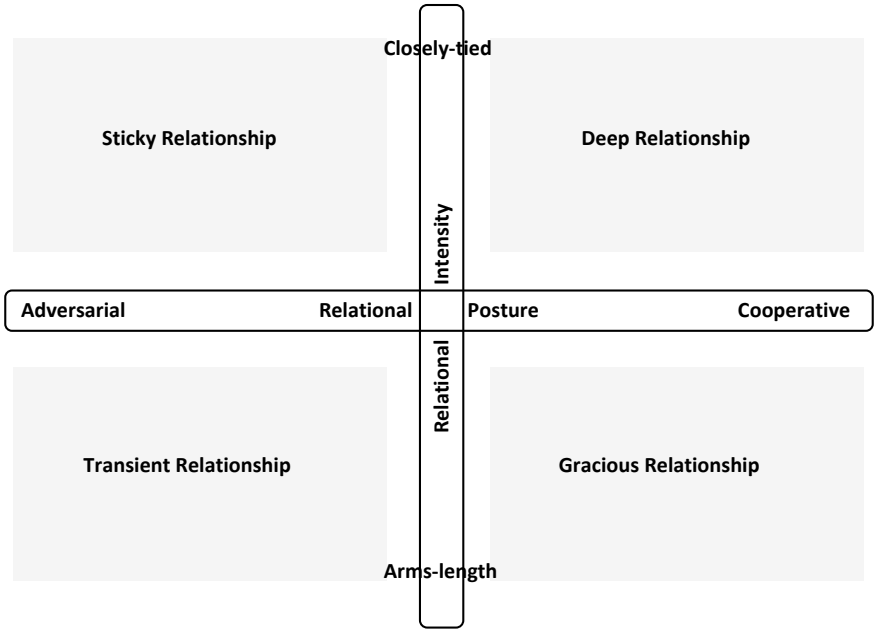

Fig. 1 Expanded buyer–supplier relationship typology (Kim and Choi 2015). *Notes* Reprinted from Kim and Choi, *Journal of Supply Chain Management*, 51, 61–86 (2015)

anchors, therefore yielding four archetypes of buyer–supplier relationship—*deep*, *sticky*, *transient* and *gracious* (Kim and Choi 2015).

The four archetypes embody different combinations of relational posture and intensity as discussed in the preceding paragraph. Each relationship type is unique and provides different strategic and managerial implications. In what follows, we provide a more detailed discussion of each of these four archetypes. In characterizing each, we highlight both the positive and negative relational effects. We will also illustrate pertinent real-world examples from a field research conducted by the authors. While these archetypes have been published in Kim and Choi (2015), these illustrative examples have not been published previously.

1 Deep Buyer–Supplier Relationship

In a *deep* type of buyer–supplier relationship, the two exchange partners are closely synchronized in their everyday operations, usually via specialized interfirm interfaces, and remain highly responsive and accommodating to each other (e.g., JIT manufacturing). Consequently, this type is characterized by efficient interfirm communications and well-coordinated production. Since both parties typically have a significant portion of their resources dedicated to the relation, they become strongly interdependent on each other, both operationally and strategically.

This type of buyer–supplier relationship has been well documented in the literature. In a field study we conducted with an automotive original equipment manufacturer (OEM) and its supply base, we observed several deep buyer–supplier relationships. For instance, a power-train system supplier has been working for this OEM for about five decades. According to a VP from the supplier, the two companies would work closely together on various business fronts—from daily operations to long-term product planning and market strategies. This supplier's level of economic dependence on this buyer is as such quite high—more than half of its annual sales come from this OEM. The supplier would even develop new buyer-specific technologies. As such, the buyer is also heavily reliant on this relationship for the quality and safety of their final products.

Another example of this deep relationship type comes from a seating system parts supplier. For this firm, the OEM is among the biggest buyers in terms of sales volume. From a strategic standpoint, the OEM is perhaps the most important partner—the two firms collaborate on various business aspects, and thus, as this supplier acknowledges, their joint discussions and ideas have a significant impact on how the supplier executes daily operations as well as its longer term plans. Over the course of relation, they have built a deep mutual understanding of the technical standards and operational procedures the buyer had prescribed, particularly for problem solving, which has now become part of the key management principles this supplier had internalized. The supplier has developed high respect and trust in the buying firm. A VP of this supplier quipped, "Our relationship is deep and wide, and we will never shut each other down."

This type of relationship typically goes deeper than formal relational contracts. The benefits of such a relationship may range from the orderly material flows to consistent product quality and lead time to the elimination of unnecessary transaction costs (Helper 1990; Sako and Helper 1998). Overall, by minimizing uncertainty and maximizing efficiency of interfirm interactions, this deep type can ensure relational stability. Both exchange parties would refrain from exploiting each other's goodwill and keep cooperating with each other. It would be in their best interest not to jeopardize the relationship. In that regard, at the individual relationship level, this deep type may be likened to a relationship between two close colleagues who have been working together for a long time. They understand each other and can efficiently work together when given a new project. The setup cost for taking on a new project would be comparatively low.

However, in our field study, we also observed some downsides of this type of buyer–supplier arrangement. In particular, two parties in such a relationship tend to, wittingly or unwittingly, stick to their mutually familiar ways of doing things when dealing with matters in their relation; that is, they can suffer from relational lock-in or what we might call over-embeddedness symptoms. Such two parties are highly embedded within and reluctant to deviate from "the ways things work." An unproductive facet of such tendency is the parties' complacency with the status quo and resistance to changes. Consequently, the buyer might complain that the supplier would appear to be increasingly rigid and set in its way. And of course, the supplier might say something similar as well.

2 Sticky Buyer–Supplier Relationship

In a *sticky* type of relationship, the buyer and supplier regard each other in essence as a necessary evil. On the one hand, both parties have invested, to some extent, in their relationship and their operations are closely interwoven. On the other hand, this relational type usually involves contractual disparities. A buyer can impose undue demands on the long-term supplier (Mudambi and Helper 1998). Typically, the more powerful party is interested in boosting transactional efficiency at the expense of the weaker party—for instance, the buyer may force the supplier into capital investments (e.g., vendor-managed inventory) to streamline the sourcing process or mandate aggressive cost reduction and quality improvement programs. The supplier may grudgingly comply, while it looks for opportunities to get back at the buyer. At the individual level, this sticky type of relationship bears resemblance to that between an autocratic boss and a subordinate, who is grappling with the top-down style of the boss. They are supposed to meet regularly and work together closely. However, in private, they may not like each other and wish to end their relationship.

In our field study, we observed this type of buyer–supplier arrangement from the automotive OEM's relation with a brake system supplier. Their business relationship, although long term (dating back to the mid-1980s), has been periodically

punctuated by multiple different programs. Each time a new program was kicked off, two firms re-negotiated their contracts, which required some capital investments mostly from the supplier's part. Meanwhile, the buyer has maintained a multiple-sourcing policy on the related products, keeping the supplier under competitive pressure. Further, over the course of time, there had been several trust-breaching events, where the supplier was used just as a benchmark for the buyer's pre-development and was not given a fair chance for new businesses. The supplier has since stayed wary whenever requested by the buyer for any extra work beyond what their contract stipulates. Their position was guarded—they took extra steps to check if it is a real opportunity or just a market study for the buyer. As one sales director put it, "the learning curve (in this relation) has been extremely painful."

Another example involves an abrasive insulation parts supplier of the OEM. Since the early 1980s when their business relation first began, this OEM has grown to be one of the biggest accounts for this supplier (accounting for 10–15% of its sales for the related products). At the same time, as the supplier had made specific investments over time, it found itself increasingly embedded in this relation. The firm now supplies almost every product line of this auto OEM. Even so, the supplier remains unsure if the buyer thinks the same way about their relation. This OEM, according to the interviews with the supplier, seems to view this business tie just as expendable. One manager of this supplier noted, whenever a new product idea or prototype came along, they would run it by the buyer, but, for the most part, they only got a lukewarm response. This buyer seems to act, according to these people, as if it knows exactly how to play the supplier. Also, over the course of relation, the supplier has experienced overall relational inequity, particularly when it came to their contracts. "According to the contract, even if something goes wrong in this relation, they (the OEM) would not be held accountable at all for almost anything," said the account director of this supplier.

In such a sticky relationship, typically the more powerful party would turn to adversarial tactics to appropriate a greater share of any extra profits (i.e., relational rents). In an extreme case, the buyer may audit the supplier to prevent it from earning excessive profits and to re-allocate the created relational rents disproportionately in its favor (Yli-Renko et al. 2001). Since such actions would necessarily invite pushbacks from the weaker party, the dominant one would frequently engage in a power play, as opposed to negotiations. The weaker, nonetheless, rather than readily surrendering, would likely attempt to get even in covert ways, for instance, by purposefully withholding critical parts and information or deviating from prescribed quality procedures. As such, this sticky type of relation does not always benefit the power-advantaged party; it can make the party vulnerable to the partner opportunism. The power-disadvantaged party, with intimate knowledge of the other party's needs, can effectively engage in covert retaliation. This relationship type can potentially cause a vicious cycle of vengeful opportunism.

3 Transient Buyer–Supplier Relationship

In a *transient* buyer–supplier relationship, the two parties' business engagement is largely on the basis of their short-term preferences. That is, it is aimed at meeting each other's expediency and matching business requirements. Both parties would have alternative business options and are typically clear about how they should interact in their relation. The dealings, mostly based on discrete contracts, are usually struck via competitive tendering and aggressive price negotiations. They relate to each other with little motivation and forward thinking for meaningful joint activities (Anand and Ward 2004). Instead, they adhere to contractual terms, leaving open competitive markets as the recourse in case their relation fails. Consequently, it is largely confrontational or, at best, indifferent. This transient type of relationship may parallel the spot exchanges in such markets as a farmers' market or Craigslist between basically "unknowns" or just "acquaintances." Both parties may repeat transactions irregularly or on an ad hoc basis, while they continue to take a suspicious and vigilant stance toward each other due to a lack of or just marginal levels of knowledge about each other's personal traits and history, and unpredictability about each other's future behavior.

In our field research, one example comes from a suspension system parts supplier. Fundamentally, this supplier never felt secure in its relation with the OEM. Since starting its business tie with the OEM in the early 2000s, the supplier has been kept under pressure to survive every year the buyer's supplier evaluation to remain among its sourcing options, while the buyer continued to look out for other potential sources. Per their formal contract, the buyer did not allow any negotiations on commercial matters, such as product prices and any transaction-related surcharges. Despite the supplier's persistent call for fairer terms, whenever such an issue gets on the table, the buyer would have the final say. Nonetheless, this supplier seemed not as much concerned with such rather harsh working relationship. For this supplier, its business tie with the OEM was not economically crucial. A sales manager of the supplier said, "We can survive without them [the OEM]." They held a view that their relationship with this OEM can go sour anytime. What they focused on in this relationship was making sure they did not get shortchanged.

Another example is the OEM's relation with a multimedia systems' supplier (radios, amplifiers, navigation, etc.). This supplier custom makes products based on the buyer's particular design and product requirements. Even so, the two companies were not closely tied from an operational standpoint. The orders typically came for limited product lines and in small volumes/batches only. Most of the commissioned work did not require any specific investments on the supplier part and could be fulfilled using its existing capabilities. Due to the purely transactional nature of the business tie, the buyer tended to impose and work on their own preferred schedules, with almost no intent to negotiate timelines for planning, pilot testing, system implementation and so forth. As a result, the two firms frequently disputed over those issues. However, for the most part, the supplier had a limited voice and

influence on the entire sourcing process. Moreover, the buyer occasionally forced the supplier into joint works with other firms (i.e., other suppliers) to its advantage.

In general, two firms in a transient relationship would likely have only a casual understanding of each other's business strategies, needs and internal operations. Consequently, such relational tie would experience high ambiguity when facing partner behavior. Even so, this relational type may afford some strategic advantages for the buying firm, particularly in terms of problem solving. The supplier, having been kept at bay from the buyer, is most likely to have had exposure to a variety of encounters and perspectives through its conceivably broad business connections (Stam and Elfring 2008). Consequently, the supplier would likely become relatively adaptable when facing various problem situations, rather than tending to keep to a particular course of action (Volberda 1996; Zahra and Filatotchev 2004). By tapping a wide array of opinions through this type of relation, the buyer would be better able to deal with changing rules of business competition and potentially become more resilient in the long run.

4 Gracious Buyer–Supplier Relationship

In a *gracious* type relationship, the buyer and supplier do not work intensively together but hold each other in high regard and in goodwill. Their business deals are struck only periodically and each in short term, but they tend to occur endearingly and collaboratively. The supplier in such a tie is typically resourceful and technologically independent, having diversified offerings and a balanced customer base. In general, both parties retain autonomy in their respective operations while remaining amicable and courteous toward each other. Such posture from both firms is typically calculated considering the shadow of the future in anticipation of greater benefits than what the current state can bring. This gracious type may be akin to an individual-level relationship involving two neighbors living in the same cul-de-sac and staying friendly to each other. They share little in common other than they live in the same neighborhood. As different needs arise, the two can help each other resorting to their own respective expertise. Perhaps one is in health care and the other is in construction.

Some examples surfaced in our field research. Notably, there is a supplier with specialty in filming technology, which had been working for the OEM since the early 2000s. For this supplier, this OEM is essentially not a major customer. Also, their working relation had been primarily based on intermittent project-based contracts. Nonetheless, the OEM kept this supplier in high regard. The supplier owned a proprietary technology, called hydro-graphics, which was rather peripheral to the functioning of the final product, but affected the finish of the product that came in contact with the consumers. Further, due to the technology's applicability potential, the supplier created a diverse customer base, spanning many different industry sectors. Accordingly, this OEM had little operational control and relational leverage. At the same time, this supplier valued this relation because working with a

reputable global OEM would lend credibility to its reputation and possibly open up other opportunities down the road.

Another example is an electric air pump supplier. As with the preceding case, for both firms, the other was not a major business partner. This supplier was not the biggest source for the buyer in terms of total annual purchases. However, this was not because the supplier is less reliable or competent, but rather in large part due to the supplier's corporate-level strategic priority for a balanced customer base. This supplier deliberately refrained from being occupied for its time and resources by any single customer. They believed that having a well-blended group of strong customers would help nurture the creation of varied perspectives and capabilities, not to mention minimizing the risks involved in R&D activities. In fact, this supplier had often utilized its diversified customer base as a test bed for a new technology or product idea, and this was how it had recouped its R&D expenditures. As the supplier's plant manager put it, "We can afford to take a chance on innovations." Apparently, this supplier was "not a cost leader," as one purchasing manager of the auto OEM said, since this supplier pursued only profitable products. Its technological acumen spoke volumes about why the buyer valued this relation. "We've learned something useful from them," added a purchasing manager from the OEM. Also, a director of the supplier remarked that in their relationship so far, some lucrative synergies had been realized through inter-divisional collaborations between the two firms.

In a gracious buyer–supplier relationship, neither party is strongly reliant on the other from the operational standpoint. Both parties would rather remain in a holding pattern to see if their business tie would pay off in any foreseeable future. For the buyer, this type of supplier tie may be the most favorable setting for realizing breakthrough innovations. The relation's arm's length nature increases the likelihood of the supplier having an exposure to otherwise far-flung resources or business circles (Rosenkopf and Nerkar 2001). Further, the party's inherent resourcefulness may translate into its vigorous engagement in exploration and boundary-spanning activities outside the focal tie (Fleming et al. 2007). That is, the supplier holds enough potential to serve as a conduit for novel ideas and non-overlapping information. This relationship type will benefit the supplier too. A positive tie to a reputable manufacturing firm can be a springboard for broadening its horizons beyond its current business spheres. At the individual level, such a relationship can promise similar effects. Often, we tend to hear and access novel ideas or new opportunities from our neighbors who are in unrelated lines of work.

5 Discussion

Our goal in this chapter is to take us beyond the conventional wisdom that close, collaborative business relationships are good, whereas arm's length, adversarial relationships are bad. For almost every company, managing its relationship with its partner, be it supplier or buyer, is an essential part of the ongoing business process

and management strategy. Particularly, buyer–supplier relationships almost invariably involve conflicts of interest and require careful strategic considerations and actions. Two parties in such an arrangement, however long and closely working together, remain self-seeking and tending toward their own profits. In general, firms on the supplier side have to navigate a set of different—often disagreeing—demands of their diverse customers. Firms on the buyer side need to find a balance between building a deep relationship with their individual suppliers and being mindful of the competitive landscape among them.

There is no single, ideal way to manage buyer–supplier relationships. Building a "deep" type of relationship, for example, may work in some cases but not in others. As noted, for instance, a deep type can offer stability but it also generates rigidity in the relationship. Each of the archetypes in our expanded relationship topology has its own pros and cons when it comes to relational outcomes. Thus, for the buyer, having an adequate understanding of potential benefits and pitfalls for each possible relationship type is of strategic importance, particularly in terms of creating a balanced supplier portfolio. For companies to successfully manage the intricacies of such relationships, first and foremost, they should be able to effectively discern and classify their various relationships. In this chapter, we discuss two relational dimensions—posture and intensity—to use as two normative yardsticks against which to assess each relationship. Making sense of how the two relational aspects play out both individually and in combination would help firms to make better and more reasonable predictions as to what a given specific relationship can do now and how it might unfold down the line.

We also note that every socio-economic relationship changes or evolves over time, and of course, various buyer–supplier relationships are no exception. As a buyer and supplier continue to face and cope with shifting expectations and conditions in their respective markets or industries, both parties would be compelled to consider and make changes to their existing relationship. However, as noted, the proposed relationship typologies in our framework represent essentially archetypes—in other words, under relatively stable environmental conditions, a given particular buyer–supplier arrangement would tend toward one of those relational states and stay steady in the particular state. However, this also implies that under certain industry landscape changing conditions or individual firms' pressing strategic needs, firms would have to adjust their existing relations. Understanding such conditions is beyond the scope of our focus in this chapter, but what may trigger a shift of relationship types is an intriguing question and worth exploring.

Further, at a casual glance, the four relationship archetypes in our framework may be associated with different material or sourcing categories. However, we argue otherwise. We submit that the individual archetypes do not necessarily dovetail with any particular material or sourcing attributes. Although the relational intensity dimension in our framework appears to connect, to some degree, to sourcing type or material nature, it is merely one of the many factors that would affect the dimension. For instance, as indicated previously in the illustrated cases for the sticky type, brake systems are in general considered highly critical for consumer safety, whereas abrasive insulation parts, while falling in the same archetype, do not

seem to be as much critical from the buyer's standpoint. Also, while both suspension system parts and multimedia systems are quite important in determining driving comfort and consumer satisfaction for cars, the related suppliers were both classified to be in a transient relation with the OEM. That is, there are many other factors affecting the overall characteristics of a given buyer–supplier relationship, other than the nature of the involved materials.

Using the expanded relationship typology we put forth here in the buyer–supplier relationship context (Kim and Choi 2015), buying companies can have a more holistic view of their supplier portfolio. Specifically, through more effectively categorizing the full spectrum of supplier relations, they can assess individual supplier's merits and risks in a more realistic way and potentially better manage their entire supply bases and extended networks.

References

Anand, G., & Ward, P. T. (2004). Fit, flexibility and performance in manufacturing: Coping with dynamic environments. *Production and Operations Management, 13*(4), 369–385.

Carter, J. R., Smeltzer, L., & Narasimhan, R. (1998). The role of buyer and supplier relationships in integrating TQM through the supply chain. *European Journal of Purchasing and Supply Management, 4*(4), 223–234.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The LJA case. *Strategic Management Journal, 21,* 345–367.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660–679.

Fleming, L., Mingo, S., & Chen, D. (2007). Collaborative brokerage, generative creativity, and creative success. *Administrative Science Quarterly, 52*(3), 443–475.

Helper, S. (1990). Comparative supplier relations in the US and Japanese auto industries. *Business and Economic History*, (19:2nd series), pp. 153–162.

Hinings, C. R., Casebeer, A., Reay, T., Golden-Biddle, K., Pablo, A., & Greenwood, R. (2003). Regionalizing healthcare in Alberta: Legislated change, uncertainty and loose coupling. *British Journal of Management, 14,* S15–S30.

Jap, S. D. (1999). Pie-expansion efforts: Collaboration processes in buyer-supplier relationships. *Journal of Marketing Research, 36*(4), 461–475.

Johnston, D. A., McCutcheon, D. M., Stuart, F. I., & Kerwood, H. (2004). Effects of supplier trust on performance of cooperative supplier relationships. *Journal of Operations Management, 22*(5), 23–38.

Kim, Y., & Choi, T. Y. (2015). Deep, sticky, transient, and gracious: An expanded buyer–supplier relationship typology. *Journal of Supply Chain Management, 51*(3), 61–86.

MacDuffie, J. P., & Helper, S. (2003). B2B and mode of exchange: Evolutionary and transformative effects. In B. Kogut (Ed.), *The Global Internet Economy*. Cambridge, MA: MIT Press.

Monczka, R. M., Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (1998). Success factors in strategic supplier alliances: The buying company perspective. *Decision Sciences, 29*(3), 553–577.

Mudambi, R., & Helper, S. (1998). The "Close but Adversarial" model of supplier relations in the US auto industry. *Strategic Management Journal, 19*(8), 775–792.

Rosenkopf, L., & Nerkar, A. (2001). Beyond local search: Boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal, 22*(4), 287–306.

Sako, M., & Helper, S. (1998). Determinants of trust in supplier relations: Evidence from the automotive industry in Japan and the United States. *Journal of Economic Behavior and Organization, 34*(3), 387–417.

Stam, W., & Elfring, T. (2008). Entrepreneurial orientation and new venture performance: The moderating role of intra- and extra-industry social capital. *Academy of Management Journal, 51*(1), 97–111.

Volberda, H. W. (1996). Toward the flexible form: How to remain vital in hypercompetitive environments. *Organization Science, 7*(4), 359–374.

Wilson, D. T. (1995). An integrated model of buyer-seller relationships. *Journal of the Academy of Marketing Science, 23*(4), 335–345.

Yli-Renko, H., Autio, E., & Sapienza, H. J. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal, 22*(6–7), 587–613.

Zahra, S. A., & Filatotchev, I. (2004). Governance of the entrepreneurial threshold firm: A knowledge-based perspective. *Journal of Management Studies, 41*(5), 885–897.

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Innovation Scouting: A New Challenge for the Purchasing Function

Richard Calvi, Matti Pihlajamaa, and Romaric Servajean-Hilst

For much of the twentieth century, technological innovation was defined as a vertically integrated process (Chandler 1977; Freeman 1982). These last decades have been marked, in many industrial sectors, by three movements whose combined effects generate some paradoxes in innovation management: (a) the tendency to focus only on the core business activities and outsource the others,[1] (b) the growing complexity of products, particularly, in the number of integrated technologies, and finally, (c) an ever-greater expectation for innovation in terms of intensity and rhythm in order to reach a sustainable competitive advantage.

The paradox is that many companies are forced to innovate a lot and quickly in markets where the products depend mainly on external technologies purchased from partners that are potentially also working with all of their competitors and sometimes being themselves competitors as well. This increasing dependence on external sources of technology was first reported by the study of Roberts in 2001. Based on an extended data collection from the largest performing companies in

[1]For example, in the French automotive sector, the INSEE annual study (2017) reports a decrease of the value-added rate ([turnover—purchasing]/ turnover) from 34.5% in 1977 to 14% in 2017. It means that for the car manufacturers, the amount of external contribution represents 86% of the turnover.

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North America, Western Europe, and Japan, the research pointed out that the percentage of companies declaring relying heavily upon external sources of technology has jumped from 20% in 1992 to 80% in 2001 (Roberts 2001).

A theorization of this movement is proposed by Chesbrough in 2003 under the general banner of "open innovation." Basically, this theory suggests that it is often beneficial for firms to collaborate with others in developing and commercializing innovations (Felin and Zenger 2014). The positive effect of the *openness* attitude on innovation performance is now well established (Cassiman and Veugelers 2006; West and Bogers 2014). Among the potential external partners for innovation, suppliers have gained a lot of attention (Brem and Tidd 2012; Pihlajamaa et al. 2017; Sjoerdsma and van Weele 2015), and even sometimes found as the most important open innovation partners (Laursen and Salter 2006; Un et al. 2010).

Few academics look at the problem from the supplier side. For example, Henke and Zhang (2010) give a comprehensive vision of the enabling factors of supplier innovation. As the purchasing function is the legitimate interface between the client and its supply base (Araujo et al. 1999), researchers have also investigated the role of this function in innovation sourcing (Schiele 2010; Luzzini and Ronchi 2011; Luzzini et al. 2015; Homfeldt et al. 2017; Servajean-Hilst and Calvi 2018; Gualandris et al. 2018). However, in practice, tapping or exploiting innovation from suppliers is far from being a well-established process.[2]

In this chapter, we investigate how a purchasing function can effectively contribute to innovation sourcing. We make a twofold contribution. First, we provide an evolutionary perspective of the purchasing function facing the challenge of acting in the offer creation process of the firm (1§). Second, we focus on an important activity that the purchasing function has to perform: the scouting of innovations (2§).

1 An Evolutionary Vision of the Role of the Purchasing Function in Offer Creation Process (OCP)

The question of the possible role of buyers in the OCP[3] arose in the academic discussion in the early 1980s. We can quote Burt and Soukup (1985) as the first academics trying to point out what they call the *new role* of purchasing in a modern design process: purchasing provides a window to new components that the suppliers have developed, gives information about the cost, performance, and market availability of the targeted components. They advocate for a formal implication of

[2]For example, in their *procurement executive study* (2016), The Hackett Group report that for Chief Purchasing Officers, among the five most important actual issues of procurement, to *"tap supplier innovation"* is the one for which they declare to have the lowest ability to address.

[3]The **o**ffer **c**reation **p**rocess refers to all activities from the opening phase of a new product development project to the launch of this product. This acronym was originally coined by Schneider Electric Company in order to identify all the activities linked to generation of new products or services.

the purchasing function in the early stages of new product development (NPD) process.

Nevertheless, more than 30 years later, it is clear that for many companies the challenge of organizing the purchasing function in order to influence the OCP is not over. And even more so, the purchasing function's involvement is sometimes even considered counterproductive for innovation (Chesbrough and Euchner 2011).

Schiele (2010) gives an interesting explanation about the difficulties to align the purchasing function with NPD objectives. He points out the dual *innovation* and *cost-oriented* role of purchasing. The life cycle perspective of purchasing differs in key aspects from a purely R&D-oriented view of NPD. For instance, in the uncertain context of innovation, the mobilization of classical purchasing tools such a cost breakdown analysis and risk assessments, and practices such as cost killing and panel reduction, make it impossible to establish a relationship. Under high uncertainty, the result of a risk assessment is that there are too high risks and limited means to cover them to follow-up. Similarly, the exigency of a cost breakdown before contracting for an innovation, which is not clearly defined, inhibits the innovativeness of the project: it obliges potential partners to specify the technical expectations very precisely and thus limits joint creativity by focusing on a framed solution too early, or it leads to a cost evaluation that does not have a good fit to the market because the technology is not mature enough, and thus can largely compromise the success of the project. On the other side, purchasing professionals are expected to take a total cost of ownership perspective that extends throughout the product's life cycle. NPD is only the first stage of the life cycle, and sometime the best supplier in the development phase may not necessarily be the best for the rest of the life cycle.

All these examples illustrate this duality and suggest the presence of the classic *exploration–exploitation* paradox originally proposed by March (1991), who argued that efforts to excel in *exploration* and *exploitation* naturally compete for scarce resources, such that they tend to crowd each other out.

A more recent literature adopts the *ambidexterity* lens to address this issue for the purchasing function (Andersen et al. 2018; Aoki and Wilhelm 2017; Gualandris et al. 2018; Servajean-Hilst and Calvi 2018). Ambidexterity refers to the ability to manage the trade-off between exploration and exploitation to excel simultaneously in both (Gibson and Birkinshaw 2004; O'Reilly and Tushman 2013). So, the challenge of ambidexterity should be overcome by a Chief Purchasing Officer if he is able to prove that his function results in both the control of operational criteria as cost, quality, and delivery and a real contribution in the innovation performance of the firm. Using the ambidexterity concept, we propose three organizational models for the involvement of the purchasing function in the OCP. In these models, we put forward three dimensions that we consider the most important in explaining different organizational arrangements: (1) specialization of actors, (2) cross-functional coordination, and (3) supply base management.

(a) The «ad hoc» involvement model

In terms of the specialization of actors, in this model (Fig. 1), purchasing agents are dedicated to the exploitation phase that we call "life cycle purchasing." They order to procure components and services needed for production and they may be mobilized when the NPD members decide that they are needed. In their study of the configuration typology for purchasing involvement in NPD, Lakemond et al. (2001) call this integration on an "ad hoc" basis. It can be a transitional model due to the lack of resources but also a real managerial option in some specific contingency situations. Lakemond et al. (2001) suggest that it can be an efficient option when the complexity and the size of the project are low. Luzzini and Ronchi (2011) argue that the model could be adopted if the level of uncertainty and complexity of products are low and in addition if there are tight relations among departments. This raises the question of the legitimacy of the purchasing function (Tchokogué et al. 2017) because the cross-functional coordination is not mandatory there, which is illustrated in the dotted arrows in Fig. 1. We, however, argue in favor of the importance of cross-functional interactions in this model because purchasing is not automatically included in the OCP but the need for its involvement is evaluated by the R&D and commercial functions who are responsible of the NPD process. If a buyer must spend time scouting the supplier market for an innovative technology,

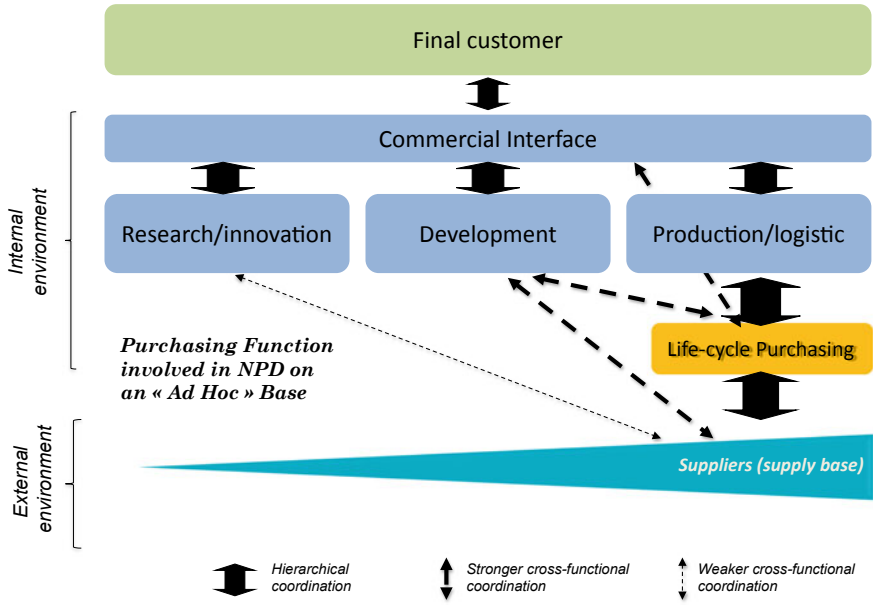

Fig. 1 "Ad hoc" involvement model (authors' own figure)

he needs to have a real *engagement letter* of these functions in order to justify all that time dedicated to an activity out of his functional objectives. In addition, if a production plant of the buying company has some troubles, the priorities might change toward more operational issues and consequently his connection with the OCP may break-up for a certain period of time.

Considering supply base management, Luzzini and Ronchi (2011) have also pointed out a weakness related to multiple interfaces with suppliers in this model because here the purchasing agent can be bypassed by the other stakeholders of the NPD process. Confusing messages and high coordination costs can be the dark side of this model. However, some companies favor this model to enhance the coherence of purchasing decisions with the current supply base between the development and the life cycle phases.

(b) The integrated involvement model in NPD

At the beginning of the 2000s, few companies had decided to specialize purchasing agents as "procurement engineers" or "NPD project buyers" (Calvi 2000; Schiele 2010) creating a *bicephalous*, i.e., "two-headed," purchasing function: some actors focus on life cycle purchasing with close connections to the production and logistic function, others focus on the OCP closely interacting with the development team in the project. This configuration seems suitable for companies manufacturing complex products with a high degree of technology content purchased from suppliers and/or where new products are leverage for running business, as in such cases, the suppliers' contribution to the firm's success is critical. These companies, following advice of O'Reilly and Tushman (2004), have decided to improve their *ambidexterity* by creating two distinct units: (i) an "operational" purchasing unit for buying and defining the purchasing strategy and (ii) NPD project buyers dedicated to the serve the R&D process (see Fig. 2).

This specialization allows creating adapted procedures for each unit and, therefore, better management of the Early Supplier Involvement (ESI) in project. For example, specific procedures can be created for selecting qualified suppliers from the supply base hence increasing purchasing's ability to support the NPD process better. In addition, it becomes possible to differentiate between the various objectives of the NPD project buyer in order to transform the "dual role" of the purchasing function evoked by Schiele (2010) into a bicephalous organization driven by the effectiveness of decisions. With such organizational configuration, it becomes easier to act in NPD projects in accordance with the theoretical recommendations of what the purchasing function must do (e.g., Wynstra et al. 1999) and, therefore, develop a real management of co-development with suppliers (e.g., Van Echtelt et al. 2008).[4]

[4]We propose that the specialization of purchasing agents can facilitate the development real Early Purchasing Involvement (EPI) practices in order to effectively connect the suppliers mobilized in the NPD strategy of the firm.

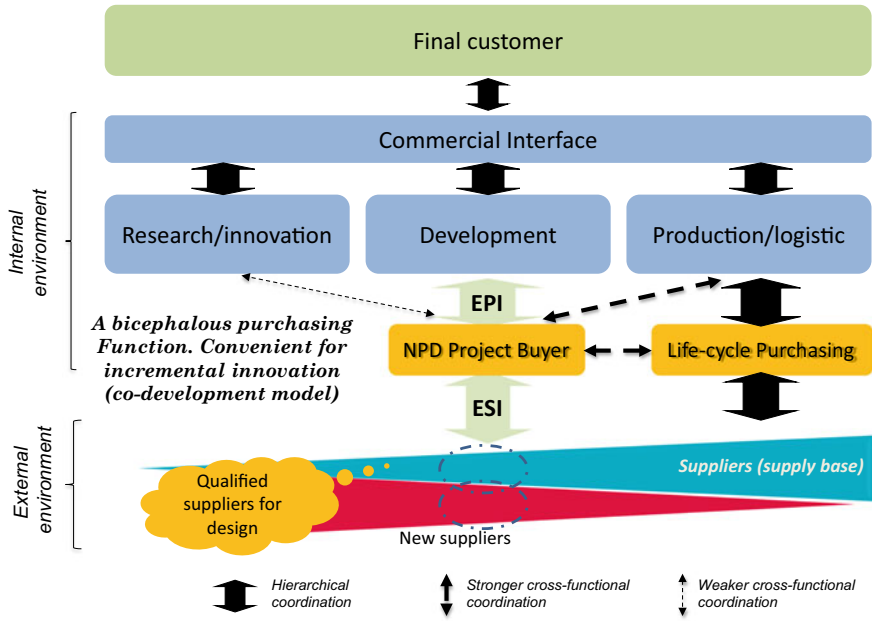

Fig. 2 Integrated involvement model (authors' own figure)

However, we can notice two drawbacks of this model. The first one is connected with the coordination costs that are substantial in this model (Luzzini and Ronchi 2011). Indeed, with at least two purchasing actors interacting with suppliers at different stages of the life cycle of the product, the challenge lies in the efficiency of coordination activities between the stakeholders. This challenge is well illustrated by Van Echtelt et al. (2008, p. 197). They argue that *"the success of involving suppliers in product development as a strategy depends on the firm's ability to capture both short-term (project) and long-term benefits (purchasing strategy)."* The purchasing function must align the decisions taken by the NPD project buyers with the purchasing strategy defined by category managers in order to capture long-term benefits. The quality of the routines developed to reach this objective is key a factor for success.

The second limit of the model is connected with the level of innovation expected from ESI. In some sectors, for example, the automotive sector, the increasing number of NPD projects[5] and the willingness to reduce the time-to-market for each one induced a tremendous pressure on project members in NPD. In this context, Maniak and Midler (2008) suggest that when the purchasing function sets up a co-development process, it must deal mainly with well-known suppliers in the

[5]According to the annual report of Renault Group, they have launch 21 new vehicle programs in 2017. An increase from 8 programs in 2012.

project time-scheduling and with a clear vision of the shared responsibilities between client and partners in order to reach the project targets. Therefore, co-development is an efficient support intrinsically for incremental innovation, but when a company seeks to introduce more discontinuous innovations the purchasing function must often investigate beyond the traditional supplier base and address fuzzy ideas of value added for the firm's OCP (Phillips et al. 2006). However, this is not compatible with the constraints of co-development, and the NPD project buyer is likely to be reluctant to carry out this type of approach. Thus, it is obvious for Maniak and Midler (2008) that to manage that kind of processes effectively and at the same time to introduce a substantial level of radical innovation in OCP, companies must define a new organizational model expanding its ambidexterity level. The last model presented is aligned with this objective.

(c) The emergence of "innovation buyer" function

In this model, the purchasing organization decides to specialize some professionals in order to early integrate the possible contributions of suppliers in the fuzzy front end of the project. This **E**arly **P**urchasing **I**nvolvement in **I**nnovation—EPI^2 (Servajean-Hilst and Calvi 2018) is an evolution of a structural ambidexterity strategy aiming at maximize the possible contribution of external resources to innovation performance (Fig. 3).

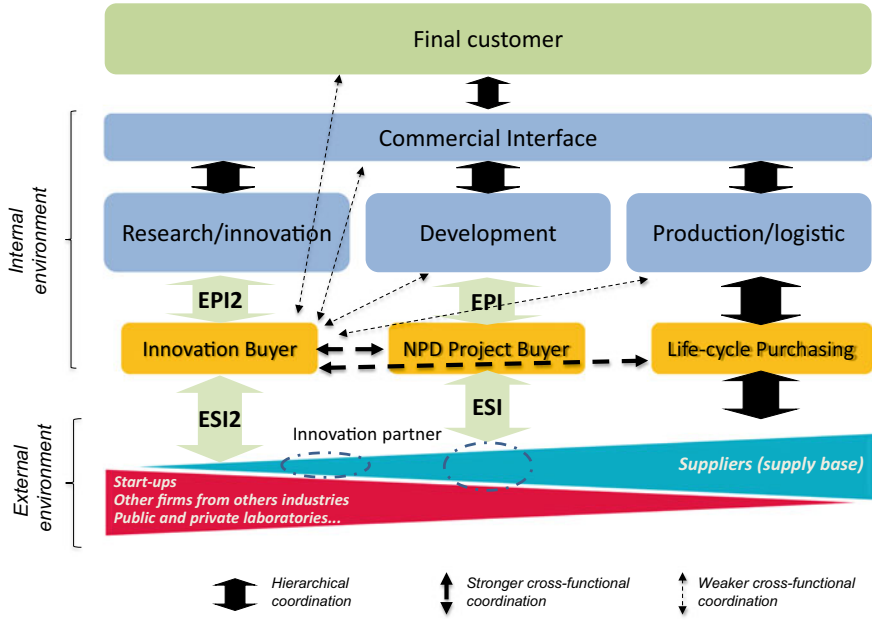

Fig. 3 Innovation buyer model (authors' own figure)

The main difficulty for the function EPI^2 resides in its legitimacy. All kinds of supply bases may be mobilized for innovation projects. In some cases, the suppliers can be from the existing supply base: e.g., existing prototype providers or an external engineering office. In other cases, they can be from brand new supply bases: start-ups, experts, or academia that may have new technologies to include in products. For the first kind of supply base, the management resembles the classical purchasing process provided by exploitation-oriented purchasing agents; but this is not the case for the second where there identification, evaluation, and integration of new partners and technologies requires to think "out of the box" of classical rules (Homfeldt et al. 2017; Servajean-Hilst and Legenvre 2017).

Further, Brattström and Richtnér (2013) describe how the quality of purchasing integration in NPD could arise from the distribution of roles between purchasing and innovation actors, specifically related to troubles in managing innovative relationships: Purchasing may take the role of the *bad cop*, innovation being the *good cop*. This division of roles toward external resources can also be found between the "classical" and this emerging purchasing functions, the innovation buyer. As an illustration, there is sometimes a need to address the classical supply base with innovative contractual forms: a need to treat panel supplier with out-of-panel methods, sometimes going against the rules of the panel, and framework agreements. The managerial difficulty here is that such tricephalous, i.e., "three-headed," organization needs a case-by-case way of managing each project-supplier and, as we can see in Fig. 3, a huge amount of coordination for the EPI^2 actors.

Having now discussed different models of how purchasing can work with other functions, we next focus on a specific activity—*innovation scouting*—that determines how well new innovation opportunities can be identified and seized. We argue that the purchasing function is particularly suitable of carrying out innovation scouting in order to have an impact on the company's innovation performance. In the next section, we discuss how purchasing can engage in innovation scouting in various situations.

2 The Roles of the Purchasing Function in Innovation Scouting

The purchasing function is a natural interface with suppliers and is therefore in a great position to scout innovations from the supply markets and support OCP (Luzzini et al. 2015). This position allows purchasing to act as a so-called *gatekeeper* between the supplier base and the rest of the buyer organization, scouting and monitoring the external environment relieving the R&D and commercial functions to focus on other domains (Cohen and Levinthal 1990).

Gatekeeping refers to acting in a mediator role between knowledge boundaries conveying ideas and knowledge from external domains to a company's internal networks (Tushman 1977). Since the amount of potentially valuable knowledge in a company's external environment is vast, gatekeepers need to filter relevant ideas

and make them understandable for the rest of the organization (Lau et al. 2003). And through this selection and translation process, they also preserve the integrity of valuable knowledge (Howells 2006).

Because of its go-between position in the middle of suppliers and internal constituents, purchasing often has direct access to external knowledge. It can increase the short-term efficiency of knowledge sourcing by pre-selecting valuable external knowledge. Moreover, it can reduce risks of internal and external knowledge leakages through the management of the emerging relationships around OCP. For instance, it is realized through the management of confidentiality agreements and through the briefing of internal and external stakeholders about the existence and the perimeter of such agreements (Servajean-Hilst and Calvi 2018). Purchasing can, therefore, become a channel for integrating innovations from the supply markets, broadening the organization's access to external innovation opportunities.

To successfully enforce the gatekeeper role and act as an innovation scout, the purchasing function needs to carry out three distinct tasks: gathering, filtering, and transmitting (Hallenbeck et al. 1999). First, there is a need to ***gather information*** from the supply markets on new ideas and innovations. Proactive and continuous supply market intelligence activities are a requirement for an up-to-date understanding of the changes in existing and potential suppliers and in available technologies and new products (Handfield et al. 2009; Wynstra et al. 2003). Gathering information may take two distinct forms. In the *pull model* of innovation scouting, the buyer is the active party of finding new information that is typically related to predefined technologies or specific needs (Homfeldt et al. 2017; Wagner and Bode 2014). In contrast, in the *push model,* the buyer works to encourage its suppliers to take the initiative to present their ideas and innovations to the buying firm. Therefore, to gain a comprehensive understanding of the latest developments, the purchasing needs to both proactively search for new information and interact with suppliers and of course to be receptive to their contributions.

The second task is ***filtering*** out those developments that do not have a potential fit with the organization's goals and choosing the ones with the most potential that are then conveyed to internal stakeholders (Hallenbeck et al. 1999). In some cases, filtering is very straightforward: e.g., locating suitable technology for a well-defined need. However, sometimes innovation scouting may serve more future-oriented and strategic purposes and the criteria for choosing innovations may be ambiguous (Felin and Zenger 2014). In these cases, filtering is supported by continuously obtaining updated information on the company's internal innovation strategy. By comparing external changes to the current company strategy, new innovation opportunities may be formulated. Innovation strategies may be defined, for example, at the level of "strategic arenas" that offer potential new product opportunities (Cooper et al. 2001). Sufficient technical and business proficiency is needed in the purchasing function for selecting the best innovations for further investigation (Cousins et al. 2011). In addition, it has been proposed that individuals with intrinsic motivation, self-control, company-specific work experience, long overall

tenure, and a well-developed internal and external network are optimal for adopting the role of an innovation scout (Maier et al. 2017).

When suitable opportunities are found, the third step is to manage the flow of information between external sources and internal recipients. It means to ***transmit*** the information to relevant internal constituents (Hallenbeck et al. 1999) and to ensure the integrity of these information exchanges (Servajean-Hilst and Calvi 2018). As the purchasing function is closely involved with the suppliers, it is usually the unit that is in the best position to understand their ideas and integrate them in the buyer's organization. Close relationships with innovative suppliers bring about trust and openness that makes it easier to access their contributions (Wagner and Hoegl 2006). And, as the purchasing function monitors supplier risk, it is in the best position to operationally monitor and prevent the risk of knowledge leakage. Furthermore, supplier innovations often include a tacit element—i.e., based on individual's experience—that is difficult to transmit (Sjoerdsma and van Weele 2015). Tight social ties and frequent meetings are a good way to ensure that the suppliers' inventions are not understood merely on a superficial level and that external knowledge is correctly transferred.

Close ties to suppliers are, however, just one side of the story. To make sure that the new knowledge has an impact, it needs to find a receptive audience. This requires well-working interfaces with other organizational functions such as R&D, marketing, services, and production (Schiele 2010) Companies' efforts to exploit new sources of innovation are often plagued by the not-invented-here syndrome: the tendency to reject ideas and knowledge when it is received from external sources (Araújo Burcharth et al. 2014; Pihlajamaa 2018).

Innovation scouting may take different forms depending on what is actually scouted and where. Indeed, we have proposed in the previous section that the main dimensions to understand the organizational challenge of the purchasing functions' role in innovation is the degree of novelty in terms of both the supply base and the technology. So next, we discuss contingencies that should be considered when planning innovation scouting strategies: (i) scouting innovations from existing versus potential suppliers and (ii) scouting ready-to-use innovations versus ideas and concepts.

(a) Existing *versus* potential suppliers

Innovation scouting tends to focus on existing suppliers as collaboration on innovation is a common step in strengthening relationships with key suppliers. Familiarity and previous experience—positive at the very least—with suppliers make it easy to access their knowledge base and help evaluate whether their innovation capabilities match with the buyer's needs. Therefore, the purchasing unit is a good candidate to evaluate suppliers on their abilities for product development, and their fit with the buying firm, organizational culture, and compatibility of technical systems (Petersen et al. 2005; Pulles et al. 2014; Schiele 2006; Wagner 2010), which are considered important predictors of innovation outcomes. Purchasing is hence likely to have a valuable understanding of the scouting of supplier

innovations, which may lead to better results compared to R&D taking the sole responsibility of the task.

In addition to scouting innovations from existing suppliers, new suppliers should be considered as they may be able to provide new perspectives and allow for the development of more innovative products (Phillips et al. 2006). By focusing too strongly on existing suppliers, companies may limit the diversity of the innovations they receive. In strong partner networks, the knowledge bases of the parties tend to converge (Dyer and Nobeoka 2000; Jouini and Charue-Duboc 2018). While this makes collaboration easier, eventually "group think" may emerge (March 1991) and truly novel ideas become rarer and rarer (Birkinshaw et al. 2007).

To ensure access to fresh innovations, purchasing should scan potential suppliers outside the current networks, and this is likely to require a new set of skills and methods for locating potential suppliers and evaluating their abilities for product development. To find new suppliers, purchasing managers may, for example, attend to trade fairs to seek new technologies (Bathelt and Gibson 2015; Servajean-Hilst 2014), organize open innovation competitions (Langner and Seidel 2009), or work with innovation intermediaries that help locate and evaluate new suppliers (Billington and Davidson 2013; Tran et al. 2011). Getting to know new ventures or start-ups can also provide an access to new products and the skills of highly innovative teams (Zaremba et al. 2017).

(b) Ready-to-use innovations *versus* fresh ideas

Another contingency addresses the maturity of the scouted innovations. Mature innovations may already be implemented in some context, and therefore many uncertainties and problems related to their use have already been resolved. Suppliers who have managed to introduce a new technological solution are likely to be highly skilled to apply it also to other contexts. Such suppliers can, therefore, be given high autonomy in subsequent collaboration, e.g., the responsibility of independently designing a part or a component (Le Dain et al. 2010). Scouting for mature innovations is, therefore, suitable for situations where the buyer has limited know-how in a domain and needs suppliers to complement the buying firm's expertise areas (Pihlajamaa et al. 2017).

In other cases, the scouting may be directed toward finding fresh ideas that are still at an early stage of the development process: for example, new product ideas and concepts (Jouini and Charue-Duboc 2018)—or even the competences of a supplier (Wynstra et al. 2003). These cannot be benefited from right away but need to be explored, integrated or co-developed with a supplier first. Compared to mature innovations that may have already been made public and, therefore, be easy to identify, ideas and concepts are likely to be more difficult to find.

With existing suppliers, high trust, frequent interactions with suppliers and including innovation as a regular topic in meeting agendas may provide a solid basis for accessing new ideas early on (Hartley et al. 1997; Henke and Zhang 2010; Schiele 2010). Acquiring ideas from potential suppliers may be more difficult and

require the purchasing managers to nurture wide networks to various suppliers to hear from new developments among the first. The situation may be easier for highly attractive companies as the suppliers may proactively present them with new ideas (Bianchi et al. 2010; Schiele 2012). Further, to provoke and identify fresh ideas that are not explicitly expressed, there is a need to develop and exploit the purchaser's network in order to rely on the "strength of weak ties" (Granovetter 1983): sourcing for brand new opportunities is generated through interactions with acquaintances, multiplying serendipitous interactions. In all the cases, after the ideas have been identified, tighter relationships can be formed to ensure their effective integration.

3 Synthesis

In this article, we have argued that the purchasing function has high potential in scouting new innovations and that it may act as a gatekeeper for the organization, gathering information of new innovations, filtering out the ones that are not relevant, and transmitting the rest to internal constituents. As the purchasing function adopts this role, it faces the challenge of ambidexterity: how to balance between the two conflicting goals of managing for operational criteria, i.e., exploitation, and contributing to the organization's innovation performance, i.e., exploration. To respond to the challenge, suitable organizational structures, roles, and scouting practices are needed.

We have discussed two sources of uncertainty that require more exploration-oriented structures: scouting from new suppliers—as opposed to existing suppliers—and scouting for ideas and concepts—as opposed to mature technologies. We propose that when the scouting focuses on ready-to-use innovations and existing suppliers, it is close to *exploitation* by nature. When the focus turns to pre-commercial ideas and concepts and to new suppliers, the nature of the scouting becomes more *explorative* and managing the challenge of ambidexterity gets more difficult.

Different organizing models are proposed for dealing with these challenges (Fig. 4). The "ad hoc" involvement model works when the exploration goals are modest. In such context, the scouting activities can be managed by commodity managers and partly by NPD project buyers connected with the suppliers. When moving toward more explorative direction and including new suppliers and pre-commercial ideas in the scope of the scouting, the integrated model should be considered. Finally, when there is a need for highly explorative scouting, the key actors involved should be innovation buyers or from R&D. In that case, it is important to coordinate and align decisions with the more exploitation-oriented purchasing function and determine responsibilities between purchasing and R&D. By choosing the right organizing model for innovation scouting, companies may ensure that purchasing function can act toward its strategic goals.

In all organizing models, purchasing needs to carry out the three tasks related to each innovation scouting: gathering information, filtering, and transmitting. How to carry out these tasks varies with innovation source and innovation maturity, and depending on the situation the purchasing managers face different challenges (see Table 1).

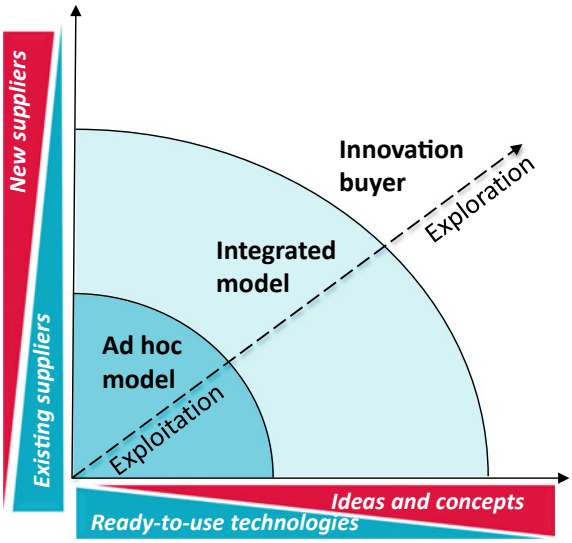

Fig. 4 Framework for choosing suitable organizing model (authors' own figure)

Table 1 Innovation scouting challenges (table compiled by authors)

		Innovation source	
		Existing suppliers	New suppliers
Innovation maturity	*Gather information*		
	Ready-to-use innovations	A key practice is to become close with suppliers to be informed about novel innovations first. The key purchasing actor must be a good business partner, i.e., to understand the expressed and latent needs of the business by developing good internal networks.	Identifying new technologies/solutions from information sources • Updated information through dedicated IT solutions (auction, sourcing platforms…), and/or visits in fairs/places and/or relays • Be updated on internal needs by a goof internal professional network
	New ideas and concepts	Be a preferred customer in order to getting access to new technologies first (Schiele 2012). Close relationships with suppliers enable hearing first about new ideas and/or commonly generating new ideas. • Good quality of information exchange through face-to-face contacts • Be a good *business partner*	Relying on informal networks in becoming aware about new developments • Be ready to listen to out of the box ideas • Translate external knowledge into potential needs • Think in terms of functionality rather than focusing only on technologies or markets • Be updated on internal roadmaps

(continued)

Table 1 (continued)

		Innovation source	
		Existing suppliers	New suppliers
	Filter		
	Ready-to-use innovations	The proposal must be approved by the R&D team and aligned with the product strategy. Suppliers' capabilities and financial stake must be aligned with the purchasing strategy of the company	Find an internal client and accompany him in the evaluation of the potential innovation. Keep in mind the alignment with the purchasing strategy
	New ideas and concepts	Previous collaboration and trust help evaluate new ideas and their feasibility. Be ready to propose new dedicated rules—exceptions to panel rules on contracts and share of IP. Listen to new ideas or capacity to organize dedicated workshops with key potential internal users	Ability to translate external knowledge into understandable information for internal stakeholders Find the right in-house expertise to evaluate new idea value and identify suitable right actor in the exploitation-oriented purchasing function who can take charge of the evaluation of suppliers' capabilities
	Transmit		
	Ready-to-use innovations	Check the quality of connections between suppliers and internal users Transmission to a life cycle buyer—when not involved in scouting—must not be forgotten	Importance of identifying and committing internal stakeholders before supplier involvement Transmission to a life cycle buyer—when not involved in scouting—must not be forgotten
	New ideas and concepts	Obtain feedback from internal clients and prepare continuous involvement of the purchasing function in the future OCP When innovation target is related to other panel than the supplier's, connection needs to be formed with relevant purchasing function	High championing efforts are needed to reduce initial opposition to ideas before supplier involvement Involvement of life cycle purchasing can be vary with the differences in knowledge bases—often mere information transmission is sufficient

Scouting innovations from existing suppliers is easier as there are lots of mechanisms already in place to facilitate collaboration. In the case of new suppliers, the purchasing function needs to find suitable methods for identifying novel

technologies and actors. New suppliers are often sought for their distinct knowledge bases and perspectives. New insights can be valuable, but they are associated with many uncertainties. This brings about challenges as the value of contributions is more difficult to measure and the integration of ideas and technologies may face resistance from internal stakeholders, keeping in mind that the longer the way from fuzzy front end to commercialization of innovation the higher the number of resistance's opportunities, and the fewer the number of levers that are available for purchasing to solve them.

Similarly, when innovation scouting targets mature innovations the level of uncertainty is lower than in the case of ideas and concepts that may have still to go through a long process before being ready for implementation. Mature technologies are easier to find, evaluate, and integrate as there is more information available of them: there may be reports of their application in various contexts and many problems related to their implementation have already been identified and solved. However, scouting for ideas and concepts may also be valuable as it allows the buyer to get in the forefront of technological development in its industry. Idea scouting requires an approach that relies on informal networks as information about ideas is often not publicly available. As this mode of innovation, scouting addresses the early stages of the innovation process where there are still many open questions, evaluating the suppliers' contribution, and convincing internal stakeholders is more challenging than in the case of ready-to-use innovations.

In this chapter, we addressed the problem of absorbing external innovations by looking at the purchasing function role and focusing on the scouting activity which determines the ambition of the openness of a firm. We proposed organizational models for that stake taking into account a double contingency: the supply base and the innovation maturity addressed. How to manage innovation scouting in various settings is still a real open agenda and we hope that our proposal can contribute to stimulate research in this topic in order to perform and improve this emerging function.

References

Andersen, P. H., Kragh, H., & Ellegaard, C. (2018). How do purchasing facilitate suppliers' contribution to organizational ambidexterity? In *Academy of Management Proceedings 2018*.

Aoki, K., & Wilhelm, M. (2017). The role of ambidexterity in managing buyer–supplier relationships: The Toyota case. *Organization Science, 28*(6), 1080–1097.

de Araújo Burcharth, A. L., Knudsen, M. P., & Søndergaard, H. A. (2014). Neither invented nor shared here: The impact and management of attitudes for the adoption of open innovation practices. *Technovation, 34* (3), 149–61.

Araujo, L., Dubois, A., & Gadde, L. E. (1999). Managing interfaces with suppliers. *Industrial Marketing Management, 28*(5), 497–506.

Bathelt, H., & Gibson, R. (2015). Learning in 'organized anarchies': The nature of technological search processes at trade fairs. *Regional Studies, 49*(6), 985–1002.

Jouini, S. B. M., & Charue-Duboc, F. (2018). Construction of relations with distant suppliers on the cognitive and relational dimensions to co-explore discontinuous innovations. *Innovations, 55*(1), 61–87.

Bianchi, M., Campodall'Orto, S., Frattini, F., & Vercesi, P. (2010). Enabling open innovation in small—and medium-sized enterprises: How to find alternative applications for your technologies». *R&D Management, 40*(4), 414–31.

Billington, C., & Davidson, R. (2013). Leveraging open innovation using intermediary networks. *Production and Operations Management, 22*(6), 1464–1477.

Birkinshaw, J., Bessant, J., & Delbridge, R. (2007). Finding, forming, and performing: creating networks for discontinuous innovation. *California Management Review, 49*(3), 67–84.

Brattström, A., & Richtnér, A. (2013). Good Cop-Bad cop: trust, control, and the lure of integration. *Journal of Product Innovation Management, 31*(3), 584–598.

Brem, A., Tidd, J. (2012). Perspectives on supplier innovation : Theories, concepts and empirical insights on open innovation and the integration of suppliers. Imperial College Press.

Burt, D. N., & Soukup, W. R. (1985). Purchasing's role in new product development. *Harvard Business Review, 63*(5), 90–97.

Calvi, R. (2000). Le rôle des services achats dans le développement des produits nouveaux: Une approche organisationnelle. *Finance Contrôle Stratégie, 3*(2), 31–55.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and External knowledge acquisition. *Management Science, 52*(1), 68–82.

Chandler, A. D., Jr. (1977). The visible hand. Harvard University Press.

Chesbrough, H., & Euchner, J. (2011). The evolution of open innovation: An interview with Henry Chesbrough. *Research-Technology Management, 54*(5), 13–18.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2001). *Portfolio Management for New Products*. Basic Books.

Cousins, P. D., Lawson, B., Petersen, K. J., & Handfield, R. B. (2011). Breakthrough scanning, supplier knowledge exchange, and new product development performance. *Journal of Product Innovation Management, 28*(6), 930–942.

Le Dain, M.-A., Calvi, R., & Cheriti, S. (2010). Developing an approach for design-or-buy-design decision-making. *Journal of Purchasing and Supply Management, 16*(2), 77–87.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal, 21*(3), 345.

Van Echtelt, F. E. A., Wynstra, F., Van Weele, A. J., & Duysters, G. (2008). Managing supplier involvement in new product development: A multiple-case study. *Journal of Product Innovation Management, 25*(2), 180–201.

Felin, T., & Zenger, T. R. (2014). Closed or open innovation? Problem solving and the governance choice. *Research Policy, 43*(5), 914–925.

Freeman, C. (1982). *The economics of industrial innovation*. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *The Academy of Management Journal, 47*(2), 209–226.

Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory, 1,* 201–233.

Gualandris, J., Legenvre, H., & Kalchschmidt, M. (2018). Exploration and exploitation within supply networks: Examining purchasing ambidexterity and its multiple performance implications. *International Journal of Operations and Production Management, 38*(3), 667–689.

Hallenbeck, G. S., Hautaluoma, J. E., & Bates, S. C. (1999). The benefits of multiple boundary spanning roles in purchasing. *Journal of Supply Chain Management*, 38–43.

Handfield, R., Petersen, K., Cousins, P., & Lawson, B. (2009). An organizational entrepreneurship model of supply management integration and performance outcomes. *International Journal of Operations & Production Management, 29*(2), 100–126.

Hartley, J. L., Meredith, J. R., McCutcheon, D., & Kamath, E. R. (1997). Suppliers' contributions to product development: An exploratory study. *IEEE Transactions on Engineering Management, 44*(3), 258–267.

Henke, J. W., & Zhang, C. (2010). Increasing supplier-driven innovation. *MIT Sloan Management Review, 51*(2), 41–46.

Homfeldt, F., Rese, A., Brenner, H., Baier, D., & Schäfer, T. F. (2017). Identification and generation of innovative ideas in the procurement of the automotive industry: The case of Audi AG. *International Journal of Innovation Management, 21*(7).

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy, 35*(5), 715–728.

Lakemond, N., van Echtelt, F., & Wynstra, F. (2001). A configuration typology for involving purchasing specialists in product development. *Journal of Supply Chain Management, 37*(3), 11–20.

Langner, B., & Seidel, V. P. (2009). Collaborative concept development using supplier competitions: Insights from the automotive industry. *Journal of Engineering and Technology Management, 26*(1–2), 1–14.

Lau, G. T., Razzaque, M. A., & Ong, A. (2003). Gatekeeping in organizational purchasing: An empirical investigation. *Journal of Business and Industrial Marketing*.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal, 27* (2), 131–150.

Luzzini, D., Amann, M., Caniato, F., Essig, M., & Ronchi, S. (2015). The path of innovation: Purchasing and supplier involvement into new product development. *Industrial Marketing Management, 47,* 109–120.

Luzzini, D., & Ronchi, S. (2011). Organizing the purchasing department for innovation. *Operations Management Research, 4*(1–2), 14–27.

Maier, M. A., Rück, P., & Brem, A. (2017). How to integrate suppliers into the innovation process? An explorative case of champion formalization in the purchasing department in times of open innovation. *International Journal of Innovation and Technology Management, 14*(06).

Maniak, R., & Midler, C. (2008). Shifting from co-development to co-innovation. *International Journal of Automotive Technology and Management*.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87.

O'Reilly, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review, 82*(4), 74–81.

O'Reilly, C. A., & Tushman, M. L. (2013). Organizational ambidexterity: Past, present, and future. *The Academy of Management Perspectives, 27*(4), 324–338.

Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2005). Supplier integration into new product development: Coordinating product, process and supply chain design. *Journal of Operations Management, 23*(3–4), 371–388.

Phillips, W., Lamming, R., Bessant, J., & Noke, H. (2006). Discontinuous innovation and supply relationships: Strategic dalliances. *R&D Management, 36*(4), 451–461.

Pihlajamaa, M. (2018). Absorbing radical ideas from unusual sources—the role of social integration mechanisms. *Technology Analysis & Strategic Management, 30*(2), 131–143.

Pihlajamaa, M., Kaipia, R., Säilä, J., & Tanskanen, K. (2017). Can supplier innovations substitute for internal R&D? A multiple case study from an absorptive capacity perspective. *Journal of Purchasing and Supply Management, 23*(4), 242–255.

Pulles, N. J., Veldman, J., & Schiele, H. (2014). Identifying innovative suppliers in business networks: An empirical study. *Industrial Marketing Management, 43*(3), 409–418.

Roberts, E. B. (2001). Benchmarking global strategic management of technology. *Research-Technology Management, 44*(2), 25–36.

Schiele, H. (2006). How to distinguish innovative suppliers? Identifying innovative suppliers as new task for purchasing. *Industrial Marketing Management, Creating value for the customer through competence-based marketing, 35*(8), 925–935.

Schiele, H. (2010). Early supplier integration: The dual role of purchasing in new product development. *R&D Management, 40*(2), 138–153.

Schiele, Holger. (2012). Accessing supplier innovation by being their preferred customer. *Research-Technology Management, 55*(1), 44–50.

Servajean-Hilst, R. (2014). Open innovation in the French automotive industry: The case of a purchasing function detecting external knowledge and triggering its absorption. In *EURAM 2014 (European Academy of Management) Conference*. Valencia: Spain.

Servajean-Hilst, R., & Calvi, R. (2018). Shades of the innovation-purchasing function—the missing link of open innovation. *International Journal of Innovation Management, 22*(1).

Servajean-Hilst, R., & Legenvre, H. (2017). *Partnering with Start-ups—Purchasing is the key for success*. Archamps: Value creation observatory. http://www.eipm.com.cn/wp-content/uploads/2018/08/The-EIPM-Value-Creation-Observatory.pdf.

Sjoerdsma, M., & van Weele, A. J. (2015). Managing supplier relationships in a new product development context. *Journal of Purchasing and Supply Management, 21*(3), 192–203.

Tchokogué, A., Paché, G., Nollet, J., & Stoleru, R. M. (2017). Intra-organizational legitimization strategies used by purchasing managers. *Journal of Purchasing and Supply Management, 23*(3), 163–175.

Tran, Y., Hsuan, J., & Mahnke, V. (2011). How do innovation intermediaries add value? Insight from new product development in fashion markets. *R&D Management, 41*(1), 80–91.

Tushman, M. L. (1977). Special boundary roles in the innovation process. *Administrative Science Quarterly, 22*(4), 587–605.

Un, C. A., Cuervo-Cazurra, A., & Asakawa, K. (2010). R&D collaborations and product innovation. *Journal of Product Innovation Management, 27*(5), 673–689.

Wagner, S. M. (2010). Supplier traits for better customer firm innovation performance. *Industrial Marketing Management, 39*(7), 1139–1149.

Wagner, S. M., & Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management, 32*(3), 65–78.

Wagner, S. M., & Hoegl, M. (2006). Involving suppliers in product development: Insights from R&D directors and project managers. *Industrial Marketing Management, Creating value for the customer through competence-based marketing, 35*(8), 936–943.

West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management, 31*(4), 814–831.

Wynstra, F., Van Weele, A., & Axelsson, B. (1999). Purchasing involvement in product development: A framework. *European Journal of Purchasing and Supply Management, 5*(3–4), 129–141.

Wynstra, F., Weggeman, M., & van Weele, A. (2003). Exploring purchasing integration in product development. *Industrial Marketing Management, 32*(1), 69–83.

Zaremba, B. W., Bode, C., & Wagner, S. M. (2017). New venture partnering capability: An empirical investigation into how buying firms effectively leverage the potential of innovative new ventures. *Journal of Supply Chain Management, 53*(1), 41–64.

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