# Strategic Relevance and Application of the Mechanism Design Theory at the example of selected European Private Procurement Auctions in a B2B-context

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**ABSTRACT,**
***Mechanism Design Theory (MDT) is a game-theoretical approach applied in negotiations and illustrates the conventional game theory's inverse. Hence, Mechanism Design Theory is limitedly spread within the industry since the strategic relevance and application are not well known by experts within the selected industries. Thus, the question arises of what describes the use case of the approach, what are its benefits and limitations, and if possible, how alternative methods and strategies can overcome limitations. The purpose of the research shall serve to work further on the knowledge gap about this tool to receive more detailed insights on its applicability and understanding in various industry sectors. With this, qualitative research, conducted as semi-structured interviews with eight experts with negotiation and procurement expertise, has been executed to find out more about the priorly listed aspects. Results illustrate that using Mechanism Design is differently understood among the experts in the industry and thus differently applied. In general, Mechanism Design Theory describes the ability to design the negotiation and process rather than consider the opponent's step. One significant aspect of the research is that a mechanistic tool, known as Bonus-Malus appraisal, can be applied with a heavy cost-engineering focus (called dirty by experts). Differently, it can be applied with an honest intention for achieving comparability among the auction participants (called clean by experts) and is further understood as to how a negotiation setting is designed. According to the interviewees, both approaches, clean and dirty, influence the negotiation outcome enormously. Nevertheless, future research needs to be conducted to focus on a detailed case-specific analysis to derive a more apparent practical application.***

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# 1. INTRODUCTION

Companies outsource significant parts of their production and contract suppliers instead due to cost-efficiency reasons and knowledge to create a sustainable competitive advantage (Hätönen & Eriksson, 2009, p. 145; Kotabe & Mudambi, 2009, p. 121). Thus, within the Source-to-Contract phase, a supplier selection and contracting process occur as negotiations between suppliers and buyers (Aktin & Rinehart, 2006, p. 49). Effective negotiations are essential to finding an agreement between interrelated supply chain members (Thomas, Thomas, Mandrot, & Runter, 2013, pp. 62-63).

In addition to that – as one option of negotiation methods – game-theoretical approaches have emerged to support and enhance the process of buyer-supplier negotiations within procurement and can lead to achieving conditions for optimal decision making (Harland et al., 2006, pp. 16-17; Schulze-Horn, Schiele, & Pulles, 2018, p. 789). The conventional Game Theory approach focuses on the potential outcome and the interaction within the negotiation (Hehenkamp, 2007, p. 772).

The inverse of Game Theory, namely Mechanism Design Theory, considers the desired negotiation outcome and designs the necessary rules to achieve this desired outcome (Schulze-Horn et al., 2018, p. 779).

Mechanism Design Theory focuses on the "game structure" and the "game's outcome" (Maskin, 2019, pp. 1-2). The theory can be used in a Business-to-Business private procurement context where a sufficient number of bidders is reached (Onderstal, 2008, p. 46f). This can be determined by the item to be purchased by the Kraljic Matrix (Zijm, Klumpp, Refattieri, & Heragu, 2019). In Business-to-Business negotiations, negotiators aim to establish long-term relationships with their suppliers (Sigurdardottir, Ujwary-Gil, & Candi, 2018, p. 438). Thus, negotiators are willing to cooperate and, beyond that, make concessions to work together to find mutual beneficial solutions (Sigurdardottir, Hotait, & Eichstädt, 2019, p. 307). In practice, Mechanism Design can be used to design the rules within a negotiation and prescribe what is possible within a negotiation while modifying the process compared to conventional negotiations (Hehenkamp, 2007, p. 772; Schulze-Horn et al., 2018, p. 779).

Considering various aspects of this game-theoretical approach, concerning having complete information, or differently, symmetric or asymmetric questions, new research topics arise. Having complete information raises the question of the benefits and limitations of the applicability (Zlotkin & Rosenschein, 1996, p. 208). Similarly, according to Jin and Wu (2002, p. 22), symmetric and asymmetric information within a negotiation raises the questions for possible rules and methods to be integrated to create a certain degree of stability within the process. According to the dissertation of Schulze-Horn et al. (2018), it concludes a need for further research on elaborating clearer applicability of the Mechanism Design Theory driven by its limitations and giving input on how to overcome or cope with limitations. Following, it helps to suggest an optimal negotiation design (Schulze-Horn, Hueren, Scheffler, & Schiele, 2020, pp. 634-635; Schulze-Horn et al., 2018, pp. 794-795).

Concerning the incentives as mentioned earlier, the aim of this research takes a critical consideration of Mechanism Design Theory concerning the use-cases and benefits as well as the limitations and strategies to overcome. The following research question leads the research:

"How can the use-case of the Mechanism Design Theory be modified for optimal applicability while taking into consideration the benefits, limitations and enhancing strategies?"

As a result, the main research question will be broken down into four sub-questions discussing the four aspects within the main research question, namely use-case, benefits, limitations and enhancing strategies. These factors contribute to an alternative formulation for a potentially better insight in its practical applicability to stress the strategic relevance of what is maximumly achievable for the desired outcome while applying the theory and enhancing the clarity on its effective future utilization.

In order to elaborate on the mentioned topic, a literature review discussing the critical aspects of the question and current findings will be discussed. Afterward, relevant methodology and research design will be introduced, providing an overview of what needs to be done to analyse the topic mentioned here. Hereby, a multi-case study shall support finding relevant information to the aspect-defined sub-question. Based on this analysis, further relevant insights regarding the main research question will be found and elaborated. The thesis will be further elaborated with a discussion of findings and practical implications and concluded limitations and incentives for further research suggestions.

# 2. LITERATURE BACKGROUND: THE USE CASES, BENEFITS, LIMITATIONS OF MECHANISM DESIGN THEORY IN PSM

## 2.1 Fundamentals of the Mechanism Design Theory

The research project is examining the applicability and relevance of a tool called Mechanism Design Theory. As in the previous chapter mentioned, Mechanism Design is the inverse form of the Game Theory, considering game structure and game's outcome (Maskin, 2019, pp. 1-2; Schulze-Horn et al., 2018, p. 779).

Mechanism Design Theory is a treatment in the form of a communication system. It focuses on the desired outcome and the rules rather than the participants' steps (Schulze-Horn et al., 2018, p. 781ff). The desired outcome describes a functional combination of supplier preferences and the desired target which might be achieved through Pareto-optimal allocation (Cousins, Lamming, Lawson, & Squire, 2008, p. 50ff). Furthermore, it is up to the company leading the negotiation to share true or false information which would have been of disadvantage for the buyer (Hehenkamp, 2007, p. 768ff).

Generally, Mechanism Design Theory is changing the order of steps within the negotiation process. It makes it more effective and efficient by adding a pre-negotiation that enhances the symmetric information and a better preparation for the actual negotiation (Jin & Wu, 2002, p. 22; Schulze-Horn et al., 2018, pp. 794-795).

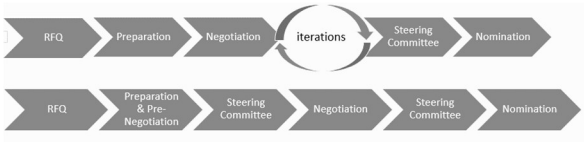


***Figure 1: Conventional versus Mechanism Design Theory negotiation process Schulze-Horn et al., 2018***

As aforementioned, Schulze-Horn et al. (2018) claim that the integration of Mechanism Design changes the order of negotiation in two aspects. It includes a pre-negotiation phase in which the aim is to get the best price before the actual negotiation, and thus, the application of Mechanism Design occurs (Schulze-Horn et al., 2018, p. 788). In addition to that, the supplier does not know that a game-theoretical tool has been

applied. This serves the purpose that the second negotiation is still coming up. In the changed order of the steering committee, it serves the purpose of presenting the direct quote from RFQ and pre-negotiation to the steering committee to be better prepared for the actual negotiation. Having this fallback position is a strategic step towards attaining the desired negotiation outcome. Having said this, after the actual negotiation has taken place, the outcome attained will be presented again to the steering committee, and a nomination will be extracted (Schulze-Horn et al., 2018, p. 787f).

It should be analysed how experts from various industries prepare auctions and how they followingly integrate mechanistic tools within their preparation or other tools they use to accomplish their target. If this is not applicable, it is interesting what intention and attitude they put forward while preparing the auction.

## 2.2 Use case at the example of electronic reverse auctions

One out of several possible applications of the Mechanism Design Theory can be found in private procurement auctions in a Business-to-Business context. Typically, a procurement auction is conducted in the form of a reverse auction and can be differentiated between and executed as online and offline (Wyld, 2011, p. 15ff).

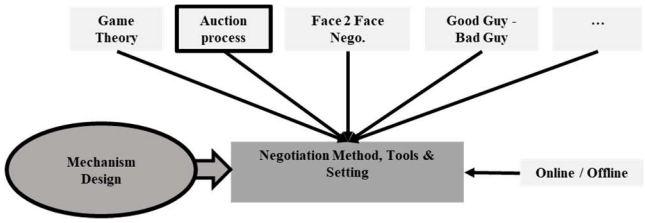


***Figure 2 The. Framework: Negotiation Method, Tool & Setting***

In the particular case of e-auctions, according to the Institute for Supply Management, an electronic reverse auction is "a type of e-auction that is typically conducted, as indicated by its name online, in real-time, between a single buying company and pre-qualified suppliers" (Wyld, 2011, p. 12). More generally, a reverse auction, or English auction, is in the optimal case where the bargaining power of the buyer is relatively high due to the pre-assumed high number of suppliers offering their bids and in which the auction starts with a low bid and ends with the highest. (Fugger, Katok, & Wambach, 2016, pp. 518-519). This specific case sets up the perfect situation for applying the Mechanism Design Theory concerning Bonus-Malus appraisals (Schulze-Horn et al., 2018, p. 782). The case in which a Bonus-Malus appraisal would become possible is where a higher number of bidders is available, and no limited bidding is highly possible (Onderstal, 2008, p. 46f). Alternatively, Dutch auction starts by asking the auctioneers a high price which is going down.

Mechanism Design can be used in Bonus-Malus appraisals to force suppliers to cut down their prices while increasing competition concerning the conditions mentioned above of limited bidding (Onderstal, 2008, p. 46f; Schulze-Horn et al., 2018, pp. 789-790). Following, this can be done in the form of pre-negotiations as suggested by Schulze-Horn et al. (2018, pp. 787-788), requesting RFQ's (Request for Quotation) and sequentially in the form of first-price auctions and second-price auctions (Beil & Wein, 2013, p. 1513).

A first-price auction is in most cases performing worse than for instance the second-price auction – this is due to the reason that there is no information yet available in the first auction (Fugger, Gretschko, & Pollrich, 2019, p. 16). It needs to be mentioned that different types of auction formats require different amounts of information (Fugger et al., 2019, pp. 15-16).

The application of the Mechanism Design Theory can help contribute to mutual satisfaction for both buyer and supplier (Lee, 2012, p. 610). Due to the case of B2B auctions, as previously mentioned, negotiators are willing to work together with the supplier and thus try to find a joint base on which it is possible to establish a long-term relationship (Sigurdardottir et al., 2019, p. 307; Sigurdardottir et al., 2018, p. 438). In addition to that, the Mechanism Design Theory can support the process of finding a solution for monopoly pricing models (Royal Swedish Academy Sciences, 2007, p. 2). Lastly, as aforementioned, the integration of an additional pre-negotiation phase enhances the step of collecting complete information to shape the objective, which can lift the buyer's position and further enhance the effectiveness of a negotiation (Schulze-Horn et al., 2018, p. 788).

## 2.3 Assessment of mechanistic use case application by Pareto and Kraljic Matrix

Auctions involve competing bidders (Bulow & Klemperer, 2009, p. 1). Within the negotiation process, a negotiation target has to be defined. The negotiation target is the desired outcome that the buying company, here in a Business-to-Business context, wants to achieve and is shaped by different criteria and product analyses (Zetik & Stuhlmacher, 2002, p. 36).

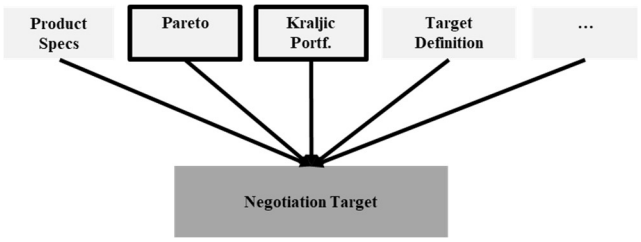


***Figure 3 Theoretical Framework: Negotiation Target***

The Pareto-Curve and Kraljic Matrix are tools to assess the use-case of the Mechanism Design Theory. As a result of this, as priorly mentioned, Mechanism Design in the context of Business-to-Business can only work out if negotiation methods, tools, and settings, a type of negotiation is chosen that brings a certain number of bidders with it (Fugger et al., 2016, p. 518).

The Pareto analysis is the first determinant to understand the part's relative importance within the buying portfolio and was invented by Vilfredo Pareto in 1906 (Mornati, 2013, p. 66).

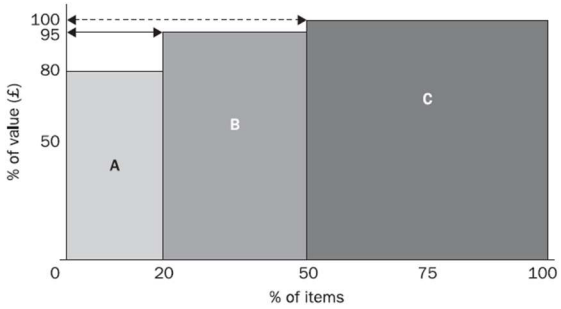


***Figure 4: Pareto Analysis according to (Cousins et al., 2008)***

It is utilized to assess parts' value position within the entire purchasing volume (all parts). It is categorized into value groups to initially define their value relevance (Cousins et al., 2008, p. 50f). The value categories are, among others, defined as A, B, or C parts, where A parts make up 70% of the total purchasing volume (Cousins et al., 2008, p. 50). According to Mornati

(2013, p. 74ff), these value categories attempt to achieve economic optimum through the curve.

The value position is connected to the Kraljic Matrix. The Kraljic Matrix is a tool invented by Peter Kraljic in 1983, which is, in essence, giving input on part's value in buying portfolio oversupply risk (Kraljic, 1983, p. 109). Hereby, a matrix is built respecting four categories – bottleneck, strategic, routine and leverage items (Glöckner, Pieters, & De Rooij, 2005, p. 3). As illustrated in figure 5, the matrix indicates appropriate negotiation strategies and the number of available suppliers to support the applicability of Mechanism Design (Glöckner et al., 2005, p. 8).

Here, as previously mentioned, a minimum number of bidders must be available and thus determined by the product item to be purchased using the Kraljic Matrix (Onderstal, 2008, p. 46; Zijm et al., 2019, p. 64ff).

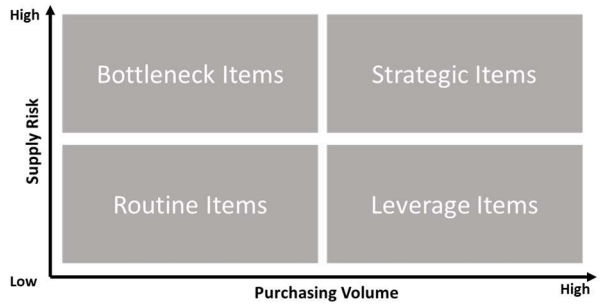


***Figure 5: Kraljic Matrix according to Kraljic (1983)***

Following the in figure 5 illustrated Kraljic Matrix as suggested by Kraljic (1983), Mechanism Design can be, according to the limited bidding issue, applied for leverage and routine items only (Glöckner et al., 2005, p. 3).

Having determined these two interrelated factors provides a good indication on how to shape the best target respecting the product item to be purchased (Padhi, Wagner, & Aggarwal, 2012, p. 7).

Integrating the tools mentioned above for assessing item specifications helps identify the best use case further and provides insights into where the benefits and limitations lay. For instance, how can the cost impact contribute and impact the negotiation process and where it leads to, as well as how the supplier market conditions influence specific negotiation strategies and the landscape for applying mechanistic tools within the negotiation.

## 2.4 Tools and strategies to overcome limiting factors

Mechanism Design can facilitate processes but also has its limitations in application.

According to Maskin (2019, p. 5), one limitation is the question of what is perceived as a fair process regarding the participants and designing the rules within the game. This is reasoned by the degree of commitment within negotiation as well as the degree a buying company integrates the supplier within the process and informs about mechanisms to be used (Maskin, 2019, p. 5ff). This is because with the parties' received information, which may not be one hundred percent truthful (Thompson, 2016, p. 2). As mentioned earlier, symmetric information and commitment can lead to mutual satisfaction and trust, which will in turn, possess a fundament for a long-term relationship (Fugger et al., 2019, pp. 15-16; Lee, 2012, p. 610; Sigurdardottir et al., 2018, p. 438). If, for instance, the behaviour is too competitive on one side with a cost-only focus, then a possible no-deal could be the worst-case outcome (Aktin & Rinehart, 2006, p. 60).

One way of overcoming the limitation is that the level of satisfaction and the degree of fairness can be enhanced through cooperative instead of competitive participants within the negotiation (Aktin & Rinehart, 2006, p. 58). If both participants are willing to cooperate and approach to align their interests, the establishment of 1) a long-term relationship between buyer and supplier and 2) mutual satisfaction is accelerated (Sigurdardottir et al., 2019, p. 307).

A second limitation occurs when the negotiation context or process becomes too complex, for instance, concerning the number of bidders and especially the items to be bid about (Conitzer & Sandholm, 2004, p. 4ff). As argued priorly, the Mechanism Design could be best applied for items with a high number of providers in the market (Herweg & Schmidt, 2017, p. 649f; Lorentziadis, 2016, p. 366). Hence, if the complexity rises in terms of items or the number of participants decreases, problems of limited bidding can arise or the inability to apply the Mechanism Design Theory properly (Conitzer & Sandholm, 2004, p. 5).

To overcome this limitation, according to Conitzer and Sandholm (2004, pp. 1-2), it is advisable to make use of automated mechanism designs that can better consider various factors at the same time, which cannot be done otherwise. Newly emerging and enhancing technologies catch more and more the interest for development since the impact needs to be observed about possibilities in its application on achieving low cost while remaining competitive (Glöckner et al., 2005, p. 9). Following Glöckner et al. (2005), those technologies can play an essential role in the future. They can bring along a tremendous positive impact with regard to still achieving the best outcome while coping with its limits. Beyond that, different rules and methods can be introduced, giving a guideline to the action taking place and thus assuring a certain degree of stability in the negotiation (Jin & Wu, 2002, p. 22).

The aspect of overcoming limitations shall be handled as proof of literature findings by the experts and serves as a source of finding out what experts suggest when limiting factors occur that might hinder an optimal auction outcome.

# 3. METHOD: CONDUCTING A QUALITATIVE MULTIPLE CASE STUDY BASED ON SEMI-STRUCTURED INTERVIEWS WITH EXPERTS

## 3.1 Conducting a qualitative multiple case study

The research is qualitative, which is developing a theory-based, inductive approach because the topic requires a selected review of experts since there is only limited knowledge existing on this topic so far (Zaborek, 2009, pp. 6-7). With this, multiple case studies will help to receive insights and analyse the interviewee's situations and decide in a later stage which information is reliable and robust, hence integrated into the findings and result section (Gustafsson, 2017, p. 11).

Qualitative research exists to explore and determine evidence on a particular topic, here mechanisms in negotiations (Sale & Thielke, 2018, p. 132). Thus, it can be used for cases, such as the in here presented ones, in which there is rare or incomplete knowledge (Gill, Stewart, Treasure, & Chadwick, 2008, p. 291). Beyond this, the interviews shall be built up in a consistent structure in which general questions shall introduce the aspect to be discussed and followed by in-depth follow-up questions

depending on the interviewee to direct him / her to the targeted answer (Gabrielian, Yang, & Spice, 1999, p. 8). Hereby, a pre-formulated interview guide will provide support to conduct the interviews and, besides, strengthen the study's internal validity (Van Thiel, 2014, p. 100). A more detailed version of the interview guide can be found in appendix A.

The goal of the interview phase is not to shape the one-best practice but rather gives insights on how an approach to a best practice can be formulated according to the research questions listed in the introduction. Further, besides the evaluation method, the outcome and the data to be analysed are dependent on the degree of expertise and knowledge of the interviewees (Gill et al., 2008, p. 292f). Since the research is conducted in the form of multiple-case studies, data collection will be solely primary data. Hence, it needs to be considered that the data might be biased by the respondent and his/ her specific situation (Mannan, 2020, p. 18). Research design implies that the interview has to be well-prepared to avoid the scenario of having unclear or incomplete questions that might confuse the interviewee during the interview and harm the credibility and quality of the results. (Gabrielian et al., 1999, p. 291; Mannan, 2020, p. 19).

## 3.2 Data collection and sampling within the industry

For this kind of study, qualitative research is the most fitting because qualitative research is multimethod in the sense of focus and an interpretive approach. Consequently, it depended on the interviewee and is attempting sensemaking due to a lack of complete information on the topic discussed (Aspers & Corte, 2019, p. 142). Further, the data will be collected in the form of semi-structured interviews. Semi-structured interviews consist of primary data and include three sections. According to Mannan (2020, p. 17), these interviews have an initial part, a middle and a concluding part. In addition, the interviewer starts introducing the interviewee to the content to be discussed in terms of introducing the narrator, the agenda and topic aspects (Mannan, 2020, p. 20). After that, the middle or central part is when the narrator and interviewee start the principal interview process by asking and answering questions, namely in-depth questions that require honest but specific answers. The interview ends with a general sum-up and clarification for further input or questions (Mannan, 2020, p. 18). This procedure serves the purpose of providing the complete interviewee information on the research to be conducted.

The advantage of conducting semi-structured or semi-standardized interviews is that it provides a more flexible interview option. It allows both the interviewer and interviewee to come up with topics that have not been anticipated before the interview and give the aimed new insights on mechanisms in negotiations (Ryan, Coughlan, & Cronin, 2009, p. 309).

The interview will be conducted in the form of questions directing the interviewee in a particular aspect-orientated area to extract experts' experience in an original style which might lead to a discussion through detailed follow-up questions (Mayring, 2020, p. 52ff). It needs to be differentiated from open and closed questions since these are no questions with no further explanations, however also no questions which leave the interviewee too much space to select the topic to talk about himself/ herself (Mannan, 2020, p. 18).

The interviewees are sampled in the form of a criteria catalogue. In addition to that, the interviewees need to have experience in procurement and shall come as far as possible from various sectors. Being said, interviewees will be selected based on their hierarchy level. Thus, the interviewees are either from a senior manager level or higher because it needs to be assured that the interviewee selected is sufficiently integrated into auction processes to be knowledgeable on the topic discussed to provide the appropriate input on the aspects discussed. The interviewee's position varies from Senior Manager level, over Chief Procurement Officer to Managing Director positions which already indicates that it is dealt with respondents in the higher hierarchy. The respondents shall come from Europe and be educated about the tool Mechanism-Design Theory and its application within auctions. Alternatively, the respondents should know at least theoretically how they could apply it. This research cannot be representative since it is a multiple-case study and qualitative research. A more detailed illustration of the research's participants can be found in appendix B.

## 3.3 Data analysis based on interview protocols to be assessed

All interviews will be recorded for further evaluation and later elaboration. Hereby, protocols help keep an ordered structure (Yamashita & Moonen, 2014, p. 9f). Quoting interviewees help to confirm and sustain certain factors, as illustrated in appendix C. In addition to this, a comparative analysis is applied to illustrate the same opinions and assumptions to sustain the urgency of an aspect and illustrate the difference between two cases (Roig-Tierno, Gonzalez-Cruz, & Llopis-Martinez, 2017, p. 17).

Comparing the different cases with each other means that different opinions are put in front of each other. A method to be applied is to review what certain interviewees have responded to a specific question. Following, sourcing for keywords that have been mentioned can be count and used for elaborating a particular view. Hence, if a specific aspect is mentioned several times, it is listed in summary, as illustrated in table 1.

Having protocols allows to come up with visual charts that might, if possible, illustrate certain opinions and following is comparing already the views which aim to come to funded reasons as found in the appendix C and D, in which factors identified by literature are proven with quotes from interviewees.

The data to be analysed is recorded with the individual interviewee's agreement and saved as either MP3 or MP4 form. On average, the interviews are planned to take 45 minutes. The list of actual conducted interview times per interviewee can be found in appendix B.

Due to data confidentiality, the company name and interviewee's name, further personal data and detailed transcripts of the interviews will not be disclosed. Therefore, as illustrated in table 1 and appendix B, different interviewees will be named after their number in the order their interviews have been conducted.

# 4. RESULTS: UTILISING MECHANISM DESIGN THEORY WITHIN PSM

Among the eight participants of the interview, on the one hand, two are using the rating Bonus-Malus as a cost-only tool to force suppliers to cut down the prices. On the other hand, two interviewees are using Bonus-Malus mixed, being said that it should serve as a rating scheme, but can and have used it as well as a mechanistic approach to the auction process. The remaining participants applied the Bonus-Penalty appraisal solely as a rating system and not very much as a tool to force suppliers to cut down their prices, but instead to make suppliers comparable for a consistent evaluation.

In the following chapter, the four different aspects and their interview results will be summarised and elaborated based on their findings.

## 4.1 Applicability of Mechanism Design Theory in auctions

All participants of the interview want to reach the best outcome. However, it needs to be mentioned that two interviewees made an exception and claimed whether an actual win-win situation is at the end possible, even if a buyer is trying to accomplish it. At this point, it already needs to be mentioned that it is dependent on the relationship a buyer is targeting. Beyond that, the interviewees were distinguishing among two different forms of application of the Mechanism Design. The first one, the so-called dirty mechanism, is all about a very subjective-driven and price-only focus in which the main target is to get the best price out of the auction without paying attention to all criteria.

Evident from the interview is that 3 out of 8 interviewees claimed that there has to be a minimum of two suppliers in the auction to apply a game mechanism. Beyond that, interviewee 1 and interviewee 3 stated clearly that the ideal number for using a mechanism such as Bonus-Malus in an auction.

Interestingly, all interviewees use the Mechanism Design Theory for various commodity groups and argue differently why they do so. For instance, interviewee 2 and 4 claim that they purchase items on a whole price scale and it depends on what the client wishes to purchase, but do not give a clear explanation why. Interviewee 3 elaborated it in more detail. She has claimed that mechanistic approaches are applied in every price-class auction in her firm, mainly for strategic items. Her reason accordingly is that her firm is a very established one in the automotive market.

**Table 1: Results of key aspects mentioned by interviewees**

| | Interviewee | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Characteristics** | | | | | | | | |
| Job Title | Chief Supply Chain Officer | Senior Lead Negotiator | Procurement System Engineer | Senior Lead Negotiator | Processes, Systems & Method Specialist | Procurement Director | Managing Partner | Partner Procurement & Supplier Management |
| Industry | Automotive | Consulting | Automotive | Consulting | Renewable | Renewable | Consulting | Consulting |
| Company Size (# Employees) | 3.500 | <100 | >500.000 | <100 | ~20.000 | ~20.000 | <30 | ~1.000 |
| Company Size (Revenue €) | ~600M | <10M | >50B | <10M | >1B | 5-6B | confidential | 220M |
| Auction Experience | 30+ | 80-100 | 25+ | 50-70 | 50+ | 100+ | >100 | several |
| **Use Case MDT** | | | | | | | | |
| Minimum # of Suppliers | 3 | 2 | >4 | 2 | 2 | 2 | n.I. | 2 |
| Ideal # of Suppliers | 5 | <6 | 4-5 | 6-10 | depending | 3-4 | n.I. | 5 |
| Auction Spend volume (€) | <50.000 | high cost | high cost | high cost | 15M | 350 p.a. | depending | depending |
| Commodity type according to Kraljic matrix | routine / leverage | various | strategic | mostly strategic | various | various | various | routine & leverage |
| Dirty Bonus-Malus Apporach | X | | | | | | X | X |
| Clean Bonus-Malus Apporach | | X | X | X | X | X | X | X |
| Justified efforts for approach | X | | | X | | | | |
| Buyer's Bargaining Position | | | X | | | | X | |
| *Total aspect hits* | *2* | *1* | *2* | *2* | *1* | *1* | *3* | *2* |
| **Benefits of Application** | | | | | | | | |
| Fairness | | X | | | X | [X] | X | X |
| Transparency | | | | | | X | X | X |
| Clarity over process | | | | | | | | |
| Achieving negotiation outcome | X | X | | | | | X | X |
| Improved commodity customization | | | | | X | X | X | X |
| Commitment | | X | | | X | X | | |
| Comparability through clear evaluation | | X | X | X | X | | | |
| Supplier-buyer relationship | | X | | | | [X] | X | |
| *Total aspect hits* | *1* | *5* | *1* | *1* | *4* | *5* | *5* | *4* |
| **Limitations of Applications** | | | | | | | | |
| Unfairness through manipulation | X | | X | | | | | |
| Communication among suppliers | X | | | | | | X | |
| Subjective evaluation | X | | X | | | | | |
| Limited bidding | X | | X | X | X | | X | X |
| Complexity for Bonus-Malus | | X | | | | | | |
| Only-price focus | | X | | | | X | | |
| Morality | X | | | | X | | | X |
| *Total aspect hits* | *5* | *2* | *3* | *1* | *2* | *1* | *2* | *2* |
| **Strategies to overcome Limitations** | | | | | | | | |
| Alignment of interest | | | X | | | | | |
| Change negotiation mode | X | | X | X | | | | |
| Cooperative Attitude | X | X | | X | | X | X | X |
| Supplier Communication | | | | X | | X | | |
| Cross-functional decision making | | X | X | | | | | |
| Artificial Intelligence | X* | | X* | | X* | | X* | |
| *Total aspect hits* | *3* | *2* | *4* | *3* | *1* | *2* | *2* | *1* |
| **Total Hit Contribution** | **11** | **10** | **10** | **7** | **8** | **9** | **12** | **9** |

Note: X for aspect mentioned & applied ; [X] for application depends ; X* for not applied but discussed in interview

Thus, the company can conduct a mechanistic auction, if auctions are applicable, even for strategic and high-value items. In a later stage, she made the assumption that it is for other firms more suitable for leverage and routine items concerning the Kraljic matrix, and a transactional relationship should be targeted.

Regarding the items, Interviewee 1 and 8 are confirming that they conduct mechanistic auctions instead of for routine and leverage items rather than for strategic items. In their case, their company was -in case of interviewee 1- not in the position to apply Mechanism Design for strategically essential items, and in the case of interviewee 8, he stated that if we reach an item of strategic importance, then it would be a) preferred and b) advisable to go into another auction mode such as a face-to-face negotiation or in general in an offline alternative in which

Another interesting observation has been made by interviewee 1 and 4. Both claimed several times that the application for a mechanism in an auction and other auction modes has to be justified. To be more precise, interviewee 1 states that a certain threshold needs to be determined by "justifying efforts versus the potential auction game" (Interviewee 1). Interviewee 4, in comparison, said, when it comes to mechanisms for strategic items, A-commodities, the efforts must be justified to conduct an auction with these tools. However, he claims that there is not one auction or one process that could fit a specific mechanism.

Interviewee 7, from consulting industry, elaborated this topic more and stated which type of auction could fit best. On the one hand, he says that if a company wants to purchase some commodity, then an English or Reverse Auction makes more sense. He added that the purchaser could signal where the market price is going.

On the other hand, he argued with conducting a Dutch auction type and, alternatively, an English Auction type. He states that it makes sense to have a Dutch auction in place in for instance, in the case of creative marketing. This is something more specific and could be a strategic decision in which it is vitally important to choose the right agency.

For this specific example, Interviewee 5, from the wind industry, provides an excellent example since her company does auctions for a spend volume of 15 million Euro, which is a significant high-cost impact reasoned by the complexity of their end product. She stated that using a Dutch Auction mode is easier to give shares to multiple suppliers to spread the risk. The buyer can incentivise accordingly to award larger shares differently in the future. Secondly, according to Interviewee 5, a Dutch auction is a suitable tool to push down the prices further since she can attain two goals: the target price accomplishment and the awarding to the fitting suppliers.

Again, Interviewee 1 confirms that while conducting an English auction, a price focus can be pursued but instead applied for low-risk items with a low to medium cost impact. Hereby, he claimed clearly that he is purchasing C-commodities and can use the dirty mechanism design, which focuses majorly on price and can be subjectively modified to award the preferred supplier and cut down the supplier's offer price. Which relationship he is targeting with his suppliers remains unclear. However, regarding this point, Interviewee 8 mentioned that a long-lasting relationship should not be based on a heavy cost-engineering practice but rather on a cooperative nature which he has rarely observed in auctions, but rather in other auction modes.

Lastly, it is interesting how the interviewees are preparing auctions using a mechanism in their process. Depending on the industry, one observation is that the preparation is relatively simple for some interviewees, whereas, for others, it is pretty complex. Interviewee 2 explained his preparation in a very detailed 6 step procedure (see Table 2).

**Table 2: Auction Preparation according to interviewee 2**

| *# Stage* | *Short Description* |
|---|---|
| Stage 1 | Analysis phase |
| Stage 2 | Bonus-Penalty Stage |
| Stage 3 | Preparation/ Def. Awarding design |
| Stage 4 | Commitment / Sign off phase |
| Stage 5 | Supplier Communication |
| Stage 6 | Awarding /Auction Conduction |

According to interviewee 2, the first stage is the analysis phase. This phase comprises a market analysis, a competitive landscape analysis, premises and the analysis of an awarding scope. As in chapter 2 described, it shows the RFQ and preparation phase. After that, in a Bonus-Penalty Stage, the comparability is discussed by giving them a "price tag" for all non-price factors, including criteria such as logistics, service, quality, and technical differentiation between the suppliers. This serves as giving a bonus or malus to each supplier if they meet or do not meet the criteria. In stage 3, it is decided which types of auctions are used, which further stages are integrated, and which incentives are included in the mechanistic auction design. The fourth stage is essential since the companies are receiving a commitment to proceed with the auction. The last two stages comprise several stages such as steering committee and nomination (figure 1).

Nevertheless, in short, it is firstly about a meeting with the suppliers, typically a one-hour meeting, in which a detailed explanation of rules and of awarding scope is communicated with the suppliers. This stage is, as illustrated in figure 1, similar to a steering committee meeting. After this, the supplier receives a supplier communication sheet including all details and commitments from the buyers' side. In the last stage, it is a full-committed meeting, typically the auction process. In the end, the winner of the auction is the winner of the business without any renegotiations. Regarding the illustrated auction preparation, similarities can be derived from the figure 1. Time efforts needed for each stage could not be precisely indicated due to interview two. It can be drawn that the analysis and preparation phase prior the commitment and sign-off phase are the most essential because these form the fundament to the later negotiation.

To sum it up, the use case of a Mechanism Design depends to a significant part on the bargaining position and the degree of competition that the auctioneer has in the negotiation. Having defined these criteria provides many indications of which types of items a buyer is purchasing and what strategic and cost-related role it plays.

## 4.2 Profiting by applying mechanistic approaches

At this point, it has to be highlighted that the application of Mechanism Design Theory is differently understood and thus differently applied among the various industries. As indicated, the topic of Mechanism Design has been approached by introducing it with the mechanistic tool of Bonus-Malus or Bonus-Penalty system. These terms will be utilised in the following interchangeably.

One apparent outcome of the interviews is that specific aspects have been mentioned several times.

Four out of the eight interviewees claimed that integrating the bonus-malus appraisal in the form of a mechanistic approach

within the negotiation process brings **fairness, transparency and clarity**. In addition to that, two out of eight interviewees confirmed that it helps to achieve the specific negotiation target, whereas the remaining interviewees were merely or not confirming.

As mentioned in chapter 4.1, the interviewees used Mechanism Design and the Bonus-Malus appraisal differently as a dirty or clean approach. It will be made clear in the following.

Interviewee 1 has confirmed that it helps to attain the priorly defined negotiation target a lot and that the party in the buyer position has:

*"the ability to create strong competition in areas wherefrom the starting point no competition has been" – Interview 1 (Minute 8.33)*

Remarkably, interviewee 1 used bonus-malus appraisals in the form of a dirty approach since it has been stated that "you see effects that you would not have seen otherwise" – by having stated this, it indicates that a dirty approach is used. According to Interviewee 1, the process can be subjectively modified to create competition since it is solely about cost focus and achieving the target price.

This opinion had been confirmed by interviewee 7, who stated that meeting the requirements for Mechanism Design Theory is vitally essential to achieve the target and attain the maximum output possible. This being said, it is a two-sided sword since it depends on the one hand on your type (dirty or clean bonus-malus appraisal) that the negotiator is choosing as well as on the other hand, the bargaining power.

If the requirement is met of having a good bargaining power over the supply base, then, according to interviewee 7, the negotiator can design the process according to his benefit. Beyond that, he claims the following:

*"If you have high bargaining power, then you can set up the rules of the game & this is the requirement for an efficient Mechanism Design." – Interview 7 (Minute 10.01)*

He mentioned the topics of fairness and transparency as well. According to him, the integrated fairness and transparency enabled through Bonus-Malus gives sufficiently strong information on what is valued, appreciated, and expected by your supply chain and what is not. This indicates that by allowing and enabling a certain degree of transparency, the supplying company has a guideline on customizing the item to be purchased according to the buyer's desires. He concluded this thought by mentioning that it is "a wonderful tool for both sides".

This has as well been mentioned by Interviewee 5 who claimed that it gives support to the supplier's focus in terms of how the offer can be modified to be more attractive and reach a better position to have the contract awarded in the end. She mentioned that it does not need to be necessarily the price; however, the criteria set within the mechanism gives input on everything regarding the setting, such as the negotiation design and the mode.

With regard to the clean approach, Interviewees 2,3, and 4 indicated its provided benefits and its consequences. Herewith, interviewee 2 says clearly that through the mechanism of Bonus-Malus in Mechanism Design Theory, however as well in general, full-commitment and full-comparability are established to enable a fair process. Thus, it helps achieve the negotiation target and better relationships with the supplier since it is an open book negotiation. This forms the relationship before the negotiation process.

Interviewee 3 claims that the integration of Bonus-Malus as a clean approach **makes the suppliers comparable** based on the evaluation criteria. She mentioned is that there is still space in order to make it even more comparable and transparent. These aspects will be further discussed in chapter 4.3 concerning objective versus subjective evaluation.

Interviewee 4 mentioned that the negotiator can **receive a total cost of ownership to the optimal decision at all times**. Having said this, he reasoned his statement by claiming that by having set clear criteria for Bonus-Malus appraisals, a consistent evaluation is assured. Further, it gives a clear view of the total value and the total cost of the item to be purchased. However, he mentioned that Bonus-Malus, in his case, is not necessarily connected to the Mechanism Design Theory.

To summarise finally, Mechanism Design Theory, in combination with Bonus-Malus, can add clarity, transparency and fairness to the process since both parties play an open game that benefits both parties. Further, it strongly depends on the bargaining position on how the negotiator can apply the Mechanism Design in the specific negotiation case.

## 4.3 Limiting factors of mechanisms within adverse effects

Interesting to observe is that different interviewees see different limitations within the applicability of Mechanism Design Theory.

Interviewee 1 is, as priorly mentioned, pursuing a cost-focus for routine commodities. He claims that a purchaser in his industry is not in the position to apply a mechanistic approach such as Bonus-Malus too often because "if the supply market finds out that you use mechanisms subjectively, they might want to reject their participation." Thus, it would harm the company's credibility and trustworthiness, resulting in the scenario that "suppliers that a purchaser wants to do business with do not want to do business with you" (interviewee 1). This is confirmed by interviewee 3, who claims that the information exchange among suppliers can **harm buyer's credibility and risks future cooperation**. Beyond that, interviewee 7 observes that collusion could harm the effectiveness of the Mechanism Design Theory towards the negotiation outcome in market cartels.

Further, the topic of **objectivity** is seen as very crucial for various reasons. Interviewee 1 states that the purchasing company wants to have the last awarding right and thus, it can never be 100 percent objective. This is also confirmed by interviewee 3. Interviewee 2 and 5 mention that it has to be done relatively, and thus objectivity has to be completely guaranteed. With, according to them, the correct application, no limitations shall occur.

Interviewees 1, 3, 4, and 7 are describing that the **competition needs to be present**. Thus, there is the limitation of limited bidding, meaning that there is no sufficient comparability and dynamic in the process, which makes it challenging to modify with the mechanisms.

Interviewee 2 has mentioned that he sees no limitations in the case that mechanisms are applied correctly. However, he assumed that it could be possible for various companies to consider it too **complex to monetise all non-price-related factors**. However, it needs to be focused solely on the most important ones. He states clearly that "every aspect and variable is quantifiable."

Regarding the **degree of fairness**, interviewees 1 and 7 stated certain exciting assumptions. Interviewee 1 said that showing a "manipulated" value to the supplier, which is consequently changing the supplier's position in the auction, is a very ordinary behaviour by the buyer but occurs in literally every negotiation. Giving the winning supplier the information that he is in the first

place is strategically wrong since the purchaser wants to receive the best possible offer. However, the awarding is communicated at a later stage.

Interviewee 2 and 6 state that every company has to **decide in the very end based on price** because there is a specific predefined price target by the company which needs to be achieved. According to interviewee 2, the reason is that "in an economy in which player act who in the end want to make revenue, have to decide based on money, meaning that they quantify everything and the question herein is if a purchaser is doing it explicitly, being said with a bonus-malus, or implicitly by comparing prices and deciding consequently."

Interviewee 7 claims that using mechanisms to cut down prices heavily would be harmful to companies in the premium segment since the premium segment has not chosen to search for the cheapest provider in the market. According to him, if a premium league company searches for the cheapest provider and the cheapest price, specific criteria will suffer. The quality, in most cases, will decline due to the cost factor. As the previous chapter mentioned, for a cost-leader in a market, it is a benefit.

Interviewee 3 and 4 would always avoid using the term “Mechanism Design Theory” in front of their suppliers because they see the risk that many suppliers put trustworthiness and credibility of the company into question but also see then the scenario coming that many suppliers would decide not to participate in such an auction. This would result again in limited bidding.

Interviewee 8 states regarding the problem of limited bidding that if a purchaser would consider the auction game from a theoretical angle, there has to be just one supplier in an auction and there could be further artificial dummy suppliers within the auction. However, since this would morally be wrong and would be against any company’s conduct, nobody would pursue that.

Fairness a purchaser brings into the auction game, subjective behaviour to influence the awarding process, limited bidding, and manipulating the auctioning process are hence limiting factors in the application of Mechanism Design Theory.

## 4.4 Enhancing strategies to overcoming undesirable situations

Firstly, a very frequently mentioned enhancing strategy to overcome limitations is the **alignment of interests** between buyers and suppliers. Hereby, interviewee 3 states that this is important, especially for strategic parts where it is vitally important to guide through a brainstorming and meeting phase with the supplier. Her example is the information exchange on innovative capabilities for a new product. However, with regard to this strategy, she limited herself to the fact that the strategy is commonly executed with other negotiation modes, preferably offline, but not in an auction. Differently, interviewee 4 gave the input that it is crucial to understand the incentives of suppliers and monopolists. According to him, "as a buying firm, you should not start the communication by auction but instead should be with the supplier ahead to understand what do suppliers want and give for both an optimal outcome" (interviewee 4). Thus, communication is highly contributing towards a cooperative and positive relationship between buying and supplying firm.

This is also confirmed by interviewee 6 who considers it vitally important in a procurement job to understand the triggering points and their key accounts. Hereby, it could also come to a compromise for both companies, even if it is, according to interviewee 6, not easy and very rare to find both companies agreeing on a particular topic. In the end, he concluded that the term "partnership” is often misused and wrongfully interpreted.

This leads to the second point that most Interviewees 1, 2 and 7 consider a **cooperative attitude** is essential. According to interviewee 1, there is an open book policy in the automotive industry in which every participating company is informed ahead about the procedure. He constrained it as there remains the question of what is fair and how open a buying company is playing towards the supplier. In addition, interviewee 2 claims that generally, a cooperative attitude towards the supplier is better than a competitive one. He reasons that the buying firm is trying to accomplish the best decision for themselves. However, it still depends on the supplying firm and is consequently obliged to cooperate with it. Interviewee 7 explains further that the detailed explanation and communication with the supplier and the commitment for a bonus-malus can help justify the procedure in a later stage when some dynamics or disagreements occur.

A third apparent enhancing strategy for a practical accomplishment of the negotiation target with Mechanism Design Theory is the **assurance of objectivity**, as strongly highlighted by interviewee 2. According to him, objectivity in the utilisation of Bonus-Malus drives the tool's effectiveness and prevents limitations from occurring if it is done correctly. Interviewee 3 has given the following advice on what could be done to achieve objectivity:

*“Purchasers should never make decisions in isolation but instead cross-functionally over departments and try to make the decision together about all aspects from all participants.” Interview 3 (Minute 16.39)*

Other interviewees also mentioned cross-functionality because if a purchaser is doing it cross-functionality, a buying company knows certainly what the coherent and essential set of criteria for the Bonus-Malus appraisal as a mechanistic tool is. Further, interviewee 2 mentioned that for the system of Bonus-Malus, everything could be expressed in formulas to make the system transparent for everyone and assure further objectivity in the process.

**The role of artificial intelligence (AI)** is seen as crucial by many interviewees in the sense that they could not imagine how it could work for any negotiation. Interviewee 5 assumes that she knows companies applying AI for simple tasks within negotiations; however, she does not see it coming for complex negotiations. Beyond that, interviewee 1 assumes that AI could be applied to transform non-price-criteria in variables and share his interest in this field. Interviewee 7 assumed that he considers it currently unrealistic that AI tools could support the negotiation process. However, he made a forecast for the future, stating that he assumes, within the upcoming 10 years, technology will be advanced to enable two machines to negotiate with each other, and no or limited human resource is required.

Regarding the issue of limited bidding, interviewee 1 made the experience that when it is evident that the target is not achievable due to limited bidding, he *stopped the auction process* and tried to find an alternative model or solution. In addition, he claimed, and this was also confirmed by interviewee 2 that since a supplier pre-qualification is always taking place ahead as an entry requirement, these events take place rarely.

As the last topic, it has been mentioned how to cope with monopolists in an auction. Interviewee 4 states that there should always be *alternative approaches* for monopolists since “there is limited competition within the process which is against a requirement of Mechanism Design Theory and especially there, it would make sense to go for an approach where you use more psychological economical aspects” (Interviewee 4). Interviewee 5, however, approaches this scenario differently and states that the situation that suppliers do not want to participate in an auction always occurs with the "big players." Hence, strategy-wise, the

purchaser makes an explicit offer which means that it is appropriate not to attend the auction but to offer the best price via E-Mail. There will not be any further discussion, and it is regarded as an exclusive offer. This strategy requires, according to interviewee 5, a strict timeline and should be consequently coordinated ahead.

At the very end, different issues require different solutions and every interviewee has their approach to tackle the problems. Nevertheless, a suitable collective of possible solutions to overcome limitations shall provide support for future negotiations.

# 5. DISCUSSION OF FINDINGS: INTEGRATING RESULTS AS PRACTICAL IMPLICATIONS

## 5.1 Influencing the rules and setting of the negotiation

As described, Mechanism Design Theory is describing a tool for influencing the negotiation setting and outcome (Maskin, 2019, pp.1-2). From the interviews, multiple experts say that also with other mechanistic approaches the outcome of a negotiation can be modified and influenced. Namely, Bonus-Malus appraisal is influencing the outcome in two perspectives. First, it makes on an objective base the competing suppliers comparable on subjective criteria, but gives the incentive for the supplier to modify a certain product to have the contract awarded. Generally, Bonus-Malus describes a criteria-based comparison function. Following section will focus more detailed on different applications and how these could be best used.

## 5.2 Case-specific application of Bonus-Malus System as a mechanistic tool in negotiations

Mechanism Design Theory (MDT) is a tool that is different from the conventional game-theoretical approach applied to design the rules and the requirements for the game (Zhou, 2016, p. 346). As argued by Interviewee 1, the negotiator can design the process to his benefit. As confirmed by interviewee 7, to efficiently apply MDT, the buyer's bargaining power is crucial to convince suppliers to participate in any negotiation mode (Rahwan, Sonenberg, & McBurney, 2004, p. 177). Further, mechanistic approaches such as Bonus-Malus appraisals can lead to mutual satisfaction because it indicates what is valued and appreciated by the buyer. The supplier can, in best case, customise his product accordingly. Thus, it achieves mutual satisfaction for buyer and supplier through fair and transparent communication while meeting the requirement of a sufficient number of participants within the game to firstly apply MDT and secondly compare them with Bonus-Malus and can be confirmed by the interviews (Fugger et al., 2016, p. 518f; Jin & Wu, 2002, p. 22; Lee, 2012, p. 610).

Interviewee 7 indicated concerning the aforementioned clean and dirty approach of Bonus-Malus appraisal differences in product specifications and conditions in which cases each approach could be applied. Generally, Bonus-Malus is a pricing-based product-related driver calculated either as a bonus (better position) or malus (worse position) in order to make suppliers comparable (Charpentier, David, & Elie, 2016, p. 2f). Followingly, Bonus-Malus is partly understood as an influencing tool of Mechanism Design Theory. It needs to be considered separately.

### *5.2.1 Dirty Bonus-Malus System*

The dirty Bonus-Malus System has, in most cases, as elaborated by the interviewees, the same effect on the negotiation target as the clean approach, which will be discussed in the later stage of this chapter.

As indicated by Interviewee 1, this approach allows

*"the ability to create strong competition wherefrom there has not been competition" (minute 08.35 – Interview 1)*

It needs to be understood that the approach is subjectively modified in order to attain the negotiation target. Having said this, applying the dirty approach is all about heavy cost-engineering and about getting the best price possible. Thus, it cannot be used for premium-segmented A-class commodities but rather for price-leading C-commodities. With regard to Table 1, it is visible that the subjective approach and the crucial style of the dirty Bonus-Malus lead to limited applicability within the auction and negotiation procedure. If purchasers applied it in the premium segment, consequently, the material quality might risk suffering under the low-cost and heavy cost-engineering as indicated by an interviewee. Implications on the application of Bonus-Malus are to use it for C-part commodities in a limited frequency while letting it become not too subjective. Adverse consequences would lead to a lack of trustworthiness and a harmful impact on the buyer-supplier relationship or the firm's credibility.

On the one hand, the dirty Bonus-Malus system contributes to actively influencing the negotiation to get the best out of it for the buying company and still owing the last voting right while doing a fair play on the surface by communicating openly that a Bonus-Malus system is applied. However, because it is not entirely communicated how Bonus-Malus is applied, it remains crucial if it is thus a fair tool to integrate it in the way how it is used in the case of heavy cost-engineering.

### *5.2.2 Clean Bonus-Malus System*

Differently, the clean approach is an objective form of evaluating the suppliers without any subjective influences. As the dirty approach, the only subjective influence is that the criteria for the product with which a bonus or malus is given are formulated. To effectively utilise the clean Bonus-Malus system, there have to be already mentioned enough suppliers to be compared. According to the items' specifications, the clean Bonus-Malus serves as a tool to transform several non-comparable suppliers into comparable objects. Through the clean comparability, it is assumed that the factor of fairness is assured so that there is an establishment of an equal chance to receive the contract with the buyer (De Quidt, Fallucchi, Kölle, Nosenzo, & Quercia, 2017, p. 176f). The opinion on the exact number of bidders within the negotiation remains unclear since it differs. Different interviewees are purchasing different commodity types and hence follow a different strategy that requires different bidders. It strongly depends on the commodity to be purchased and what the supplying market is offering to sum it up. With strategic items, usually A-commodities, it is difficult to find a high number of suppliers, whereas there are more suppliers if the item's complexity is shrinking (Xu, Zhao, & Wang, 2017, p. 80).

One extracted benefit of the clean Bonus-Malus system is that it assures complete fairness because criteria have been set up before the auction beginning, and suppliers will be evaluated with regard to the criteria. However, one outstanding disadvantage is that the last awarding right is not entirely existing, which might cause disruptions within the buying company to give away the right to award a particular contract.

## 5.3 The future role of artificial intelligence as a supporting tool within negotiations

As illustrated by Table 1, interviewees neither use artificial intelligence (AI) within their mechanistic designed negotiations

nor in negotiation in general. Differently, two interviewees were interested in the future role of AI in negotiations and how it can change the negotiation process. One interviewee claimed that he could imagine that on a scope of 10 years, AI will be that advanced that two machines are negotiating with each other, first at a more superficial layer but in a later stage also for more complex items.

According to Wheeler (2021, pp. 5-6), AI can help tackle bargaining problems through big data units. In addition to that, he is claiming that with big data, everything can become enabled in the future. Through big data and the collection of multidimensional data, a whole new level of advanced and facilitated negotiation can take place, which has an impact on the one hand on how negotiation takes place and on the other hand, how it will be conducted (Dinnar, Dede, Johnson, Straub, & Korjus, 2021, pp. 66-67).

To the current point in time, distributed artificial intelligence (DAI) provides an example of how AI can support the process. DAI is suggesting computational approaches for decision-making within negotiations (Oliver, 2013, p. 89f).

Regarding the role of AI in the future, it is doubtful which role it will play in the next 10 years. However, it is already foreseeable that AI will influence our way of doing business soon. Thus, the two interviewees who have mentioned that are right about their assumptions for the future. The accelerating role of big data and machine learning can enable a whole new sphere of how negotiations can be conducted.

# 6. LIMITATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

One limitation to this research is primarily the sample size of eight experts from selected industries. Due to this small number of participants, the findings are not representative and cannot be generalised unless not having a size of approximately 60 participants to make it a little more representative (Faber & Fonseca, 2014, pp. 28-29).

Another limitation to the research is that since just procurement experts from three industries, namely consulting, automotive, and renewables, have been interviewed, it is firm biased and unclear if it is applicable for other industries beyond. This can also be seen in the results since the outcomes of each interview are very similar if the interviewees were coming from one company or the same industry, but were varying if these had been cross-industrially. Differentiating factors influencing the results could be the industry, targeted relationship with the supplier, the commodity type to be purchased, and the willingness to cooperate based on the commodity type (Abu Bakar & Peszynski, 2010, pp. 1189-1190).

Hence, it is not easy to find the best practice out of the research conducted because there have been several diverse and differentiating cases. This gives an incentive for future research in the sense of looking more in detail on the four aspects analysed in this research, namely use case, benefits and limitations, and strategies to overcome limitations, but with a more robust case focus. This is research required on what role Mechanism Design Theory plays for companies with a high bargaining power or how a particular industry uses mechanistic design and mechanistic approaches. Further, future research should consider the efforts used in order to prepare such auctions and where different benefits lay between a Dutch and English Auction

# 7. CONCLUSION

Striking results of the study showed that the use case is enormously depending on the participants within the negotiation to prevent the problem of limited bidding and vague comparability (Bajari, McMillan, & Tadelis, 2009, p. 372f). Further, it can be derived that Mechanism Design Theory in an auction is used for commodities characterised by high and low supply risk and cost-impact items. Most interviewees indicated that they rarely use Mechanism Design Theory as a tool in an auction but rather use it differently, primarily offline negotiation modes. Thus, Mechanism Design Theory's efforts are more justified when negotiating strategic parts rather than low-cost items. With regard to auctions, procurement experts tend to use a mechanistic approach known as Bonus-Malus System to make suppliers comparable with each other.

Respecting the requirements above, using mechanistic approaches, on the one hand, can help to achieve the negotiation target. It creates competition among the participants and supports through the full-comparability achieved through Bonus-Malus. On the other hand, what limitations can occur depends strongly on which focus the user is applying. If the purchaser plays dirty, the game is subjectively influenced, which can harm the firm's credibility and influence the willingness to cooperate. Further, limited bidding can introduce the issue of not achieving good comparability and a lack of competition, which would not lead to the desired target in the case of an auction. Hence, objectivity needs to be assured through many variables, communication with suppliers shall be assured. If the process is becoming too complex and seems not to work as intended, it should be switched to another negotiation mode.

A theoretical implication to this research of relevance and applicability of the Mechanism Design Theory is that case-specific stage preparation should be analyse with regard to the in-case details and requirements for applicability either in auctions or in other negotiation modes to assure its full potential also in cross-industrial context. The practical implication is rather considering the applicability of the Mechanism Design Theory in which case and in which negotiation mode it can be applied and thus adjust the preparation phase accordingly to its approach. Thus, companies can apply the cost-only or dirty approach of the Bonus-Malus System when having a low-cost item where it does not essentially matter which relationship is targeted. In contrast, a clean approach based on different criteria can lead to full comparability of the suppliers and show them which supplier fits their pre-determined criteria list. Having strategic items, it is very advisable to change the auction mode because purchasing strategic or critical items requires a different negotiation mode due to the complexity and possible customisation of the item itself.

Concluding, Mechanism Design Theory is a powerful tool to attain a predefined negotiation target. In comparison to Game Theory, it enables the negotiators to design the rules and setting of the negotiation, which facilitates the process a lot. However, the scope of utilisation and applicability regarding the use case needs to be analysed cross-industrial since the Mechanism Design can be applied differently according to the focus target.

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## Appendix A: Draft from Interview Guide

| Aspect | Question |
|---|---|
| Introduction | What is your current job title?<br>In which industry are you operating?<br>What is the size of your company in terms of revenue / employees?<br>What is your experperince with auctions? |
| Auction Preparation | How do you prepare auctions?<br>a) What functional areas are involved in the aution preparation?<br>b) What type of auction are you using? |
| Use Case | What type of item / parts are you negotiating about in auction?<br>a) How many suppliers do you have in these auction / assume to be appropriate?<br>b) How important are these parts in terms of criticality & supply risk?<br>c) Would you describe the cost impact as high/ medium/ low? |
| Benefits | Where do you consequently see the benefit in applying mechanistic tools within you negotiations? |
| Limitations | What situations/ conditions do you consider unfavourable? Where do you see limitations?<br>a) What do you think about the fairness of a mechanistic approach?<br>b) Do you think that the number of bidders could be problematic?<br>c) Have you ever experienced dynamics within the negotiation? |
| Strategies to overcome Limitations | What strategies / approaches would you suggest to overcome limitations?<br>a) How do you deal with limitatons? Do you change the approach / method?<br>b) What alternative settings / methods would you suggest if you experience limitations?<br>c) Have you ever used artificial intelligence to support the mechanistic approach within you negotiation? |

## Appendix B: Overview of Interviewees

| Interviewee | Job Title | Industry | # of Employees | Approx. Revenue (€) | Auction Experience | Interview Length |
|---|---|---|---|---|---|---|
| 1 | Chief Supply Chain Officer | Automotive | 3500 employees | ~600M | 30+ | 41.45 |
| 2 | Senior Lead Negotiator | Consulting | <100 employees | <10M | 80-100 | 45.38 |
| 3 | Procurement System Engineer | Automotive | <500.000 employees | several Billions | 25+ | 38.28 |
| 4 | Senior Lead Negotiator | Consulting | <100 employees | <10M | 50-70 | 42.33 |
| 5 | Processes, Systems and Method Specialist | Wind Industry | ~20.000 employees | >1B | 50+ | 58.03 |
| 6 | Procurement Director | Wind Industry | ~20.000 employees | 5-6B | 12 years + | 53.54 |
| 7 | Managing Partner | Consulting | <30 employees | confidential | >100 | 44.56 |
| 8 | Managing Partner Procurement and Supplier Management | Consulting | ~1.000 employees | 220M | diverse | 38.02 |

# Appendix C: Literature-based factors to be researched

| Aspect | Factor | Literature Reference | Quote from interviewee |
|---|---|---|---|
| 1, 3 | Limited Bidding | Herweg & Schmidt, 2017, p.649f | "If we have below 3 bidders, it would have an effect on my efforts but also on the target that I want to achieve." - Interview 1 (Minute 17.53) |
| 1 | Auction Spent Volume | Mornati, 2013, p.66 | "The threshold is determined by efforts versus potential games, hence efforts need to justify efforts." - Interview 1 (Minute 07.15) |
| 1, 2, 3 | Bargaining Position | Hehenkamp, 2007, p.772 | "If you have a high bargaining power, then you can set up the rules of the game and I think that this is a requirement for having an efficient MDT." - Interview 7 (Minute 08.52) |
| 1 | Commodity Type | Kraljic, 1983, p.109 | "We usually do it for strategic parts, but we are in a big company. I can imagine that smaller companies mostly use it for routine and leverage items." - Interview 3 (Minute 06.03) |
| 1, 3 | Bonus-Malus Appraisal | Zettik, 2002, p.36 | "Bonus-Malus is ine key criteria to do a full mechanistic approach." - Interview 4 (Minute 03.15) |
| 2, 3 | Fairness | Maskin, 2019, p.5 | "It needs to be made fairly, transparent and also unbiased." - Interview 3 (Minute 07.23) |
| 2, 3 | Transparency | Thompson, 2016, p.2 | "Automotive industry is applying open book policy." - Interview 1 (Minute 23.43) |
| 2 | Mutual Satisfaction | Lee, 2012, p.610 | "Mutual satisfaction can only exist if there is mutual benefits." - Interview 7 (Minute 17.44) |
| 2 | Commitment | Fugger et al., 2019, p.15-16 | "It is an essential tool to guarantee the full-commitment by both sides" - Interview 2 (Minute 10.01) |
| 2, 4 | Supplier-Buyer Relationship | Sigurdardottir et al., 2019, p.307 | "In the end, I have to fulfill what's good for my company and not for me as a private person." - Interview 6 (Minute 32.04) |
| 2, 4 | Attitude | Aktin & Rinehart, 2006, p.60 | "You can never say up front whether it is a cooperative of competitive attitude." - Interview 5 (Minute 34.58) |
| 4 | Artificial Intelligence | Glöckner et al., 2005, p. 9 | "Using input from two parties, two machienes might negotiate on a scope of 10 years, if possible." -Interview 7 (Minute 26.55) |

For Table 1: 1= Use Case; 2= Benefits; 3= Limitations; 4= Strategies to overcome

# Appendix D: Interview Summary

| Interviewee | Aspect | Answer Summary |
|---|---|---|
| Interviewee 1 | Auction Preparation | 1) Clear overview in articles which are able to be sourced via e auctions<br>2) Important factor is annual spend volume on articles (no auction lower than 50.000€)<br>3) There need to be a proper RFQ for items (collect market data and price data through round of clarification / some sort of a pre-negotiation - optimisation of pricing for items)<br>4) After having received entrance prices - start of execution planning |
| | Types of items to be purchased | low risk items - routine or leverage items / c- items are a grey zone |
| | Benefits | create strong competition / reaches out the limits of its application<br>"you see what is actually possible and see effects you wouldn't have seen otherwise"<br>very powerful to create competition where there hasn't been competition before<br>application of bonus-malus increases the effectiveness of achieving target priorly defined |
| | Limitations | depends on the output you want to achieve<br>you cannot use the tool too often because if supply market finds out that you use Bonus-Malus too often, they might want to reject their participation in future auctions<br>you wanto to control the outcome ("I need the last right")<br>Is it fair to show the supplier in a wrong position due to bonus- malus? - "I guess it happens in all negotiations and you would never tell the winning supplier that he is the winning supplier<br>Harmful for credibitity in terms sof that the supplier claims that "all I see is fake" and thus parties that a company wants to do business with does not want to do business with me.<br>Number of bidder NEVER below 3 because it would have an effect in the efforts - that's why the target of the auction needs to justify the efforts. |
| | Strategies to overcome limits | "I stopped an auction if it was obvious that I would not be achieving my target which is one of my entry requirements."<br>Assumption to variabilise the Bonus-Malus through AI depending on the auction situation in terms of hieght (x euros which justifies either a certain bonus or malus calculation.<br>Aligning interests dependend on how open you play - in automotive, there is an open book policy that is an exchange in quotation analysis form. |
| Interviewee 2 | Auction Preparation | 1) Analysis phase<br>2) Bonus-Penalty Stage<br>3) Preparation / Definition of the awarding design<br>4) Commitment phase /Sign-off phase<br>5) Auction conducting / Awarding |
| | Types of items to be purchased | varies between two and six , sometimes 1 if we do make or buy decisions - high cost impact and not only commodities / indirect procurement |
| | Benefits | Guarantees full committment and full comparability by the buying firm (different variables, not only price)<br>Transparancy - nice tool to create a better relationship<br>Bonus-Malus does not need to be solely a comparison, but can also be given to an allocation |
| | Limitations | "If it is done right, then there shouldn't be any limitation."<br>Complexity of calculating the variables -every aspect/ variable is quantifiable.<br>Every company is in the very end deciding based on money.<br>Limitation could be where you as a buyer do not want to be transparent to supplier because of internal startegic information |
| | Strategies to overcome limits | Assure objectivity<br>Cooperative attitude is better then a competitive<br>But: Bonus-Penalty should generally not hurt you |
| Interviewee 3 | Auction Preparation | 1) Analysis of the environment of the negotiation<br>2) What are the possibilities with the tool you are using/ are you conducting the auction with pen & paper<br>3) You have to organise everything (invite suppliers, online vs offline, conduct auction |
| | Types of items to be purchased | around 4-5 suppliers at least.<br>We do it for strategic items with high impact but smaller companies would do it mostly for routine and leverage items.<br>Most suitable for transaction-oriented relationship. |
| | Benefits | You can monetarise every variable within the mechanistic approach.<br>We are that our partners are commited to us because we depend on them (delivery, time etc.) & everything can be fixed through Bonus-Malus.<br>It makes suppliers comparable. |
| | Limitations | It needs to be made fair, transparent and unbiased.<br>Exchange between suppliers can occur if a clean approach is applied - can harm credibility & that's why it is important to play fair.<br>It is not always 100% objective as it should supposed to be.<br>Sometimes, it is hard to calculate the cost for each variable.<br>Only transparent under full-committment and fair play. |
| | Strategies to overcome limits | Don't make any decisions in isolation, rather cross-functionally<br>Everything can be expressed in formus to assure full comparability<br>Alignment of interest is also good for integrating innovative capabilitiesbut there auctions might not be the best tool for that topics / items |

| Interviewee | Aspect | Answer Summary |
|---|---|---|
| Interviewee 4 | Auction Preparation | With Bonus-Malus, cross-functional alignment with all decision makers and stakeholders which aspects besides pricing are relevant to the awarding decision - afterwards clarify what are the differeneces between the suppliers. |
| | Types of items to be purchased | With mechanistic design, there need to be at least two suppliers (roughly 50% of the cases).<br>Other auctions vary between 6-10 suppliers.<br>A-Class type of commodities but more effort needed needs be justified.<br>no specific risk (can vary if the supplier assures low risk delivery). |
| | Benefits | Guarantees to receive the total cost of ownership to the optimal decisions at alltime and you know what the optimal decision is because it's based on the evaluation.<br>However, there is no ONE auction that could fit - it is optimal in any case. |
| | Limitations | It is potentially harder to evaluate subjective criteria but it should be anyways evaluated the criteria.<br>Requires competition to fully use it.<br>Should never become too mechanistic.<br>Never use the term "Mechanism Design Theory" in front of your supplier.<br>Generally, there are not much limitations if it is done right. |
| | Strategies to overcome limits | you need other approaches for monopolistic approaches where there is limited competition and where it makes sense to go for an approach where you use more psychological economical aspects.<br>It is important to understand the incentives of the suppliers as well as in monopolistic game-theoretical approaches.<br>Give both the best outcome, if possible.<br>Solely use real and correct informatition. |
| Interviewee 5 | Auction Preparation | 1) We start with a "who can win what" template<br>2) Bonus-Penalty Stage<br>3) Commitment Paper Phase<br>4) Best Auction Type (Choosing for one type) |
| | Types of items to be purchased | Depending on the item that we are purchasing - everything is possible. |
| | Benefits | Bonus-Malus is a good function and gives the supplier support with your focus - not necessarily price.<br>Supplier can see what might be an important aspect and can modify the item accordingly to receive a bonus<br>It makes suppliers comparable and gives a better indication on preferred supplier.<br>It provides a catalogue of criteria for everything. |
| | Limitations | It can be used mechanistic in a sense that buyers cut down prices heavily.<br>Subjectivity is a problem and thus a buyer needs to be able to answer on certain set priority.<br>Committment from both sides is very important. |
| | Strategies to overcome limits | Requesting exclusive offer if supplier is not willing to participate in auction (mostly with monopolists).<br>AI is only possible if you have same projects and products<br>Cooperative attitude is good, but one cannot say upfront if it's cooperative or competitive |
| Interviewee 6 | Auction Preparation | 1) Understanding via an analysis of the sitituation / is an auction suitable or not?<br>2) Aligning technical and commercial requirements<br>3) Bundling tthe global volume over time from the region<br>4) Comprehensive RFQ preparation<br>5) Integrating received data into Bonus-Malus<br>6) Start auction design<br>7) Which commitment can I give my partner after having selected necessary information? |
| | Types of items to be purchased | mechanical / electronic componenets - usually aournd 350M € annual volume<br>It varies from strategic (loop cable) to routine items (electronic components).<br>A lot of suppliers in the market but depending on the item that you want to purchase. |
| | Benefits | It is transparent and it is compliant<br>Relationship with supplier is maintained to be good but it shouldn't be too close since we are dealing with a rotating duty.<br>You can make a clear comparison.<br>It is up to you if you use it as a price-only tool - depending on the targeted relationship.<br>Achieve better results. |
| | Limitations | Adding variables rises competitiveness<br>Subjectivity is a problem. - Because it is done by human it is somehow biased. |
| | Strategies to overcome limits | No one is forced to do anything.<br>Cross-Functional Decison-Making for Objectivity. |

| Interviewee | Aspect | Answer Summary |
|---|---|---|
| Interviewee 7 | Auction Preparation | 1) What is important for the buyer / customer in terms of qualitative asoects, not only quantititative<br>2) Quantify the qualitative aspects |
| | Types of items to be purchased | Typically startegic high-impact intems / but also low-cost items (it can vary).<br>We use the Kraljic Matrix to assess this.<br>Criticality depends on the product to be purchased |
| | Benefits | MDT gives the intelligence to design the right auction for the process.<br>It can maximise the output.<br>"If you have the bargaining power, then you can set up the rules of the game and I think that this is a requirement for having an efficient design." |
| | Limitations | You should always try to monetarise your competitive advantage<br>Differentiation between clean and dirty approach.<br>Potential collusion between suppliers in cartels. (Dynamics between participants) |
| | Strategies to overcome limits | Intelligent MDT is really the foundation for furture AI project so I think that the topic of the dissertation is (MOST OF AUCTION PROCESSES ARE STUPID AND THERE IS NO INTELLIGENT DEISGN BEHIND IT; BUT WITH PERFECT BM IN PLACE YOU HAVE A STRONG MARKET DESIGN AND YOU WILL BE SUCCESSFUL IN THE FUTURE NEGOTIATIONS)<br>Being able to explain the Bonus-Penalty |
| Interviewee 8 | Auction Preparation | Step 1: Evaluation if an auction really makes it sense?<br>Step 2: When to use it / in which stage? (usually last stage in tender process)<br>Step 3: In which supplier environment are we acting?<br>Step 4: clear plan and which auction type to be used? |
| | Types of items to be purchased | minimum 2 suppliers but actually ideally 5 suppliers<br>Auctions are used to purchase routine or leverage items if we reagrd it from the angle of Kraljic<br>For more strategic items, the supplier and buyer want to do it face-to-face |
| | Benefits | Makes it comparable<br>achieve the target priorly defined more effectively |
| | Limitations | If dirty, you are able to influence the target<br>It neefs to be played fair and transparent<br>Limited number of bidders in the auction |
| | Strategies to overcome limits | Normally, I would switch the negotiation mode but it would not occur due to a proper analysis before. |