Strategic supplier selection: the importance of process formality in non-automated supplier selection decisions

Manuel Woschank\textsuperscript{1,}, Patrick Dallasega\textsuperscript{2}, Bernd M. Zunk\textsuperscript{3} and Corina Pacher\textsuperscript{4}

Abstract: Industry 4.0 mainly focuses on the application of modern technologies (digitalization) and the changing role of human beings (digital transformation) in modern production and logistics systems. Besides the basic principles of digitalization, interconnectivity, and autonomization, the importance of human-centered decision-making processes, such as the selection of strategic suppliers, is also increasing, as complex, novel, and unstructured decisions cannot be fully computerized. In this context, there is still a lack of understanding of which formal patterns in the strategic supplier selection process will lead to better supplier performance. Until now, most of the literature emphasizes a minor number of process-related factors in the strategic supplier selection process leading to limited support for the individual decision-maker. This study introduces a cause-effect model that extends prior research by investigating the impact of process formality, as a comprehensive measurement construct of target-, information-, organization-, and heuristics-related process factors in the strategic supplier selection process on supplier performance and purchaser satisfaction. Based on the usage of variance-based structural equation modeling in a large-scale field study, a significant relationship between process formality and supplier performance as well as between process formality and purchaser satisfaction is substantiated.

Subjects: Production, Operations & Information Management; Strategic Management; Manufacturing Industries

Keywords: Strategic supplier selection; process formality; supplier performance; purchaser satisfaction; Logistics 4.0; Smart Logistics

1. Introduction
In the fourth industrial revolution era, cognitive work becomes more and more important. Operators of future manufacturing enterprises will be asked to perform more complex cognitive tasks inducing the need for advanced aid systems for complex decision support (Baumane-Vitošiņa et al., 2022; Kaiblinger & Woschank, 2022; Rauch et al., 2020). Thereby, the strategic supplier selection process (SSSP) can be seen as one of the most important functions in a manufacturing enterprise to guarantee a reliable and cost-efficient supply of required materials and services for the production process (Arnolds et al., 2013; Irlinger, 2012; Zunk et al., 2020). Specifically, strategic suppliers play an important role in the core competencies of the company, the long-term sales and operations planning strategy, where the supplier is part of a long-time collaboration with the customer company (Durst, 2011; Zunk & Koch, 2014; Zunk et al., 2020). The SSSP can significantly influence the profit of a company and, therefore, is often considered as one of the main sources to
gain a sustainable competitive advantage. Traditionally, the SSSP is focused on cost-, quality- as well as time-orientated targets (Arnolds et al., 2013; Cousins et al., 2002; Zunk & Schiele, 2011). Additional ones, like social, ecologic, environmental, and further targets, like the dependency reduction on a single source of supply, can be mentioned (Schulte, 2009).

Besides, to provide appropriate decision support for the SSSP, the following peculiarities of this domain should be considered: The SSSP consists of non-automated, as well as non-programmable decisions being mostly non-recurring, novel, politic/strategic, complex, and often unstructured. Therefore, the SSSP can be supported by applying heuristics and problem-solving techniques (Elbanna & Child, 2007; Pfohl, 1977; Riedl, 2012; Simon, 1966).

Strategic suppliers usually deliver a crucial product and/or service that can be hardly imitated by other suppliers (Schumacher, 2008) and are, or will be, a part of core-competence-based cooperation (Zunk, 2013; Durst, 2011; Zunk et al., 2020). In addition, in SSSP usually, a single decision-making process takes place, meaning that one single person/entity is responsible for the selection process (Buhrmann, 2010; Dyckhoff & Spengler, 2010; Kaufmann et al., 2014; Riedl, 2012).

Up to now, there is still a lack of understanding regarding which adequate formal behavioral patterns in the SSSP lead to better supplier performance. Dean and Sharman (1993) investigated the relationship between the concept of procedural rationality and decision-making success. According to their results, managers who have systematically collected information achieved better outcomes. Subsequently, Kaufmann et al. (2012b) transferred the concept of procedural rationality to supplier selection decisions. The results showed a significant impact of procedural rationality on financial and non-financial performance. However, the concept of procedural rationality provides only limited support for the design of strategic supplier selection processes because it is mainly limited to the formal execution of information processing activities.

Most of the recent studies identified in the area of strategic supplier selection processes also tend to focus on a limited number of, mainly information-related, process factors in the SSSP, which limits the applicability of the established research findings in terms of process improvement and performance improvement. This paper extends the described information-related process factors in the SSSP by considering a multitude of target-related, organization-related, and heuristics-related factors that are derived from a literature review for the conceptualization of a comprehensive measurement construct for process formality.

Additionally, a high majority of decision support models for SSSP consider a limited number of economic-based factors for the evaluation of the supplier performance.

Therefore, this paper considers the impact of process formality on economic-based supplier performance factors in SSSP by investigating cost-based measures, as suggested by Kaufmann et al. (2012a), and extends the measurement model by incorporating additional quality-based and time-based measures.

Scientific literature further indicates the non-negligible importance of socio-psychological effects in terms of satisfaction and commitment (Pulles et al., 2016; Schiele et al., 2012; Steinmann & Schreyögg, 2000), which have not been frequently considered in decision support models for SSSP yet. Thus, the proposed research model includes socio-psychological process performance factors specified herein as a subjective measure of the purchaser regarding his satisfaction and commitment with the SSSP and his final supplier selection decision, defined as the purchaser satisfaction.

The remainder of the paper is organized as follows. The second section describes the theoretical foundation of this paper. The third section focuses on material and methods. The fourth and fifth sections report and discuss the results by answering the research questions and describing the implications, limitations, and future research directions.
2. Theoretical foundations

2.1. The concept of process formality

The concept of process formality is defined as a set of reasonable, formalized, and standardized measures for adequate formal behavior in the SSSP. Thereby, the authors postulate that like production processes, SSSP can be improved by using controlled interactions in the course of decision-making procedures (Klein & Scholl, 2011; Pfohl, 1977). By conducting a literature review, the authors identified 73 pertinent studies for the conceptualization of the process formality. Moreover, the categorization of the identified studies is based on a grounded theory approach (Böhm, 2000; Breuer, 2010) where the authors defined and coded categories by importing qualitative data, creating preliminary categories, reviewing their convergent or divergent relationships, and redefining the final categories within a circular approach (Equit & Hohage, 2016). Table 1 summarizes the categorizations and findings from the analyzed scientific literature.

According to Table 1, only a handful of studies were assigned to the first cluster of “target-related process factors”. The identified studies focus on the degree of precision of the target system, and the continuous usage of this target system during the SSSP. Most of the identified studies were assigned to the second cluster of “information-related process factors” which relate to the intensity of information supply and information processing activities in the SSSP. In addition, the third cluster was defined as “organization-related process factors”. This cluster measures the level of systematically organized process activities in the SSSP. The remaining studies were assigned to the fourth cluster of “heuristics-related process factors” which investigates the processing of logical problem-solving procedures during the SSSP. Moreover, the authors identified a set of research studies that are mainly based on information-related variables but tend to include additional influencing process factors. These studies were assigned to the cluster “multi-dimensional research studies”.

Most of the identified studies cannot provide extensive answers for the comprehensive understanding of adequate formal behavioral patterns in the SSSP because they primarily focus on isolated or mainly information-based process factors. Literature shows that the consideration of unidimensional process factors does not always have a significant positive impact on the performance outcomes thus increasing the need for more extended models. Therefore, this study comprises the identified target-related, information-related, organization-related, and heuristics-related process factors into a comprehensive measurement construct for the process formality.

2.2. The concept of supplier performance

The concept of supplier performance considers economic-based factors for the evaluation of SSSP outcomes. According to the literature, the authors conclude that the effects of decision-making procedures in business organizations can be measured on 1) the supply chain level, 2) the company level, 3) the department level, and 4) on the level of the individual entity.

Acharya (2012) introduces a set of measures on the supply chain level while researchers like Schenkel (2006) focus on the market success on the company level as an external measure combined with the company-internal efficiency. Moreover, Hsu et al. (2008) recommend the measurement of the financial and the overall performance of the company, and Wentzel (2002) used the managerial performance and the budgetary performance in his measurement approach.

On the level of the individual supplier, the supplier performance is mainly measured by cost-based indicators. Kaufmann et al. (2012a) investigate the financial decision effectiveness by measuring total costs, actual costs, price stability, and the meeting of target costs during the supplier transactions. More holistic approaches tend to incorporate additional measures to establish a multi-dimensional construct of supplier performance. Buhrmann (2010) used the non-financial decision effectiveness which includes quality- and time-based measures, and the financial decision effectiveness which includes cost-based measures of the supplier performance. A similar approach is used by Kaufmann
Table 1. Main findings of related literature

| Categorization                              | Main findings                                                                                                                                 |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Target-related process factors              | Hauschildt (1988) emphasizes the importance of target systems in decision-making processes. In decision-making processes, specific target systems do not automatically exist and must therefore be created by using a process of target formulation to fit the overall targets of the enterprise. Researchers like Conant and White (1999), Dyson and Foster (1982), Kenis (1979), Neupert (1987), and Schinkel (2006) show a significant relationship between the formalization of targets in decision-making processes and various efficiency-related measures. Claycomb et al. (2000) highlight a clear interaction between the degree of formalization in decision-making processes and the market performance respectively the financial performance. According to Geißler (1986), a missing definition of targets can be the starting point of failures by causing constitutional, procedural, and personal problems in decision-making processes. Redl (2012) identifies a significant relationship between the determination of relevant decision criteria before the supplier selection as part of a decision process decomposition strategy, which is linked to the residual uncertainty that affects the supplier's strategic capabilities and the financial supplier performance. Buhrmann (2010) acknowledges a significant impact of the decision task decomposition variable, on the non-financial decision effectiveness respectively on the financial decision effectiveness. Thereby, the decision task decomposition variable includes the determination of relevant decision criteria, the splitting of the decision into smaller pieces, and the determination of specifications before the supplier selection. |
| Information-related process factors         | Theoretical discussions regarding the conceptualization of information-related process factors were conducted by Bourgeois and Eisenhardt (1988), Segars and Grover (1998), Dyson and Foster (1982), Greenley and Bayus (1993), Premkumar and King (1994), and Wild (1982). Bronner et al. (1972) have investigated that participants in laboratory experiments never used all theoretically available information. The investigations by Cramme (2005) show a significant correlation between the information demand activities, coming from personal resources (e.g., suppliers) and the decision-making efficiency. Moreover, the results show no significant correlation between the information demand activities from impersonal resources (e.g., market data) and the decision-making efficiency. The studies by Witte (1988; 1972a; 1972b; 1972c) provide valuable, but sometimes controversial insights. For example, the researchers found no significant relationship between the information demand and supply activities and the efficiency of the decision-making processes. However, further studies, e.g., Molloy and Schwenk (1995), Moon et al. (2003), Premkumar and King (1992), Venkatraman and Ramanujam (1987), demonstrate a significant correlation between the usage of information technology and reference processes generally and an increase in the decision-making performance. |
Table 1. (Continued)

| Categorization                        | Main findings                                                                                                                                                                                                 |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organization-related process factors  | Some basic conceptualizations of organizational activities in decision-making processes can be found in the studies by Pfahl (1977), Graver and Segars (2005), Segars and Graver (1998), and Venkatraman and Ramanujam (1987). Joost (1975) notes that organizational activities are distributed over the whole duration of the decision-making process. Increased organizational activities will lead to higher transparency and higher efficiency in decision-making processes. John and Martin (1984) postulate that the organizational structure significantly influences the credibility and utilization of planning and decision-making activities. Langley (1989) states that the formal analysis of problem-solving processes acts as glue within the interactive processing of the necessary process activities, generating organizational commitment, and ensuring continuing action. Schenkel (2006) postulates that the clarification of frameworks and tasks as well as the personal and temporal assignment of tasks need to be perceived as indicators of the formal quality which directly affects the quality of the planning process. |
| Heuristics-related process factors    | Theoretical investigations, e.g., Moon et al. (2003), Wild (1982), Bourgeois and Eisenhardt (1988), and Pfahl (1977), recommend the usage of heuristics, reference processes, and reference models in managerial planning and decision-making activities. For Buhmann (2010), both the prioritization of evaluation criteria and the assignment of weight before the supplier evaluation are part of the concept of the decision task composing variable which significantly impacts the non-financial decision effectiveness (e.g., quality targets) respectively the financial decision effectiveness (e.g., total costs). Redil (2012) defines the prioritization of evaluation criteria and the assignment of weight before the supplier evaluation as part of his conceptualization of the decision process decomposition which significantly affects the residual uncertainty leading to increased supplier’s strategic capabilities and better financial supplier performance. Additional studies, e.g., Neuert (1987) and Elbanna and Child (2007), note a positive relationship between the application of problem-solving techniques and decision-making efficiency. According to Klein and Yadav (1989), it should be noted that the number of dominant alternative solutions significantly affects the choice accuracy and the choice effort. |
Dean and Sharfman (1993) introduced the concept of procedural rationality, which is primarily based on information-oriented measures. Their results indicate that managers who have systematically collected information and used analytical techniques were more effective than those who did not (Dean & Sharfman, 1996; Dean & Sharfman, 1993). Elbanna and Child (2007) share this view, stating that procedural rationality has an impact on organizational performance. Acharya (2012) investigated that procedural rationality did not have any effect on the total costs of the supply chain, but the interaction of information availability and procedural rationality influenced the overall supply chain performance. In recent studies, Kaufmann et al. showed a significant impact of procedural rationality on financial as well as non-financial performance (Kaufmann et al., 2012b). Moreover, Kaufmann et al. (2014) found that procedural rationality in sourcing teams enhances cost performance. Additional significant effects of procedural rationality in supplier selection decisions were identified for the reduction of residual uncertainty in Chinese and US samples on the financial and non-financial performance (Kaufmann et al., 2014). Besides procedural rationality, the heuristics-based concept of (decision) comprehensiveness by Fredrickson (1984, 1983) is one of the most frequently applied approaches in decision-making research. Fredrickson and Iaquinto (1989) found that changes in organizational size, executive team tenure, and the level of team continuity were associated with changes in comprehensiveness. In another study, Atuahene-Gima & Li, 2004) discovered a positive relationship between comprehensiveness and new product performance, while Nooraie (2008) demonstrated that the decision magnitude is significantly associated with the level of comprehensiveness in the decision-making process. Similarly, Simons et al. (1999) pinpoint that comprehensiveness partly moderates the relationship between team diversity variables and financial performance.

| Categorization                                      | Main findings                                                                                                                                 |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Additional multi-dimensional research studies        | Dean and Sharfman (1993) introduced the concept of procedural rationality, which is primarily based on information-oriented measures. Their results indicate that managers who have systematically collected information and used analytical techniques were more effective than those who did not (Dean & Sharfman, 1996; Dean & Sharfman, 1993). Elbanna and Child (2007) share this view, stating that procedural rationality has an impact on organizational performance. Acharya (2012) investigated that procedural rationality did not have any effect on the total costs of the supply chain, but the interaction of information availability and procedural rationality influenced the overall supply chain performance. In recent studies, Kaufmann et al. showed a significant impact of procedural rationality on financial as well as non-financial performance (Kaufmann et al., 2012b). Moreover, Kaufmann et al. (2014) found that procedural rationality in sourcing teams enhances cost performance. Additional significant effects of procedural rationality in supplier selection decisions were identified for the reduction of residual uncertainty in Chinese and US samples on the financial and non-financial performance (Kaufmann et al., 2014). Besides procedural rationality, the heuristics-based concept of (decision) comprehensiveness by Fredrickson (1984, 1983) is one of the most frequently applied approaches in decision-making research. Fredrickson and Iaquinto (1989) found that changes in organizational size, executive team tenure, and the level of team continuity were associated with changes in comprehensiveness. In another study, Atuahene-Gima & Li, 2004) discovered a positive relationship between comprehensiveness and new product performance, while Nooraie (2008) demonstrated that the decision magnitude is significantly associated with the level of comprehensiveness in the decision-making process. Similarly, Simons et al. (1999) pinpoint that comprehensiveness partly moderates the relationship between team diversity variables and financial performance. |
et al. (2012b) by measuring the cost-based supplier financial performance together with the quality- and time-based supplier non-financial performance. Moreover, Riedl (2012) investigates the cost-based financial supplier performance and the supplier’s technical-, innovation-, management-, service-, and financial-strength-based strategic capabilities. Other studies measured the cost-based supplier financial performance and the quality- and time-based supplier non-financial performance (Kaufmann & Carter, 2006; Kaufmann et al., 2014; Riedl et al., 2013).

This study introduces a cause-effect model that extends prior research by investigating the impact of process formality, as a comprehensive measurement construct of target-, information-, organization-, and heuristics-related process factors in the strategic supplier selection process on supplier performance and purchaser satisfaction. After introducing the concept of process formality, the supplier performance as the economic-based evaluation of the outcomes of the SSSP is focused on the usage of cost-based measurement indicators that will be measured based on pre-defined targets in comparison to actual economic-based outcomes (Staehle et al., 1999; Wild, 1982). Moreover, the proposed model will include further measures, in particular, quality- and time-dimensions to establish a more comprehensive construct of the supplier performance.

2.3. The concept of purchaser satisfaction
The concept of purchaser satisfaction will be used to measure the socio-psychological effects of the SSSP, which have not been frequently considered in the literature. However, the subjective satisfaction of the purchasing managers can be seen as the driving force behind specific actions in the SSSP, which is based on subjective estimation of the process outcomes (Pulles et al., 2016; Schiele et al., 2012; Steinmann & Schreyögg, 2000).

Neuert (1987) refers to the concept of personal efficiency which measures the satisfaction of the decision-maker in terms of process satisfaction and identification with the achieved results. Therefore, other studies recommend the usage of standardized self-rating scales (Brouër, 2014; Chong & Chong, 2002; Gul et al., 1995). Moreover, researchers like Piercy and Morgan (1990) and Schenkel (2006) measure the satisfaction with the established plan, while researchers like Juga et al. (2010), Saura et al. (2008), and Zhang et al. (2005) turn to various dimensions of the service satisfaction or customer satisfaction as a set of socio-psychological indicators for the outcomes of the decision-making processes. In addition to the economic-based evaluation of the outcomes of the SSSP which will be measured by the supplier performance, this study introduces the purchaser satisfaction as a measure for the socio-psychological evaluation of the outcomes of the SSSP. Thereby, the authors consider the satisfaction and commitment of the individual purchasers with the SSSP and with their final supplier selection decision.

2.4. Hypothesis development
In this section, the authors develop the basic hypotheses for the subsequent investigation of SSSP in manufacturing companies. In line with the literature review, the authors propose that the fulfillment of formal behavioral patterns in the strategic supplier selection process has a significant influence on the supplier performance.

Unfortunately, up to now, only a handful of studies were conducted in the specific areas of purchasing and supply management. Kaufmann et al. (2016); (2012b) used the concept of procedural rationality by Dean and Sharfman (1996); Dean & Sharfman (1993) to investigate the effects on financial as well as non-financial performance in single supplier selection decisions (Kaufmann et al., 2012b). In a follow-up study, Kaufmann et al. (2014) further showed a significant effect of procedural rationality on cost performance and quality/delivery/innovativeness performance in sourcing teams. Moreover, a multitude of valuable studies for the development of our hypothesis and underlying constructs were found in strategic management. In this context, the models identified, investigate the effects of certain rationality-orientated behavioral patterns, e.g., the comprehensives (Fredrickson, 1984), the degree of rational planning behavior (Neuert, 1987), the quality of planning (Pulendran et al., 2003), etc., in decision-making processes on performance
measures, like organizational/business performance (Elbanna & Child, 2007; Goll & Rasheed, 2005, 1997; Papke-Shields et al., 2006; Pulendran et al., 2003; Schenkel, 2006) new product performance (Nooraie, 2008), financial performance (Simons et al., 1999), and overall efficiency (Neuert, 1987).

In this study, the authors postulate that the fulfillment of formal behavioral patterns in the SSSP, measured by the process formality (PF), has a significant impact on the supplier performance (SP). Moreover, the developed research model investigates the relationship between the process formality (PF) in the SSSP and socio-psychological process performance factors, measured by the purchaser satisfaction (PS).

Therefore, the hypotheses to be tested in our research are formulated as follows:

Hypothesis 1. The process formality has a significant impact on supplier performance in the strategic supplier selection process.

Hypothesis 2. The process formality has a significant impact on purchaser satisfaction in the strategic supplier selection process.

3. Material and methods

3.1. Sample and data collection

The empirical study focuses on the investigation of the cause-effect relationships in SSSP in manufacturing enterprises. Thereby, the selection of key informants is regarded as one of the most crucial factors that influence the validity of the established results (Bortz & Schuster, 2010; Kumar et al., 1993). The contact to the units of analyses “purchasing managers in manufacturing enterprises in Central-Europe” was established by using the following three membership directories of logistics and purchasing organizations: BVL (Bundesvereinigung Logistik), BMOE (Bundesverband Materialwirtschaft, Einkauf und Logistik), and MUL (Montanuniversitaet Leoben). Moreover, based on the “NACE” industrial branch classification system, the authors defined manufacturing enterprises as specialized companies that are mainly machine-based and produce larger quantities of goods and services within a specific timeframe, based on the economic division of labor (Dyckhoff & Spengler, 2010; NACE, 2020).

In line with the research design of previous research studies, the participants were asked to recall a specific strategic supplier selection process from the past, which fulfilled the following criteria: The process was conducted within the last twelve months, and the final decision was made by themselves, they were able to assess the supplier performance in terms of price, quality, and time measures, the final decision was not clear in the very beginning, the required purchasing object was a material which was strategically important for the corporate success of the company (Kaufmann et al., 2012b, 2014, 2016; Riedl, 2012; Riedl et al., 2013).

The authors used a field study as a research method and a questionnaire-based survey as a method of data collection. The standardized questionnaire was developed by using state-of-the-art guidelines for empirical research studies (Kirchhoff et al., 2010; Moosbrugger & Kelava, 2012; Porst, 2011) and pre-tested by 23 specialists working in the field of strategic supplier selection processes.

By combining the signed members of the membership directories, the authors generated a list of 3,975 purchasing managers. The final sample consisted of 206 fully completed questionnaires leading to a response rate of 5.2% for the subsequent statistical analyses. The operationalization of the variables is based on the guidelines by Esser (Schnell et al., 2011) for the selection and/or...
Table 2. Variables and measurement items

| Process formality (PF) | Main sources |
|-----------------------|--------------|
| PF_1                  | I had well-defined targets for the supplier selection | Hauschildt (1988); Claycomb et al. (2000); Neuert (1987); Riedl (2012); Buhrmann (2010) |
| PF_2                  | I have reviewed the defined targets during the SSSP | |
| PF_3                  | I have reviewed the defined targets during the final supplier selection decision | |
| PF_4                  | I have searched for decision-relevant information during the SSSP | Dean and Sharfman (1993); Dean and Sharfman (1996); Kaufmann et al. (2012b) |
| PF_5                  | I have used a well-defined process for the supplier selection | Neuert (1987); Schenkel (2006); Joost (1975) |
| PF_6                  | I have strictly organized the supplier selection process | |
| PF_7                  | I have used a pragmatic approach (facts & figure-oriented process) for the supplier selection | |
| PF_8                  | I have used well-defined evaluation criteria for the supplier selection | Neuert (1987); Dean and Sharfman (1996); Kaufmann et al. (2012b); Riedl (2012); Buhrmann (2010); Elbanna and Child (2007) |
| PF_9                  | I have evaluated all suppliers based on defined evaluation criteria | |
| PF_10                 | I have accurately elaborated all consequences of a choice | |
| PF_11                 | I have accurately elaborated all differences between all suppliers | |

| Supplier performance (SP) | Main sources |
|--------------------------|--------------|
| SP_1                     | Development of total costs since the beginning of the SSSP | Kaufmann et al. (2012b); Kaufmann et al. (2014); Riedl (2012); Buhrmann (2010) |
| SP_2                     | Price stability since the beginning of the supplier selection | |
| SP_3                     | Comparison of actual costs to costs at the beginning of the SSSP | |
| SP_4                     | Adherence to quality standards | |
| SP_5                     | Frequency of quality complaints | |
| SP_6                     | On-time delivery performance | |
| SP_7                     | Reliability in terms of complete deliveries | |
| SP_8                     | Reliability in terms of on-time deliveries | |

| Purchaser satisfaction (PS) | Main sources |
|----------------------------|--------------|
| PS_1                       | How satisfied are you with the supplier selection decision | Neuert (1987); Bronner (1973); Schröder (1986); Schiele et al. (2012); Pulles et al. (2016) |
| PS_2                       | How do you commit to the supplier selection decision | |
| PS_3                       | How satisfied are you with the process of supplier selection | |

the development of appropriate indicators. In this research, the authors primarily used reflective measurement constructs by using a five-point Likert scale (Cooper & Schindler, 2014). Table 2 displays the variables and measurement items.
3.2. Process formality
Based on the literature review the scale for the independent variable process formality was conceptualized as a comprehensive measurement construct of target-, information-, organization-, and heuristics-related process factors in the strategic supplier selection process. The authors measured the definition and review of targets (Buhrmann, 2010; Claycomb et al., 2000; Hauschildt, 1988; Neuert, 1987; Riedl, 2012), the search for relevant information (Kaufmann et al., 2012b; Dean & Sharfman, 1993; Dean & Sharfman, 1996); the process organization (Joost, 1975; Neuert, 1987; Schenkel, 2006), and the application of heuristics (Buhrmann, 2010; Elbanna & Child, 2007; Kaufmann et al., 2012b; Neuert, 1987; Riedl, 2012; Dean & Sharfman, 1996) in the SSSP.

3.3. Supplier performance
The authors defined the first dependent variable supplier performance as a holistic construct that included a set of economic-based measures. Therefore, the outcomes of the strategic supplier selection process will be investigated by measuring the supplier performance based on costs, price stability, delivery time, and quality indicators (Buhrmann, 2010; Kaufmann et al., 2012b, 2014; Riedl, 2012).

3.4. Purchaser satisfaction
In the model, the second dependent variable was conceptualized as a subjective measure of the supply manager regarding their satisfaction and commitment with the SSSP and with the final strategic supplier selection decision. The purchaser satisfaction was measured based on a set of socio-psychological indicators as an additional measurement variable for the outcomes of the SSSP (Pulles et al., 2016; Schiele et al., 2012; Neuert, 1987; Schröder, 1986; Bronner, 1973).

4. Results
In this section, the authors analyze the results of the statistical procedures that were computed by using IBM® SPSS® Statistics v.27 for the descriptive analysis and SmartPLS® v.3.3.2 for the structural equation modeling procedures.

4.1. Descriptive analysis
The 206 participating manufacturing enterprises pertain to the following branches: 6.3% “Chemicals/Pharma”, 6.8% “Wood/Paper”, 6.8%, “Automotive”, 4.9% “Plastics/Glass”, 20.9% “Mechanical Engineering”, 17.0% “Metal”, 2.9% “Food/Clothing”, 13.1% “Optics/Electronics”, and the remaining 21.4% are assigned to other product-manufacturing branches. Most of the responders (66.1%) had more than 10 years of experience in supply management-related tasks. The average time elapsed since the final decision of the SSP was 5.8 months (SD = 4.3).

4.2. Biases tests
As suggested by Armstrong and Overton (1977), the authors tested the non-response bias by evaluating the representability based on significant differences in earlier and later responses. The conducted ANOVA showed no significant differences in all indicator values between “earlier”, “average”, and “later” received survey responses. This can be seen as another indication of the representability as well as the external validity of the research results.

Moreover, the so-called recalling information bias (Kaufmann et al., 2012b; Srinivasan & Ratchford, 1991) was evaluated by using a T-test. The results showed no significant differences in all indicator values between “recently conducted” and “more elapsed” SSSP.

4.3. Evaluation of the measurement model
For the evaluation of the measurement model, the authors computed Cronbach’s alpha (CBA) values resulting in 0.905 for the PF, 0.921 for the SP, and 0.855 for the PS. All of them are above the recommended value of 0.600 respectively 0.700 and, thus, ensure internal consistency reliability (Hair et al., 2014; Heath & Jean, 1997).
Moreover, the authors consider the composite reliability (CR) as a second measure of internal consistency reliability. The computed values come out at 0.921 for the PF, 0.935 for the SP, and 0.911 for the PS. All computed values are above the recommended limit of 0.700 which further confirms the internal consistency reliability of our measurement model (Fornell & Larcker, 1981; Hair, 2014; Peter, 1979). In the next step, the indicator reliability was computed.

Table 3 displays the indicator loadings. According to the literature, the recommended values for the indicator loadings should not be below 0.400 (Homburg & Baumgartner, 1995; Krasnova et al., 2008). If the indicator reliability is between 0.400 and 0.700, it should only be optimized if the deletion of an indicator leads to an increase in both the composite reliability and the average variance extracted. Ideally, the indicator reliability should be above 0.700 (Hair, 2014). However, all indicators investigated showed values above the recommended threshold in the field study and, therefore, they can be considered as reliable.

In the next step, the average variance extracted (AVE) was calculated. In our case, the AVE values are 0.518 for the PF, 0.645 for the SP, and 0.773 for the PS. All values are above the minimum criteria of 0.400, (Bagozzi & Youjae, 1988) and above the more conservatively defined value of 0.500 (Hair, 2014; Hair et al., 2014) which ensures the convergent validity of the research model.

| Scale items       | Mean value | Std. Dev. | Indicator loadings | Indicator significance |
|-------------------|------------|-----------|--------------------|------------------------|
| Process formality (PF) |            |           |                    |                        |
| PF.1              | 4.223      | 1.002     | .748               | .000                   |
| PF.2              | 4.320      | 0.934     | .808               | .000                   |
| PF.3              | 4.388      | 0.965     | .789               | .000                   |
| PF.4              | 4.078      | 1.056     | .590               | .000                   |
| PF.5              | 3.985      | 1.150     | .635               | .000                   |
| PF.6              | 3.592      | 1.139     | .582               | .000                   |
| PF.7              | 4.218      | 0.950     | .655               | .000                   |
| PF.8              | 4.252      | 1.047     | .766               | .000                   |
| PF.9              | 4.165      | 1.074     | .807               | .000                   |
| PF.10             | 3.825      | 1.095     | .741               | .000                   |
| PF.11             | 3.913      | 1.092     | .744               | .000                   |
| Supplier performance (SP) |            |           |                    |                        |
| SP.1              | 3.985      | 1.005     | .762               | .000                   |
| SP.2              | 4.126      | 1.033     | .802               | .000                   |
| SP.3              | 4.126      | 1.047     | .752               | .000                   |
| SP.4              | 4.209      | 0.963     | .774               | .000                   |
| SP.5              | 3.981      | 1.113     | .827               | .000                   |
| SP.6              | 4.034      | 4.345     | .814               | .000                   |
| SP.7              | 4.345      | 0.959     | .869               | .000                   |
| SP.8              | 4.126      | 0.970     | .817               | .000                   |
| Purchaser satisfaction (PS) |            |           |                    |                        |
| PS.1              | 4.515      | 0.825     | .919               | .000                   |
| PS.2              | 4.393      | 0.853     | .871               | .000                   |
| PS.3              | 4.126      | 0.869     | .847               | .000                   |
Discriminant validity I was evaluated by computing the cross-loadings. Literature suggests that an indicator's outer loading on the associated variable should be greater than any of its cross-loadings (Hair, 2014). This was the chase for all indicators. The computed results thus confirm the discriminant validity of the research model. Discriminant validity II was assessed by concerning the Fornell-Larcker criterion. According to the literature, the square root of each construct's average variance extracted (AVE) values should be greater than its highest correlation with any other construct (Hair, 2014). This holds for all the computed values, therefore further confirming the discriminant validity of the research model. In addition, the Heterotrait-Monotrait Ratio (HTMT) is generated as a third measure for the discriminant validity. The calculations result in the following values: PF→SP: HTMT = 0.628, PS→SP: HTMT = 0.796, PS→PF: HTMT = 0.661. All values are below the recommended value of 0.850, (Hair, 2014) with this third value confirming the discriminant validity of the underlying research model.

In the last step, the authors calculated the indicator significance. As displayed in Table 3, all indicator values are significant and, therefore, below the recommended p-value of 0.050 (Gefen & Straub, 2005).

4.4. Evaluation of the structural model
In the first step, the authors computed the significance of the path coefficients. The results show a highly significant path coefficient for the PF on the SP and a highly significant path coefficient for the PF on the PS. This means that the proposed cause-effect relationships are confirmed in the structural model of the field study (Bortz & Schuster, 2010). Moreover, the values regarding the size of the path coefficients are positive (0.579 for PF→SP respectively 0.603 for PF→PS) therefore in line with the proposed relationships. In addition, the calculated coefficients of determination (R²-values) show positive and moderate values (Hair, 2014). In detail, the results are R²-value for the SP = 0.335, and R²-value for the PS = 0.364. Moreover, the calculated effect size (f²) shows a large effect (f² = 0.503) for the relationship between the PF and the SP and a large effect (f² = 0.572) for the relationship between the PF and the PS (Cohen, 1988; Hair, 2014).

Furthermore, all computed Q² values are above the recommended threshold of 0.000 (Geisser, 1975; Hair, 2014; Stone, 1974).

The predictive relevance of the research model is thus ensured. For an additional assessment of discriminant validity, the authors calculated the collinearity statistics (VIF). Thereby, all resulting values are higher than the recommended minimum value of 0.200 and lower than the recommended maximum value of 5.000 which again confirms the discriminant validity of the research model (Hair, 2014; Kock & Lynn, 2012).

The authors calculated the standardized root mean squared residual (SRMR) for the composite model. In this case, the SRMR value is 0.071 which, according to literature recommendations (Hair, 2014; Hu & Bentler, 1999), can be considered as a good model fit.

4.5. Evaluation of the proposed cause-effect relationships
As displayed in Figure 1, the results of the structural equation modeling calculations show a highly significant relationship (p-value = 0.000) between the PF and the SP. Hence, hypothesis 1 is confirmed, meaning that there is a significant impact of the process formality (PF) in SSSP on the cost-, time-, quality-based strategic supplier performance, defined as the supplier performance (SP).

Moreover, the results of the structural equation modeling calculations show a highly significant relationship (p-value = 0.000) between the PF and the PS. Hypothesis 2 is thus confirmed, meaning that there is a significant impact of the process formality (PF) in SSSP on the purchaser satisfaction (PS), introduced as a subjective measure of the supply manager regarding their satisfaction and commitment with the SSSP and with the final strategic supplier selection decision.
5. Discussion

5.1. Discussion of the research findings
This research contributes to the body of knowledge by enhancing the understanding of which formal behavioral patterns in the SSSP will ultimately lead to better supplier performance and higher purchaser satisfaction.

In a first step, the authors conceptualized a latent construct “process formality” in SSSP which goes beyond the actual state-of-the-art concepts and theories of rational behavior in decision-making processes named procedural rationality (Acharya, 2012; Kaufmann et al., 2014; Dean & Sharfman, 1996), rational processing (Kaufmann et al., 2016), and decision comprehensiveness (Atuahene-Gima & Li, 2004; Fredrickson, 1983; Nooraie, 2008), etc. This was done by comprising target-, information-, organization-, and heuristics-related process factors into a comprehensive measurement model. Based on the behavioral decision-making theory, a multitude of studies was transferred from marketing, strategic management, logistics and operations management as well as supply chain management to the area of supply management. Overall, the developed process formality measurement model comprises a list of 11 multi-dimensional items that were validated by using data from manufacturing enterprises in Central-Europe.

The empirical data confirmed a positive and highly significant relationship between process formality and the supplier performance ($\gamma_1 = 0.576$, p-value $= 0.000$, $R^2 = 0.331$). The findings confirm the hypothesis that the degree of process formality in the SSSP positively affects the overall supplier performance measured by a set of cost-, quality- and time-based indicators. In line with previous studies, this research result highlights the importance of formal behavioral patterns in SSSP processes (Kaufmann et al., 2012b, 2014, 2016).

Furthermore, the empirical data confirmed a positive and highly significant relationship between process formality and purchaser satisfaction ($\gamma_2 = 0.601$, p-value $= 0.000$, $R^2 = 0.362$). This confirms the hypothesis that the degree of process formality, as a measure of formal behavior, in the SSSP shown in Figure 1.
positively affects the satisfaction and commitment of the purchasing manager regarding the execution of the SSSP and the final supplier selection decision. To the best of our knowledge, this has not been considered in the literature yet and thus it can be considered as another novel result of this study.

It can be stated that controlled interactions, which are based on the concept of process formality will have a significant impact on the overall-strategic supplier performance, and on socio-psychological aspects, like the satisfaction and commitment of the purchaser. Thereby, the concept of process formality includes the degree of precision of the target system and the continuous usage of the target system in the course of the SSSP and during the final strategic supplier selection decision, the intensity of search activities for decision-relevant information, the maturity level of systematically organized activities, and the application of heuristics in the SSSP.

From a methodological point of view, this research study applied state structural equation modeling for the multivariate investigation of the proposed cause-effect relationships. These techniques deliver a multitude of valuable insights, e.g., in terms of enhanced validity, reliability, and overall model fit measures which, in contrast to most of the existing studies in supply management which are mainly based application of more “conservative” statistical methods, can be seen as another benefit of this research study.

Moreover, the selected sample is comprising a heterogeneous setting of manufacturing enterprises from different industrial sectors, e.g., metal, wood, automotive, chemicals, etc. Therefore, the provided instruments can be used in cross-sector studies, as well.

5.2. Limitation of the research study
Our research investigates the impact of process formality on supplier performance as well as on purchaser satisfaction within the scope of the individual supplier. As such, this research does not address the impact of process formality on the companies’ performance or the overall performance of the entire supply network.

Moreover, this research focuses on the individually performed SSSP, and therefore, group processes are not considered. Furthermore, our research is limited to the industrial sector of manufacturing enterprises in Central-Europe which limits the transferability of the established research findings in terms of potential cross-cultural differences.

5.3. Implications
Based on the holistic approach of this study, future research has to continue the development of the descriptive decision-making theory by transferring insights from subject-related disciplines to the specific field of the SSSP in manufacturing enterprises which, in the end, should contribute to establishing a more comprehensive theory of supply management. Moreover, in the opinion of the authors, there lies a considerable potential in the application of behavioral theories in supply management and related fields like logistics, operations management, and supply chain management. Besides the in-depth investigation of cause-effect relations between the process formality and various performance constructs, further research should also focus on the company-internal and company-external determinants as well as situational, contextual, and personal variables in SSSP. Thereby, the further investigation of cultural variables and complex group decision-making approaches might play an important role in future supply management research (Stek et al., 2022). Especially in the context of modern Industry 4.0 applications, research should, therefore, also take a specific focus on the investigation of the future role of human beings in smart and sustainable ecosystems (Woschank et al., 2021b, 2022a).

Accordingly, recommendations for action at the company level as well as for vocational training and continuing education at the tertiary level and in the in-company continuing education of future experts will be outlined.
Recommendations for actions at the company level

Management should design and implement a structured SSSP to increase supplier performance based on the developed and empirically validated concept of process formality. Based on the research findings, managers can develop computer-based and/or manual support systems (e.g., handbooks, checklists, guide booklets) for the SSSP. For a comprehensive improvement of the SSSP, the authors strongly recommend considering all the elements of process formality to reach an increased supplier performance. Thus, it is important to recognize that an isolated focus (e.g., the increase of the information quality in the SSSP), will only be partially helpful. Furthermore, the authors highly suggest considering motivational elements (e.g., satisfaction and commitment) as integral aspects in the SSSP (Weller et al., 2021; Zunk, 2015; Zunk et al., 2013). The supply manager’s motivation plays an important role in the SSSP (e.g., especially in the development of the target system, during the information search as well as information processing activities) and during the final supplier selection decision.

Based on the empirical findings of our study, the authors recommend that practitioners should introduce and conduct regular and continuous strategic supplier selection training processes for supply managers. These should concern the phases, planning, instruments, heuristics, and personnel of the SSSP in manufacturing enterprises. This could be implemented, for example, via the development and introduction of short and phased modularized measures, also called microcredentials (Woschank & Pacher, 2020a; 2020b; 2020c).

Recommendations for action in tertiary vocational education and training

The competencies required in the context of SSSP in manufacturing enterprises should also be reflected in the relevant competency profiles of the university to be able to integrate competency development and promotion actively and transparently into the curricula (Pacher et al., 2022; Pacher & Woschank, 2020; Ralph et al., 2022). The authors further recommend the application of laboratory experiments to investigate human behavior in supply management processes (Zsifkovits et al., 2021). This significantly underrated research method should be used as an additional tool for the development of decision-making research by allowing the researcher to design specific frameworks that eliminate possible confounding variables (Deck & Smith, 2013; Kompatscher et al., 2021; Woschank & Pacher, 2020d).

Universities must create more awareness for the SSSP respectively for strategic planning and decision-making processes in general by developing more accurate education programs. Therefore, the multidisciplinary approach on how to integrate and deal with SSSP concepts from the different angles of the respective disciplines is essential (Ralph et al., 2022; Zunk, 2018; Zunk & Sadei, 2015). Moreover, universities should provide opportunities to learn and develop problem-based behavior in managerial planning and decision-making processes to connect theoretical concepts with practical applications (Ralph et al., 2021; Woschank et al., 2021a).

5.4. Conclusions
In a nutshell, this paper investigates which formal behavioral patterns in the strategic supplier selection process (SSSP) in manufacturing enterprises lead to improved supplier performance (SP) and higher purchaser satisfaction (PS). Therefore, the authors propose a latent construct named process formality (PF) incorporates which goes far beyond actual state-of-the-art concepts by identifying target-, information-, organization-, and heuristics-related process factors to empirically substantiate its impact on SP and PS. Therefore, the paper provides a novel elaboration of theoretical constructs and, later on, the empirical substantiation regarding the composition as well as the temporal, personal, and content-relation design of supplier selection processes in manufacturing enterprises, also in a practice-focused intention. Using a large-scale questionnaire distributed to central European purchasing managers, where empirical research is particularly scarce, the two hypotheses were tested and confirmed. A positive and highly significant relationship between process formality and supplier performance was found,
confirming the hypothesis that the degree of the process formality in the SSPP positively affects the overall supplier performance measured by a set of cost-, quality- and time-based indicators. Moreover, the research confirmed the hypothesis that process formality positively affects the satisfaction and commitment of the purchasing manager regarding the execution of the SSPP and the final supplier selection decision. As a result, motivational elements like purchaser satisfaction and purchaser commitment to the formal supplier selection procedures should not be neglected. Finally, for a realignment of the changing role of the human being in modern manufacturing enterprises, this paper further provides empirically-confirmed evidence for training initiatives based on the investigated and corroborated major success factors in the strategic supplier selection process, identified as the constitutional elements of the process formality.

Acknowledgements
This research study is based on the dissertation of M. Woschank (2018) “The Impact of Decision Making Process Maturity on Decision Making Efficiency”. Moreover, this research study is part of project “SME 4.0 – Industry 4.0 for SMEs” which has received funding from the European Union’s Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No. 734713.

Author details
Manuel Woschank
E-mail: manuel.woschank@unileoben.ac.at
ORCID ID: http://orcid.org/0000-0003-1496-3388
Patrick Dallasega
ORCID ID: http://orcid.org/0000-0001-6120-8620
Bernd M. Zunk
ORCID ID: http://orcid.org/0000-0003-0985-4769
Corina Pacher
ORCID ID: http://orcid.org/0000-0002-6700-4220
1 Chair of Industrial Logistics, Montanuniversität Leoben, Erzherzog Johann-Strasse 3/1, 8700 Leoben, Austria. 2 Faculty of Science and Technology, Free University of Bozen-Bolzano, Bolzano, Universitätsplatz 5, 39100 Bozen-Bolzano, Italy. 3 Institute of Business Economics and Industrial Sociology, Graz University of Technology, Rechbauerauße 12, 8010 Graz, Austria. 4 Life Long Learning, Graz University of Technology, Rechbauerauße 12, 8010 Graz, Austria.

Data availability
The authors declare that the data are available on request due to privacy/ethical restrictions.

Disclosure statement
The authors declare that there’s no financial/personal interest or belief that could affect their objectivity, or if there is, stating the source and nature of that potential conflict.

Citation information
Cite this article as: Strategic supplier selection: the importance of process formality in non-automated supplier selection decisions, Manuel Woschank, Patrick Dallasega, Bernd M. Zunk & Corina Pacher, Cogent Engineering (2022), 9: 2094853.

References
Acharya, S. (2012). Impact of procedural rationality on decision making in supply chain management. The IUP Journal of Supply Chain Management, IX(3), 7–23.
Armstrong, J. S., & Overton, T. S. (1977). Estimating non-response bias in mail surveys. Journal of Marketing Research, 14(3), 396–402. https://doi.org/10.1177/00222477701400320
Arnolds, H., Heege, F., Röh, C., & Tussing, W. (2013). Materialwirtschaft und Einkauf. Grundlagen - Spezialthemen - Übungen (12th ed.). Springer.
Atuahene-Gima, K., & Li, H. (2004). Strategic decision comprehensiveness and new product development outcomes in new technology ventures. Academy of Management Journal, 47(4), 583–597. https://doi.org/10.2307/20159603
Bagazzi, R. P., & Youjae, Y. (1988). On the evaluation of structural equation models. Journal of the Academy of Marketing Science, 16(1), 74–94. https://doi.org/10.1007/BF02723327
Baumane-Vitolina, I., Woschank, M., Apsalone, M., Sumilo, E., & Pacher, C. (2022). Organizational innovation implications for manufacturing SMEs: Findings from an empirical study. Procedia Computer Science, 200, 736–747. https://doi.org/10.1016/j.procs.2022.01.272
Böhm, A. (2000). Theoretisches Codieren. In U. Flick, E. von Kardorff, & I. Steinke (Eds.), Qualitative Forschung. Ein Handbuch (pp. 475–485). Rowohlt.
Bortz, J., & Schuster, C. (2010). Statistik für Human- und Sozialwissenschaftler (7th ed.). Springer.
Bourgeois, L. T., & Eisenhardt, K. M. M. (1988). Strategic decision processes in high velocity environments: Four cases in the microcomputer industry. Management Science, 34(7), 816–835. https://doi.org/10.1287/mnsc.34.7.816
Breuer, F. (2010). Wissenschaftstheoretische Grundlagen qualitativer Methodik in der Psychologie. In G. Mey & K. Mruck (Eds.), Handbuch Qualitative Forschung in der Psychologie (pp. 35–69). VS Verlag für Sozialwissenschaften.
Bronner, R., Witte, E., & Wossidlo, P. R. (1972). Betriebswirtschaftliche Experimente zum Informations-Verhalten in Entscheidungsprozessen. In E. Witte (Ed.), Das Informationsverhalten in Entscheidungsprozessen (pp. 165–203). J.C.B. Mohr.
Bronner, R. (1973). Entscheidung unter Zeitdruck. Eine Experimentalforschung zur empirischen Theorie der Unternehmung. J.C.B. Mohr.
Brouër, B. (2014). Selbstbeurteilung in selbsterorganisationssof ten Lernumgebungen. In Entwicklung eines Modells der Selbstbeurteilung und evidenzbasierter Impulse für die Förderung der Selbstbeurteilung in der Praxis. Klinkhardt.
Buhrmann, C. (2010). Supplier selection decisions. Reducing the vulnerability to judgment and decision biases and the implications for supplier performance. European Management Publications.
Chong, V. K., & Chong, K. M. (2002). Budget goal commitment and informational effects of budget participation on performance: A structural equation modeling approach. Behavioral Research in Accounting, 14(1), 65–86. https://doi.org/10.2308/bria.2002.14.1.65
Claycomb, C., Germain, R. N., & Dröge, C. (2000). The effects of formal strategic marketing planning on the industrial firm’s configuration, structure, exchange patterns, and performance. Industrial Marketing Management, 29(3), 219–234. https://doi.org/10.1016/S0255-6186(99)00055-8

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Erlbaum.

Conant, J. S., & White, J. C. (1999). Marketing program planning, process benefits and store performance: An initial study among small retail firms. Journal of Retailing, 75(4), 525–541. https://doi.org/10.1016/S0022-4359(99)00017-2

Cooper, D. R., & Schindler, P. S. (2014). Business research methods (12th ed.). McGraw-Hill.

Cousins, P., Lammers, R., Lawson, B., & Squire, B. (2002). Strategic supply management. Principles, theories and practice. Prentice Hall.

Cramme, C. (2005). Informationsverhalten als Determinante organisationaler Entscheidungssituationen. Hampp.

Dean, J. W. Jr., & Sharron, M. P. (1993). Procedural rationality in the strategic decision-making process. Journal of Management Studies, 30(4), 587–610. https://doi.org/10.1111/j.1467-6486.1993.tb00317.x

Dean, J. W. Jr., & Sharron, M. P. (1996). Does decision process matter? A study of strategic decision-making effectiveness. Academy of Management Journal, 39(2), 368–396. https://doi.org/10.2307/256784

Deck, C., & Smith, V. (2013). Using laboratory experiments in logistics and supply chain research. Journal of Business Logistics, 34(1), 6–14. https://doi.org/10.1111/jbl.12006

Durst, S. M. (2013). Strategische Lieferantenentwicklung-Rahmenbedingungen, Optionen und Auswirkungen auf Abnehmer und Lieferant. In Supply Management Research (pp. 3–28). Gabler.

Dyckhoff, H., & Spengler, T. S. (2010). Produktionswirtschaft: Eine Einführung (3rd ed.). Springer.

Dyson, R. G., & Foster, M. J. (1982). The relationship of participation and effectiveness in strategic planning. Strategic Management Journal, 3(1), 77–88. https://doi.org/10.1002/smj.4250030107

Eibanna, S., & Child, J. (2007). The influence of decision, environmental and firm characteristics on the rationality of strategic decision-making. Journal of Management Studies, 44(4), 561–591. https://doi.org/10.1111/j.1467-6486.2006.00670.x

Equit, C., & Höhage, C. (2016). Handbuch Grounded Theory: Von der Methodologie zur Forschungspraxis. Beltz Juventa.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, XVIII(1), 39–50. https://doi.org/10.1177/002224378101800104

Frederickson, J. W. (1983). Rationality in strategic decision processes. Academy of Management Journal, 17–21. https://doi.org/10.5465/ambpp.1983.49769310

Frederickson, J. W. (1984). The comprehensiveness of strategic decision processes: Extension, observations, future directions. Academy of Management Journal, 27(3), 445–466. https://doi.org/10.2307/256039

Frederickson, J. W., & Iaquinto, A. L. (1989). Inertia and creeping rationality in strategic decision processes. Academy of Management Journal, 32(3), 516–542. https://doi.org/10.2307/256433

Gefen, D., & Straub, D. W. (2005). A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example. Communications of the Association for Information Systems, 16(1), 91–109. https://doi.org/10.17705/1CAIS.01605

Geisser, S. (1975). The predictive sample reuse method with applications. Journal of the American Statistical Association, 70, 350–328. https://doi.org/10.1080/01621459.1975.10479865

Geißler, H. (1986). Fehlschlüsse. Eine empirisch-explorative Ursachenanalyse. Lang.

Gil Saura, I., Servero Franés, D., Berenguer Contri, G., & Fuentes Blasco, M. (2008). Logistics service quality: A new way to loyalty. Industrial Management & Data Systems, 108(5), 650–668. https://doi.org/10.1108/02635570810876778

Goll, I., & Rasheed, A. A. (1997). Rational decision-making and firm performance: The moderating role of environment. Strategic Management Journal, 18(7), 583–591. https://doi.org/10.1002/(SICI)1097-0266(19970818)18:7<583::AID-SMJ907>3.0.CO;2-Z

Goll, I., & Rasheed, A. A. (2005). The relationships between top management demographic characteristics, rational decision making, environmental munificence, and firm performance. Organization Studies, 26(7), 999–1023. https://doi.org/10.1177/0170840605053538

Greenley, G. E., & Bayus, B. L. (1993). Marketing planning decision making in UK and US companies: An empirical comparative study. Journal of Marketing Management, 9(2), 155–172. https://doi.org/10.1080/0267257X.1993.9964227

Grover, V., & Segars, A. H. (2005). An empirical evaluation of stages of strategic information systems planning: Patterns of process design and effectiveness. Information & Management, 42(5), 761–779. https://doi.org/10.1016/j.im.2004.08.002

Gull, F. A., Tsui, J. S. L., Fong, S. C., & Kwok, H. Y. L. (1995). Decentralisation as a moderating factor in the budgetary participation-performance relationship: Some Hong Kong evidence. Accounting and Business Research, 25(98), 107–113. https://doi.org/10.1080/00014788.1995.9729933

Hair, J. F. (2014). A primer on partial least squares structural equations modeling (PLS-SEM). Sage.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). Multivariate data analysis (7th ed.). Pearson.

Hauschildt, J. (1980). Entscheidungssituation. In E. Witte, J. Hauschildt, & O. Grün (Eds.), Innovative Entscheidungsprozesse. Die Ergebnisse des Projektes "Innovative Entscheidungsprozesse" (pp. 55–124). J.C.B. Mohr.

Heath, A., & Jean, M. (1997). Why are there so few formal measuring instruments in social and political research? In L. Lyberg, P. Biemer, M. Collins, E. de Leeuw, C. Dippo, N. Schwarz, & D. Trewin (Eds.), Survey measurement and process quality (pp. 71–86). John Wiley & Sons.

Homburg, C., & Baumgartner, H. (1995). Beurteilung von Kausalmodellen: Bestandsaufnahme und Anwendungsempfehlungen. Marketing: Zeitschrift für Forschung und Praxis, 171, 162–176. https://doi.org/10.15358/0346-1369-1995-3-162

Hsu, C. C., Kannan, V. R., Tan, K. C., & Keong Leong, G. (2003). Information sharing, buyer-supplier relationships, and firm performance. International Journal of Physical Distribution & Logistics Management, 38(4), 296–310. https://doi.org/10.1108/09600030810875391

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis. Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Irlinger, W. (2012). Kausalmodelle zur Lieferantenbewertung. Gabler.
John, G., & Martin, J. (1984). Effects of organizational structure on marketing planning credibility and utilization of plan output. *Journal of Marketing Research, XXI*(1), 170–183. https://doi.org/10.1177/002224378402100205

Joost, N. (1975). Organisation in Entscheidungsprozessen. Eine empirische Untersuchung. J.C.B. Mohr.

Juga, J., Juntunen, J., & Grant, D. B. (2010). Service quality and its relation to satisfaction and loyalty in logistics outsourcing relationships. Managing Service Quality: An International Journal, 20(6), 496–510. https://doi.org/10.1108/09605521011092857

Kaililinger, A., & Woschank, M. (2022). State of the art and future directions of digital twins for production logistics: A systematic literature review. Applied Sciences, 12(2), 669. https://doi.org/10.3390/app12020669

Kaufmann, L., & Carter, C. R. (2006). International supply chain partnerships and risk management: A comparison of U.S. and German practices. *Journal of Operations Management, 24*(5), 653–675. https://doi.org/10.1016/j.jom.2005.07.001

Kaufmann, L., Carter, C. R., & Buhrmann, C. (2012a). The impact of individual debiasing efforts on financial decision effectiveness in the supplier selection process. *International Journal of Physical Distribution & Logistics Management, 42*(5), 411–433. https://doi.org/10.1108/09600031211246492

Kaufmann, L., Kreft, S., Ehrhott, M., & Reimann, F. (2012b). Rationality in supplier selection decisions: The effect of the buyer’s national task environment. *Journal of Purchasing and Supply Management, 18*(2), 76–91. https://doi.org/10.1016/j.pursup.2012.04.004

Kaufmann, L., Meschnig, G., & Reimann, F. (2014). Rational and intuitive decision-making in sourcing teams: Effects on decision outcomes. *Journal of Purchasing and Supply Management, 20*(2), 104–112. https://doi.org/10.1016/j.pursup.2014.03.003

Kaufmann, L., Wagner, C. M., & Carter, C. R. (2016). Individual modes and patterns of rational and intuitive decision-making by purchasing managers. *Journal of Purchasing & Supply Management, 23*(2), 82–93. https://doi.org/10.1016/j.pursup.2016.09.001

Kenis, I. (1979). Effects of budgetary goal characteristics on managerial attitudes and performance. *The Accounting Review, 54*(4), 707–721. https://www.jstor.org/stable/245627

Kirchhoff, S., Kuhnth, S., Lipp, P., & Schlawin, S. (2010). Der Fragebogen. Datenbasis, Konstruktion und Auswertung (5th ed.). Verlag für Sozialwissenschaften.

Klein, N. N., & Yadav, M. S. (1989). Context effects on effort and accuracy in choice: An enquiry into adaptive decision making. *Journal of Consumer Research, 16*(1), 411–421. https://doi.org/10.1086/209181

Klein, R., & Scholl, A. (2013). Planung und Entscheidung: Konzepte, Modelle und Methoden einer modernen betriebswirtschaftlichen Entscheidungsanalyse. 2nd. Vahlen.

Kock, N., & Lynn, G. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems, 13*(7), 546–580. https://doi.org/10.17705/1jais.00302

Kompatscher, J., Pacher, C., & Woschank, M. (2021). The LogiLegol.ob: A problem-based learning approach for higher education institutions. In *Proceedings of the International Conference on Industrial Engineering and Operations Management Singapore* (IEOM), March 9-11, 2021, (pp. 1834–1844).

Krasnova, H., Hildebrand, T., Günther, O., Kovrigin, A., & Nowobilka, A. (2008). Why participate in an online social network: An empirical analysis. In *Proceedings of the 16th European Conference on Information Systems* (pp. 1–12).

Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal, 36*(6), 1633–1651. https://doi.org/10.2307/2568794

Langley, A. (1989). In search of rationality: The purposes behind the use of formal analysis in organizations. *Administrative Science Quarterly, 34*(4), 598–631. https://doi.org/10.2307/2393569

Mollov, S., & Schwenk, C. R. (1995). The effects of information technology on strategic decision making. *Journal of Management Studies, 32*(3), 283–311. https://doi.org/10.1111/1467-6489.1995.tb00777.x

Moon, M. A., Smith, C. D., & Mentzer, J. T. (2003). Conducting a sales forecasting audit. *International Journal of Forecasting, 19*(1), 5–25. https://doi.org/10.1016/S0169-2070(02)00032-8

Moosbrugger, H., & Kelava, A. (2012). Testtheorie und Fragebogengestaltung (2nd ed.). Springer.

NACE. (2020). Retrieved October 10, 2021 from http://www.wko.at/statistik/Extranet/Rechtsgrundlagen/MOZ%20KST/AT.pdf

Neuert, J. O. (1987). Planungsgrenze. Eine experimentelle Untersuchung zum Zusammenhang zwischen Planungsverhalten und Planungserfolg. Wilfer.

Nooraie, M. (2008). Decision magnitude of impact and strategic decision-making process output. *Management Decision, 46*(4), 640–655. https://doi.org/10.1108/00251740810865102

Pacher, C., & Woschank, M. (2020). Competencies in the digitalized working environment: A concept for engineering education in higher education institutions. In *Proceedings of the International Conference on Industrial Engineering and Operations Management* (IEOM, Zimbabwe, Harare, October 20-22, 2020, (pp. 1203–1212).

Pacher, C., Woschank, M., Rauch, E., & Zunk, B. M. (2022). Systematic development of a competence profile for industrial logistics engineering education (Vol. 200, pp. 758–767). https://doi.org/10.1016/j.procs.2022.01.274

Popke-Shields, K. E., Molhotra, M. K., & Grover, V. (2006). Evolution in the strategic manufacturing planning process of organizations. *Journal of Operations Management, 24*(5), 621–639. https://doi.org/10.1016/j.jom.2005.11.012

Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *Journal of Marketing Research, 16*(1), 6–17. https://doi.org/10.1177/002224377901600102

Pföhl, H. C. (1977). Problemorientierte Entscheidungsfindung in Organisationen. de Gruyter.

Piercy, N. F., & Brown, N. A. (1990). Organisational context and behavioural problems as determinants of the effectiveness of the strategic marketing planning process. *Journal of Marketing Management, 6*(2), 127–143. https://doi.org/10.1080/0267257X.1990.9964121

Porst, R. (2013). Fragebogen: Ein Arbeitsbuch (3rd ed.). Verlag für Sozialwissenschaften.

Premkumar, G., & King, W. R. (1992). An empirical assessment of information systems planning and the role of information systems in organizations. *Journal of Management Information Systems, 9*(2), 99–125. http://10.1080/0885393920008742122.1992.11517960

Premkumar, G., & King, W. R. (1994). Organizational characteristics and information systems planning: An empirical study. *Information Systems Research, 5*(2), 75–109. https://doi.org/10.1287/isre.5.2.75
Pulendran, S., Speed, R., & Widing, R. E. (2003). Marketing planning, market orientation and business performance. European Journal of Marketing, 37(3/4), 476–497. https://doi.org/10.1108/03090560310459050

Puelles, N. J., Schiele, H., Veldman, J., & Hüttinger, L. (2016). The impact of customer attractiveness and supplier satisfaction of becoming a preferred customer. International Journal of Logistics Management, 27(3), 956–987. https://doi.org/10.1108/09571651611728290

Ralph, B. J., Woschank, M., Miklausch, P., Käiblinger, A., Pacher, C., Sorgor, M., Zufkowitz, H., & Stockinger, M. (2021). MUL 4.0: Systematic digitalization of a value chain from raw material to recycling. Procedia Manufacturing, 55, 335–342. https://doi.org/10.1016/j.promfg.2021.10.047

Ralph, B. J., Woschank, M., Pacher, C., & Murphy, M. (2022). Evidence-based redesign of engineering education lectures: Theoretical framework and preliminary empirical evidence. European Journal of Engineering Education, 47(4), 636–663. https://doi.org/10.1080/03043797.2022.2025341

Rouch, E., Linder, C., & Dallasega, P. (2020). Anthropocentric perspective of production management before and within Industry 4.0. Computers & Industrial Engineering, 139, 105644. https://doi.org/10.1016/j.cie.2019.01.018

Riedl, D. (2012). Behavioral supply management. A decision theory-based investigation of decision process decomposition in the United States and China. European Management Publications.

Riedl, D., Kaufmann, L., Zimmermann, C., & Perols, J. L. (2013). Reducing uncertainty in supplier selection decisions: Antecedents and outcomes of procedural rationality. Journal of Operations Management, 31(1–2), 24–36. https://doi.org/10.1016/j.jom.2012.10.003

Schenkel, B. (2006). Die Qualität der marktbezogenen Planung, Konzeptualisierung, Erfolgswirkungen, Determinanten, Wahrnehmungsunterschiede. Deutscher Universitäts-Verlag.

Schiele, H., Calvi, R., & Gibbert, M. (2012). Customer attractiveness, supplier satisfaction and preferred customer satisfaction: Introduction, definitions and overarching framework. Industrial Marketing Management, 41(8), 1178–1185. https://doi.org/10.1016/j.indmarman.2012.10.002

Schnell, R., Hill, P. B., & Esser, E. (2011). Methoden der empirischen Sozialforschung (9th ed.). Oldenburg.

Schröder, W. (1986). Leitungsorientierung und Entscheidungsverhalten. Eine Experimental-Untersuchung zur Wirkung individueller Werte in Problemlöseprozessen. Lang.

Schulte, C. (2009). Logistik. Wege zur Optimierung der Supply Chain (5th ed.). Vahlen.

Schurichter, S. C. (2000). Die 3 Faktoren des Einkaufs: Einkauf und Lieferanten strategisch positionieren. Wiley.

Segars, A. H., & Grover, V. (1998). Strategic information systems planning success: An investigation of the construct and its measurement. MIS Quarterly, 22(2), 139–163. https://doi.org/10.25307/2493933

Simon, H. A. (1966). Perspektiven der Automatik für Entscheider. Schnelle.

Simons, T., Pelled, L. H., & Smith, K. A. (1999). Making use of difference: Diversity, debate, and decision comprehensiveness in top management teams. Academy of Management Journal, 42(6), 662–673. https://doi.org/10.2307/256987

Srinivasan, N., & Ratchford, B. T. (1991). An empirical test of a model of external search for automobiles. Journal of Consumer Research, 18(2), 233–242. https://doi.org/10.1086/209255

Staehle, W. H., Conrad, P., & Sydow, J. (1999). Management. Eine verhaltenswissenschaftliche Perspektive (8th ed.). Vahlen.

Steinmann, H., & Schreyögg, G. (2000). Management. Grundlagen der Unternehmensführung: Konzepte - Funktionen - Fallstudien (5th ed.). Gabler.

Stek, K., Zunk, B. M., Koch, V., & Schiele, H. (2022). Culture ’s consequences for purchasing comparing purchasing job Ad requirements from different European countries with cultural models. International Journal of Purchasing & Supply Management, 18(1), 305–339. https://doi.org/10.1510/IJP.2022.122552

Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. Journal of the Royal Statistical Society. Series B (Methodological), 36(2), 111–147. https://doi.org/10.1111/j.2517-6161.1974.tb00994.x

Venkatraman, N., & Ramanujam, V. (1987). Planning system success: A conceptualization and an operational Model. Management Science, 33(6), 687–705. https://doi.org/10.1287/mnsc.33.6.687

Weller, S. B. M., Puelles, N. J., & Zunk, B. M. (2021). The micro-processes of supplier satisfaction: A longitudinal multiple case study. Journal of Purchasing and Supply Management, 27(4), 100711. https://doi.org/10.1016/j.jupsm.2021.100711

Wentzel, K. (2002). The influence of fairness perceptions and goal commitment on managers’ performance in a budget setting. Behavioral Research in Accounting, 14 (1), 247–271. https://doi.org/10.2308/bria.2002.14.1.247

Wild, J. (1982). Grundlagen der Unternehmensplanung (4th ed.). Westdeutscher Verlag.

Witte, E. (1972a). Die Effizienz der Informations-Aktivität. In E. Witte (Ed.), Das Informationsverhalten in Entscheidungsprozessen (pp. 6–32). J.C.B. Mohr.

Witte, E. (1972b). Die Effizienz der Informations-Nachfrage-Aktivität. In E. Witte (Ed.), Das Informationsverhalten in Entscheidungsprozessen (pp. 44–59). J.C.B. Mohr.

Witte, E. (1972c). Die Effizienz der Informations-Versorgungs-Aktivität. In E. Witte (Ed.), Das Informationsverhalten in Entscheidungsprozessen (pp. 32–44). J.C.B. Mohr.

Witte, E. (1988). Informationsverhalten. In E. Witte, J. Hauschildt, & O. Grün (Eds.), Innovative Entscheidungsprozesse. Die Ergebnisse des Projektes “Columbus” (pp. 227–240). J.C.B. Mohr.

Woschank, M., & Pacher, C. (2020a). Fostering transformational learning processes in industrial engineering: In Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA (IEOM), August 10–14, 2020, (pp. 2022–2029).

Woschank, M., & Pacher, C. (2020b). Program planning in the context of industrial logistics engineering education. Procedia Manufacturing, 51, 1819–1824. https://doi.org/10.1016/j.promfg.2020.10.253

Woschank, M., & Pacher, C. (2020c). Teaching and learning methods in the context of industrial logistics engineering education. Procedia Manufacturing, 51, 1709–1716. https://doi.org/10.1016/j.promfg.2020.10.238

Woschank, M., & Pacher, C. (2020d). A holistic didactical approach for industrial logistics engineering education in the LOGILAB at the Montanuniversität Leoben. Procedia Manufacturing, 51, 1814–1818. https://doi.org/10.1016/j.promfg.2020.10.252

Woschank, M., Pacher, C., Miklausch, P., Käiblinger, A., & Murphy, M. (2021a). The Usage of Challenge-Based Learning in Industrial Engineering Education. In Auer, M., Hortsch, H., Michler, O., Köhler, T. (Eds.), Mobility for Smart Cities and Regional Development - Challenges for Higher
Education (pp. 869–878). Springer International Publishing 22–24 September 2021. https://doi.org/10.1007/978-3-030-93907-6_93

Woschank, M., Kaiblinger, A., & Miklautsch, P. (2021b). Digitalization in industrial logistics: Contemporary evidence and future directions. In: Proceedings of the International Conference on Industrial Engineering and Operations Management Singapore (IEOM), March 9–11, 2021, (pp. 1322–1333).

Woschank, M., Steinwieder, D., Kaiblinger, A., Miklautsch, P., Pocher, C., & Zsifkovits, H. (2021a). The integration of smart systems in the context of industrial logistics in manufacturing enterprises. (Vol. 200, pp. 727–737). https://doi.org/10.1016/j.procs.2022.01.271

Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2005). Logistics flexibility and its impact on customer satisfaction. The International Journal of Logistics Management, 16(1), 71–95. https://doi.org/10.1108/09574090510613167

Zsifkovits, H., Woschank, M., & Pocher, C. (2021). A case study: Industry 4.0 and human factors in SMEs. In D. T. Matt, V. Modrak, & H. Zsifkovits (Eds.), Industry 4.0 for SMEs. concepts, examples and applications (pp. 233–261). https://doi.org/10.1007/978-3-030-70516-9_8, Palgrave Macmillan (Springer Nature).

Zunk, B. M., & Schiele, H. (2011). Stability of prices through “preferred customer status” - Factors influencing innovation and pricing behaviour of suppliers (Preisstabilität durch ”preferred customer-status”: Einflussfaktoren auf Innovationsleistung und Preisgestaltung von Lieferanten). ZWF Zeitschrift für Wirtschaftlichen Fabrikbetrieb, 106(12), 974–978. https://doi.org/10.3139/104.110679

Zunk, B. M. (2013). Ideal-typical competence profile of industrial buyer-seller relationship controllers in technology firms - empirical evidence from Austria. International Journal of Industrial Engineering and Management, 4(2), 87–94. https://www.proquest.com/openview/92d5d12fccc066c1935710a3c4eb822e8/1?pq-origsite=gbscholar&cbl=5348132

Zunk, B. M., Soos, J., Uitz, I., Denger, A., & Bader, M. (2013). The influence of human motivation factors on the successful implementation of product life cycle management tools: Explorative findings and managerial implications. Manufacturing Technology, 13(4), 580–586. https://doi.org/10.21062/ujepx.2013/a/1213-2489/MT/13/4/580

Zunk, B. M., & Koch, V. (2014). Customer ranking model for project businesses: A case study from the automotive industry. International Journal of Engineering Business Management, 6(1), 1–9. https://doi.org/10.5772/58454

Zunk, B. M. (2015). Exploration of factors influencing the customers’ motivation in buyer-supplier relationships on industrial markets. International Journal of Engineering Business Management, 7(23), 1–6. https://doi.org/10.5772/62110

Zunk, B. M., & Sadei, C. (2015). Sharpening the industrial engineering and management qualification profile: Research findings from Austria. International Journal of Industrial Engineering and Management, 6(3), 109–120. https://www.proquest.com/openview/12438356cd50b02cc119674a1540ce20/1?pq-origsite=gbscholar&cbl=5348132

Zunk, B. M. (2018). Positioning “Techno-Economics” as an interdisciplinary reference frame for research and teaching at the interface of applied natural sciences and applied social sciences: An approach based on Austrian IEM study programmes. International Journal of Industrial Engineering and Management, 9(1), 17–23.

Zunk, B. M., Woschank, M., Reinisch, M. G., & Weller, S. B. M. (2020). Management of Critical Lower-Tier Suppliers in Global Networks: Practical Relevance, Literature Review, and Management Perspectives. IEEE Engineering Management Review, 48(4), 181–194. https://doi.org/10.1109/EMR.2020.3015544
