

# Evaluating cognitive biases and DSS utilization in strategic management: A socio-technical perspective

Petra Blahova<sup>1,†</sup>, Jan Saro<sup>1,†</sup>, Jan Rydval<sup>1,†</sup>, Helena Brozova<sup>1,†</sup>

<sup>1</sup> Czech University of Life Sciences Prague, Kamýcka 129, 165 00 Prague, Czech Republic

## Abstract

Senior managers' perceptions of Decision Support System (DSS) determine DSS implementation in the context of knowledge management (KM) strategies. Although increasing information complexity requires advanced decision-making, senior managers often prioritize intuition-based decisions, so low DSS use may heighten the risk of decision failures. Moreover, behavioral economics research indicates a high susceptibility to cognitive biases among senior managers. However, little is known about the alignment between senior managers' decision-making processes and behavioral patterns, DSS perception and use, cognitive biases and KM strategy success. This study aims to explore senior managers' cognitive biases in decision-making as a function of DSS perception and KM strategy implementation. For this purpose, we used socio-technical methods, including semi-structured interviews with senior managers in international corporations, applying Daniel Kahneman's structured judgment technique to identify cognitive biases. This pilot study provides a glimpse into senior managers' decision-making behaviors and their potential effects on KM strategy success. The findings indicate a high level of cognitive biases associated with low DSS use and unclear or underdeveloped KM strategies. These preliminary insights highlight the importance of addressing cognitive biases in DSS use and perception during decision-making challenges.

## Keywords

Decision support system, strategic management, cognitive bias, behavioral economics, knowledge management, socio-technical

## 1. Introduction

Senior managers' perceptions of the benefits and challenges of implementing a Decision Support System (DSS) as a Knowledge Management (KM) strategy may determine organizational learning and innovation. Industry executives rely on information on the internal and external environment of their organization for decision-making. Nevertheless, they must seek new avenues to gain a competitive edge with the increasing complexity and volume of available information. Combined with rapid digitalization, this increasing volume of information creates a constantly changing environment and, as a result, an urgency to make more frequent decisions.

As decision frequency increases across all management levels and organizations, executives must hone their effective and timely decision-making skills. Many strategic management researchers take the position that executives make strategic decisions based on a structured

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† These authors contributed equally.

✉ [blahovap@pef.czu.cz](mailto:blahovap@pef.czu.cz) (P. Blahova); [saroj@pef.czu.cz](mailto:saroj@pef.czu.cz) (J. Saro); [rydval@pef.czu.cz](mailto:rydval@pef.czu.cz) (J. Rydval); [brozova@pef.czu.cz](mailto:brozova@pef.czu.cz) (H. Brozova)

ORCID: 0000-0002-7686-9613 (P. Blahova); 0009-0001-4355-5271 (J. Saro); 0000-0002-3463-5042 (J. Rydval); 0000-0002-0322-251X (H. Brozova)



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process involving careful consideration of alternatives [1]. However, behavioral economy (BE) research indicates that senior managers tend to follow expert intuition [2], boasting expert knowledge and well-developed decision intuition. Consequently, strategic decision-making is primarily based on expert intuition [3].

According to Winter [13], [25], "In many cases, a strategic decision based on emotion or intuition may be more efficient than a decision arrived at after thorough and rigorous analysis of all the possible outcomes and implications." But in other cases, intuitive and human-centric decision-making may cause critical errors and threaten the entire organization, leading to decision failures because such a decision-making process necessarily entails cognitive-biases [4]. In fact, not only a high level of cognitive biases but also a preference for intuitive experiencebased decision-making characterize the profile of these senior managers, accounting for suboptimal DSS use and acceptance [2].

Although DSSs help to gain competitive advantage and ultimately to succeed in the organization, DSS use among senior managers is low, indicating an unwillingness to use or low trust in these systems, among other reasons. However, the purpose of the study is not to explain this low use but to examine several mutually related aspects in the decision-making process potentially related to DSS use. Notwithstanding previous research on DSS perceptions, benefits and challenges in strategic management, behavioral economics, dynamic capabilities (DC) and KM strategy, little is known about the alignment between senior managers' decision-making processes and behavioral patterns, DSS perception, cognitive biases and KM strategy success.

KM strategy success indicates the level of innovation and adaptability of an organization. As proposed by [14], the learning organization is defined as a means to reflect upon and reassess knowledge created by individuals in the organizational context. The organization changes as the result of this learning process, which can be viewed as an ongoing sense-making activity based on the collective knowledge of its individuals [15]. According to Mumford [16], knowledge creation, development and team work are key socio-technical design strategies, which must be applied to all members of an organization, not just top experts or management. In an increasingly complex environment, organizations must gain dynamic capabilities (DC) to modify behaviors in responding to external effects, thus enhancing their adaptability and competitiveness [6], [7], [5]. To summarize, dynamic capabilities (DC) are enabled by the success of the KM strategy and the learning process. The learning organization and KM strategy context is a necessary element of this research.

In this context, this study aims to explore strategic decision-making challenges, processes, tools, behaviors, KM strategy and cognitive biases and identify relationships between these phenomena. For this purpose, we conducted semi-structured interviews with senior managers from international global organizations. To guide this exploration, the study sought to answer three research questions:

RQ1: How can we examine senior managers' decision-making processes and behaviors, DSS perception, cognitive biases and KM strategy success?

RQ2: What is the relationship, if any, between senior managers' DSS perception, cognitive biases level and KM strategy success within selected decision-making problematic situation?

RQ3: What could be the role of the three examined research elements in an organizational learning process and can be an organizational learning model designed based in this research?

## 2. Soft Systems Methodology (SSM), strategic thinking, cognitive biases, DSS, KM, organizational learning and dynamic capabilities

This chapter briefly outlines concepts introduced in this research. The intention is to provide a conceptual basis for the conducted research while reflecting on reality of the increasing complexity of organizational concepts.

### 2.1. SSM

In this research, we leveraged the ability of SSM to mimic a cyclic learning process [20] studied as a systems model. Human activity can be studied using systems models, but these models should never be regarded as portraits of objective reality [18]. From a soft systems perspective, such models are mere tools used by an observer or group of observers to interpret reality. Thus, systems models enable us to convey these interpretations of reality in a debate among participants [19].

Based on SSM, semi-structured interviews about a problem, i.e., a situation perceived as problematic by stakeholders, yield purposeful activity models [20]. These models foster and structure debate around the problem. When contrasted against perceptions of the actual situation, they identify desirable and (culturally) feasible changes [20].

### 2.2. Strategic thinking and cognitive biases

The highly competitive environment and increasing amount and complexity of information requires a flexible organizational culture that encourages knowledge sharing, collaboration, and continuous learning where leadership plays a crucial role [5]

Strategic thinking (ST) has been described as an “organization’s ability to create and develop a strategic vision by exploring all potential future organizational events and challenging traditional thinking to promote sound decision-making in record time” [21] and as required managerial competency comprising conceptual thinking, visionary thinking, creativity, analytical thinking, learning, synthesizing, and objectivity [22]. ST helps managers develop better strategies and inspire employees to collaborate in innovative tactics for the firm’s survival [23]. Senior managers apply strategic decision-making with unique behavioral patterns.

Strategic decision-making is often based on expert intuition. But while this approach may be more efficient in some cases, it may also cause critical errors and threaten the organization in other cases [2]. Intuitive decision-making always includes cognitive biases, which lead to decision failures [27], [28]. Strategic managers should examine their own cognitive biases and try their best to mitigate them. Disregarding tools designed to limit biases may result in business failure. Arnott [2] has provided a comprehensive list of cognitive biases, with a clear description of categories and types in the context of DSS research.

### 2.3. Organizational learning, dynamic capabilities, DSS

In a rapidly changing environment, a firm cannot thrive without organizational learning, innovation, and adaptability. The DC [6], [21] theory emphasizes the importance of sensing, seizing, and transforming to address these changes. Knowledge management (KM) facilitates knowledge creation, sharing, and use, thereby enhancing decision-making, innovation, and adaptability.

Strategic management integrates these elements by setting goals and evaluating strategies. The problem is that strategic decision-making behavior specifics are more reliant on expert

knowledge and intuition and have a higher level of cognitive biases [27], [28]. A potential tool to avoid biased or not fully informed decisions is DSS. DSS, assuming fully integrated with external and internal systems, providing a real-time analysis, simulations, alternatives from various perspectives, can enable a positive impact on all above-mentioned elements.

### 3. Methods

In this study, we applied the theoretical foundations and concepts described in Chapter 2, namely, SSM, strategic thinking, and behavioral economics, to identify cognitive biases, organizational learning, KM, dynamic capabilities and DSS.

#### 3.1. Research Procedure

Our research procedure consisted of several steps. First, we selected methods addressing cognitive biases, perceptions of DSS as a new system and KM strategy success. For this purpose, we scripted interviews to include all the aforementioned phenomena. The socio-technical approach was suitable for this complex research. This socio-technical approach encompassed user participation, high engagement in real problem identification, SSM [20], [24], holistic multi-criteria benefit analysis, organizational dynamic capabilities and systems model proposal. The interview procedure included the following steps:

- The decision-making background was developed by drawing ideas upon SSM by identifying a real problem that respondents wanted and needed to solve. The task was to provide a challenging decision-making problem or process that was time-consuming and expensive, with negative results, and therefore requiring a change.
- The organizational decision-making practices were described to better understand the context and current decision-making patterns and processes, as well as prior knowledge and tools.
- The solution for the given problem was discussed in the context of the new system. The benefits and challenges of OLD vs NEW were discussed to assess how the managers perceived the benefits of the new system, which adopted holistic multi-criteria used for potential future system and change (Figure 1). The willingness and intention to adopt and implement potential DSS was also questioned.
- KM strategy success and execution in this specific problem and in the organization were also examined by the holistic multi-criteria benefit analysis (Figure 1). Benefits and challenges of current KM strategy success compared to future plan.
- Cognitive Biases were identified and evaluated based on a Kahneman structured questionnaire.

<b>HOLISTIC MULTI-CRITERIA BENEFIT ANALYSIS</b>			
	<b>Change in Behavior</b>		
	<b>Potential Future System</b>		
<b>Negative Impact &amp; Influence Benefit</b>	<i>What are the negatives of the future system / behavior?</i>	<i>What are the positives of the future system / behavior?</i>	<b>Positive Impact &amp; Influence Benefit</b>
	<i>What are the negatives of the current system / behavior?</i>	<i>What are the positives of the current system /behavior?</i>	
	<b>No Change in Behavior</b>		
	<b>Current System</b>		

Figure 1: Holistic multi-criteria benefit analysis by Peter Bednar [12]

### 3.2. Data – participants, context, factors, analysis

Participants of the research were international senior strategic and executive managers from various large global corporations and business owners in top executive management roles as these are involved in strategic decision-making. The participants' selection was enabled by utilizing a professional experience network contact list of a researcher. The researcher's 20 years of experience in strategic management roles in various global corporations created a valuable network of senior managers.

All of the 60-minute, semi-structured interviews were conducted face to face and structured inspired by SSM. In the interviews, each manager identified and described in detail an ongoing challenge or problem of the current decision-making process requiring a solution. The semistructured interview was separated into problem definition, solution proposal involving a new DSS process, and benefits and challenges of the new and old systems assessed by holistic multi-criteria benefit analysis, as shown in Figure 1. In addition, the researcher assessed the willingness to accept the new solution and to implement a new DSS. KM strategy success was also examined by holistic multi-criteria benefit analysis, identifying benefits and challenges of current Knowledge management and future better one. Lastly, cognitive biases were examined using Daniel Kahneman's specific structured questionnaire [27] with fourteen questions, as outlined in Table 1. The answer options were binary (yes or no), so we were able to count the number of cognitively biased responses and, therefore, to express the level of cognitive biases as a percentage of biased responses.

To summarize, three research elements /concepts were examined based on the defined problem and solution discussion; DSS perception and willingness to adopt the new system, KM strategy success and cognitive bias level.

Analysis of the data was conducted both qualitatively and quantitatively. Qualitative evaluation was based on manual structuring, categorizing, and coding responses. DSS and KM strategy was evaluated by ability, level and depth of perceived benefits and challenges. DSS was

also evaluated by willingness to implement the new system. Cognitive biases were examined only quantitatively. Quantification was conducted for all three elements. All are scaled as low, medium and high levels, which are based on numerical scaling on the scale of 100 points for DSS and KM and on a percentage of biased answers out of 100% potential ones.

Table 1  
Cognitive Bias Questionnaire, Daniel Kahneman's recommended questions

Cognitive Biases Questionnaire	
<b>Self-Interested Biases</b>	
1	Is there any reason to suspect motivated errors, or errors driven by the self interest of the recommending team?
2	Does the set of individuals making the proposal stand to gain more than usual from the outcome?
3	Do the options proposed include only one realistic alternative?
4	Do you suspect any intentional or unintentional deception in the proposal?
<b>Affect Heuristic</b>	
5	Have the people making the recommendation fallen in love with it?
6	Does this decision involve a strong emotional component such as those concerning employees, brands, or locations?
7	Does it seem likely that the risks and costs have been minimized, while the benefits have been exaggerated?
8	Do any team members seem to be deeply attached to the recommendation?
<b>Saliency Bias</b>	
9	Could the diagnosis of the situation be overly influenced by an analogy to a memorable success?
10	Has the team cited examples of recent success stories in making the case for the proposal?
<b>Confirmation Bias</b>	
11	Have credible alternatives been considered?
12	Were the alternatives fully evaluated in an objective and fact-based way?
13	Did the team actively look for information that would disprove their main assumptions?
14	Were the alternatives presented in a way that made them seem implausible?

#### 4. Research Model – adoption and design

Our research model enabled us to define the research problem, analyze findings and identify relationships. Although this research examined factors related to organizational learning, KM and perception of DSS benefits, we adapted a model developed by Atanassova [7], which was originally designed to analyze organizational learning. According to Atanassova [7], "a detailed framework for organizational learning starting at the individual and unfolding to organizational strategic level still is missing". Therefore, the Market Intelligence Accumulation Through Social Media (MIATSM) model was adopted because this model conceptualizes the processes and factors that enable/hinder organizational learning. The MIATSM model was adopted by Bednar [12], and by Atanassova [7] specifically to study adaptive capabilities

Using Atanassova's adopted MIATSM model [7], we studied organizations through a sociotechnical lens as complex entities changed by their engaged actor's preferences to transition from the OLD (existing decision-making processes and tools used for decision-making) to the NEW system (willingness to adopt a new process and tool allowing effective and better informed decisions). Figure 2 shows Atanassova's adapted MIATSM model designed to analyze

organizational learning [7] and the model adapted for this research. Below are listed characteristics of both models:

- Both models assume prior knowledge, triggers driving learning acting upon an executed activity, and system dynamics.
- Triggers are positive market opportunities understanding development in Atanassova's model, sense-making and applying/acting upon the learnt.
- Triggers in our model are undesirable outcome/process/result of OLD process. The trigger is not perceived as a growth and learning opportunity as in Atanassova's model, but rather acting upon a decision-making challenge while being aware that the OLD process represents the not-helpful approach. The NEW system is represented by DSS benefits perception and willingness to implement the system, thus sense making learning step.
- Knowledge management is same in both models.
- What is different in our model is a newly added element of cognitive bias as a trigger element in the model. This model allows to show not only positive organizational learning resulting into new positive adaptive and dynamic capabilities, but also negative loop and returning to the OLD (original processes and tools).
- Combination of the unique characteristics is resulting into desired positive new or changed adaptive capability; the same as in Atanassova's model.

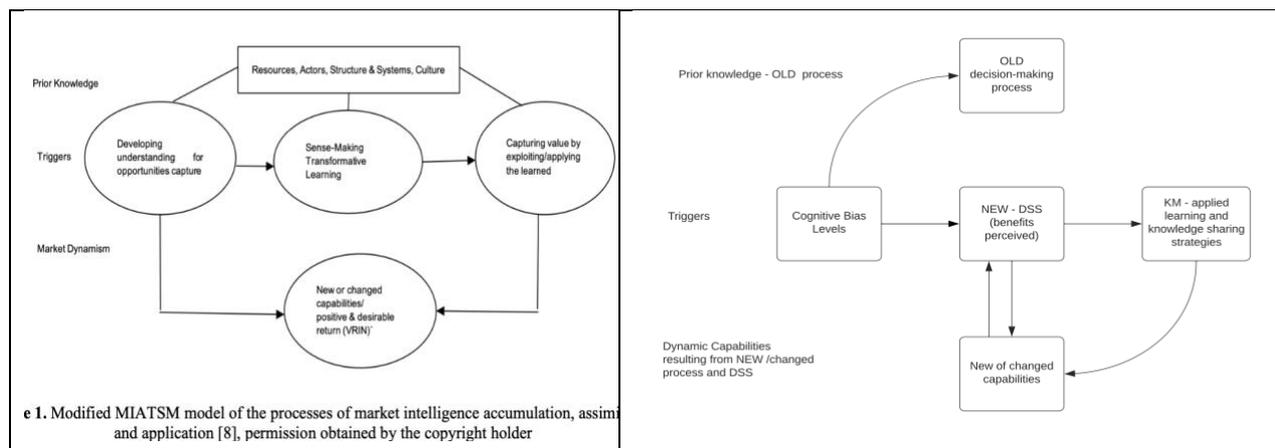


Figure 2: MIATSM model adopted by Atanassova [7] and model modified for this research

## 5. Preliminary Findings

RQ1: We tried to answer the “how” question by applying some ideas of SSM, and holistic benefit analysis, allowing to obtain perceived benefits and challenges for DSS and KM strategy elements. Kahneman's questionnaire was applied to quantify cognitive biases.

RQ2: The managers interviewed in this study showed medium and high levels of cognitive bias. High levels of cognitive bias were associated with low KM and/or DSS use. Medium levels of cognitive bias were associated with medium-to-low KM or DSS use. Overall, the level of cognitive bias was strongly correlated with the level of KM.

## 5.1. Interviews results structure

Table 2 outlines the summarized answers of respondents 1-5. These answers were scaled into low/medium/high levels. The three columns of results correspond to the three study elements, namely (i) DSS solution perception, (ii) KM strategy success perception evaluated by level and depth of provided perceived benefits and challenges of current vs new/future system. And (iii) cognitive bias, which was determined based on biased responses to 14 questions of the questionnaire (Table 1).

Table 2  
Evaluation and quantification of the results from the interviews

Company Type	Role	Problematic Situation/Challenge Definition	DSS perception Benefits Analysis OLD vs NEW		KM strategy success Benefits Analysis Current vs Future		Cognitive Biases	
SMB, Legal	Partner	Lack of reliable legal assistants, issue on every meeting among partners. Decision is made manually, relying on mix of belief and knowing.	Defined benefits and challenges of old and new process, but was very negative towards any change, thus not considering system driven solution, not believing in success.	5	Transfer of knowledge only via person. Hired a special role to implement KM processes, document based knowledge management system. Perceives benefits of future KM.	20	64% biased based on 14 questions	64
Large Corporation, online job platform	CFO	Missing standard expected ROI on investments which are pushed by managers as critical. Missing long-term evaluation of such projects, products.	Agrees to system driven solution, process change documentation, DSS. Believes in a values, change, provides list of perceived benefits of new system.	100	Knowledge held in each country, but existing KM within functional departments (within HR, withing Finance, withing IT). Not connected, but benefits and challenges identified.	20	71% biased based on 14 questions	71
Large Corporation, SW HW gaming	CEO	Often missing information about the market specifics of each country, relying on ad hoc and subjective information from local country managers	Perceived challenges of current system, but non perceived benefits of DSS as DSS not needed as finance systems and sales channels provide enough information.	5	Knowledge not transferred to local branches, very difficult to obtain useful and helping trainings, colaboration only directive. Challenges described.	10	100% biased based on 14 questions	100
SMB e-commerce	CEO	As a newly starting company there are missing forecasts related to market information, customers preferences and competition.	DSS fully integrated - long list of benefits listed and perceived. Agreed to add missing information.	100	Knowledge sharing, open transparency among all staff, KM strategy as one of the most important pillars - all in progress. Describes benefits and challenges current vs future	80	35% biased based on 14 questions	36
SMB construction	CEO	Missing comprehensive forecasts due to seasonality, unreliable employees thus difficult to plan project reliably	Willing to change the process, but doubts about it's cost and implementation in the area of unreliable employees. Perceives benefits of new.	50	KM strategy not formalized but in construction the technical knowledge handover embedded in the leader-teams relationship. Benefits described.	40	35% biased based on 14 questions	36

### Color meanings

negative
medium
positive

### DSS perception

No/Low (0-5)
Medium (50)
High (100)

### KM Strategy level

Low (10,20)
Medium (40, 50, 60)
High (80)

### Bias level

67-100 High
34-66
0-33 Low

## 5.2. Quantified relationships

Figure 3 shows the quantification results, highlighting medium-to-high cognitive bias. None of the respondents showed low levels of cognitive bias. High levels of cognitive bias are associated with low KM and DSS. Medium levels of cognitive bias are associated with medium or high DSS and KM.

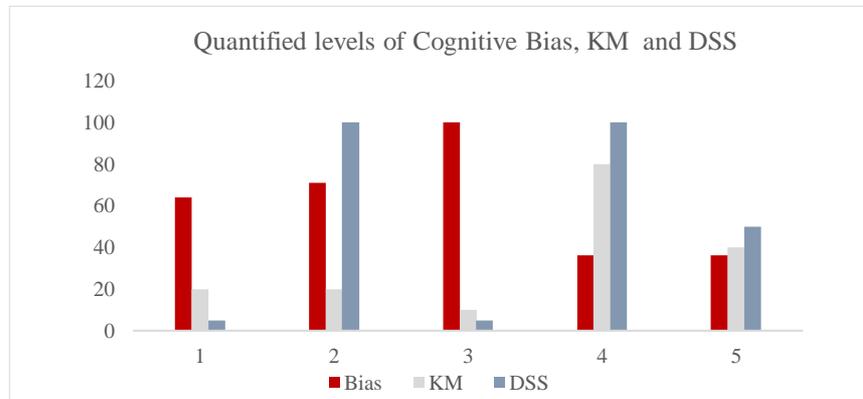


Figure 3: Quantified levels of Cognitive Bias, KM success and perception of DSS benefits perception & willingness to implement a new DSS solution

The level of Cognitive Bias was strongly correlated with the success of the KM strategy (Figure 4), but not with the perception of DSS benefits or willingness to change to a new DSS solution.

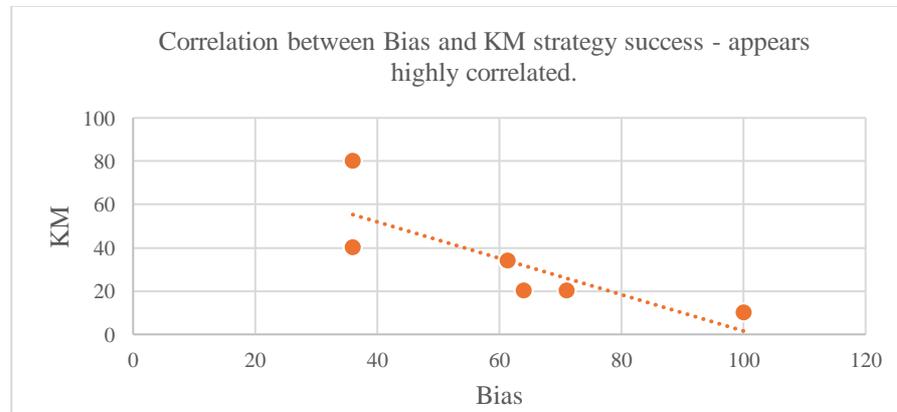


Figure 4: Correlation between the level of Cognitive Bias and the success of the KM strategy

## 5.3. Organizational learning model

The Figure (5) shows the results in a research model. Discovered patterns from the pilot study are that high levels of cognitive bias (red) lead to either low DSS or low KM, thus no learning achieved, resulting in a return to the OLD process. Medium levels of cognitive bias lead to NEW DSS and KM, thus increasing learning and new capabilities.

Based on the results in this pilot study it seems that high levels of cognitive bias have a role in decreasing the organizational learning by triggering back to OLD system. Only in the cases of high perception of DSS benefits, or DSS usage, the NEW system triggers learning from the change as well as from considering the challenges of OLD. DSS perception factor overwrites the potential

negative effect of highly biased decision-making. On the other hand, medium levels of cognitive bias are connected with medium or high perception of DSS benefits. Medium or high DSS perception enables the KM success. In this pilot study, only medium and high DSS perception are connected to medium and high KM success.

RQ3: The examined elements in this research were included in the adapted model of organizational learning (Figure 2) indicating their potential role in achieving new or changed dynamic capabilities.

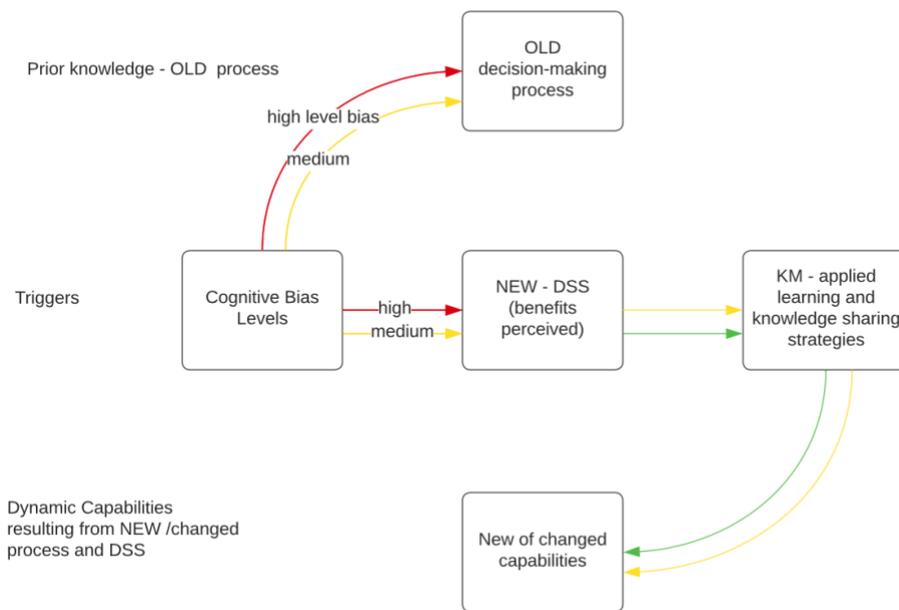


Figure 5: Research model reflecting the individual unique results

## 6. Discussion

The results of this pilot study underscore the suitability of the methods and provide insights into the complexities of senior managers' decision-making behaviors and thinking. The results are discussed in several sections on the interviews, SSM and cognitive biases.

The discussion of decision-making problems during the interviews was dynamic and collaborative. Such active collaboration influenced the researchers, making it essential to document any deviations from the script, omission of specific topics, and other aspects, after each interview session. This approach may yield interesting outcomes, such as interviewer's progression in thinking process or even potential sabotage of the interview's objectives. A tendency to omit predetermined topics or to experience other deviations will be the topic of the conference workshop discussion, i.e., how other researchers addressed this topic, to assure the unbiased results. Given that semi-structured interviews are inherently evolving, some changes are expected, but they must be identified when they are significant. During the interviews, SSM fostered dynamic discussions and strong engagement, thus providing to be a useful method [20], [24].

Our preliminary findings confirm the ability of our research method to identify a significant level of cognitive biases. In line with our assumptions, strong cognitive biases were identified among all senior managers. Considering that these managers lead successful organizations, these cognitive biases may lead to critical failures in the future. Nevertheless, the problematic

situation chosen by the senior managers might not have been perceived as complex or critical for the business. Problems or errors must be substantial and imminent threats to a business before managers consider change and adaptation, as shown when applying system dynamics in strategic management [26]. Therefore, the findings of our pilot study suggest that either the decision problem was not critical for the business or that the system had not yet displayed failures.

The organizational learning model was adopted [7] to analyze learning process during addressing a challenge in decision-making management process. The model was adapted enabling both positive and negative effect of model elements on the desired result; positive and desired new or changed dynamic capabilities. Cognitive bias element is part of learning triggers and the results showed that high levels of cognitive bias may be a negative factor of organizational learning, which indicates the potential thread of cognitive bias leading to decision-making failures [2].

### 6.1. Limitations

The main limitations of this study are related to participant selection because only one participant was interviewed per company. Although all participants were level C senior managers, board members, executives, or owners and all interviews led to in-depth discussions, these factors limited the research. The preliminary results also provide a single, subjective perspective, in a limited time frame. The interviews were based on a specific decision problem or challenge selected and defined by the manager at that time for an interactive and dynamic discussion in line with SSM principles but might have biased the results because they were related to only one decision problem, not to the decision-making practices of the company and the manager. Furthermore, these preliminary results may be subject to researcher's subjective interpretation, especially in the quantification approach. The level of cognitive bias level quantified in this study seems appropriate considering the binary response options (yes/no), but the quantification of the willingness to change and use DSS to solve decision-making problems and the success of the KM strategy must be supported by previously published results.

The KM strategy expresses dynamic capabilities and organization learning, but this relationship may be an oversimplification of three similar but different concepts. Although DSS and KM quantification may be subjective, human behaviors and preferences have been quantified by Becker [29] and Kahneman [27], [28], among other researchers. The quantification approach shall be confirmed by previous research.

## 7. Conclusion

Senior managers show mostly high levels of cognitive biases connected mostly to low levels of DSS perception and low levels of KM strategy success. The preliminary results indicate stronger relationship between level of cognitive bias and KM than cognitive bias and DSS. These preliminary findings provide initial insights into the complexities of senior managers' decisionmaking behaviors, which affect the success of a KM strategy. KM policies provide the foundation for innovation and adaptability, so our preliminary findings of KM relationship to high cognitive bias indicates potential failures in organizational learning. Next research will focus on obtaining twenty more senior managers while qualitative results coding will be conducted by using suitable application.

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