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RESEARCH PERSPECTIVES ON CREATIVE INTERSECTIONS

Using Design Thinking to improve Strategic Decisions during Collaborative Sensemaking

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Human cognitive limitations affect strategic decision-making. One of such effects is emergence of cognitive biases, deviations from rationality in judgment. These biases can negatively influence an organisation's capability to capture and utilize new ideas, thus inhibiting innovation. Researchers have documented different strategies for mitigating cognitive biases – and many of them overlap with the ones emphasised in design thinking. However, research so far does not offer any specific "recipes" for mitigation of cognitive biases. This paper links together research on challenges of strategic decision-making, cognitive biases and design thinking. The paper investigates the effects of applying design-thinking tool in collaborative sensemaking stage, within a small business team, aiming to mitigate confirmation bias. The study indicated that newly introduced design-thinking tools did not have the expected positive influence on decision-making. The research contributes to the field by developing a new framework on how to identify and mitigate confirmation bias in strategic decision-making.

keywords: design thinking; cognitive bias; confirmation bias; strategic decision making

Introduction

Decision-making is a cognitive process where one selects a satisfactory solution among several alternative possibilities. Strategic decision-making is the process by which top-management in companies (individuals or groups of people) make the most fundamental decisions (Das, 1999; Mintzberg & Waters, 1982). Individual subjective factors influence

environmental and organisational perceptions and subsequently, strategy formulation (Anderson & Paine, 1975). Strategic decision processes are characterized by novelty, complexity and open-endedness, and lack of structure (Mintzberg, 1976; Mason & Mitroff, 1981). Decision makers usually begin with little comprehension of the situation and then deepen their understanding while working with the challenge. These challenges are often "wicked problems" (Churchman, 1967), which are also studied in design research (Dorst, 2015). To simplify these "wicked problems", decision makers can rely on judgmental rules, or heuristics (Schwenk, 1984; Levy, 1994; von Krogh & Roos, 1996; Das, 1999). Sometimes these "rules of thumb" could be necessary and useful, but they can also lead to emergence of cognitive biases – systematic patterns of deviation from norm or rationality in judgment (Kahneman & Tversky, 1979; Kahneman, 1982; Haselton, 2005; Kahneman, Lovallo, & Sibony, 2011).

Researchers have documented different strategies for mitigating cognitive biases – many of these overlap with those emphasised in design thinking (Liedtka, 2014; McCollough, Denmark, & Harker, 2013; Dorst, 2015). For instance, in their review, Liedtka et al. (2014) discuss influences of tools like ethnography, visualisation, team collaboration, prototyping on projection, ego-centric empathy, focusing illusion, confirmation and availability biases. Some potential methods for mitigation of biases include increase of accuracy motivation (Hart et al., 2009). These are methods of self-awareness and self-assessment that are referred to as the two-system models of reasoning. However, research so far does not offer any specific "recipes" for mitigating cognitive biases. Indeed, in design-thinking, research and practices addressing "wicked problems" utilise the process of abductive reasoning, a creative inference that involves integration and justification of ideas to develop new knowledge that is important at the discovery stage of scientific hypothesis formation and testing (Walton, 2014). Furthermore, designers use "framing" as one of the key problem-solving processes through which they can conceive new approaches to problem situations (Dorst, 2015; Whitbeck, 1998). Investigation into how design-thinking methods could help manage biases has the potential to contribute to this field of study.

In this paper, we link together the challenges of strategic decision-making and cognitive biases with design-thinking research, beginning to build a basis for managers to effectively utilise design thinking to improve organizational decision-making. This could help managers to cognitively legitimise (Birkinshaw, 2008; Suchman, 1995) and support integration of the design thinking mindset and its approaches and tools within organisations (Schmiedgen et al., 2015). This can improve, for instance, organisational working culture (e.g., working in teams), and clarify design thinking's utility as a method for improving organisational decision-making processes and outcomes. Specifically, the paper investigates the effect of design-thinking tool on confirmation bias in the sensemaking stage within small business team.

The research question asks:

> *Can confirmation bias be identified, categorized and mitigated with the help of design thinking in the collaborative sensemaking stage of strategic decision-making?*

To answer the question, we will first introduce the key concepts connected to the chosen topic and review the literature on bias mitigation in business and design. Then we will

show through a pilot study in a small business team how confirmation bias was identified and targeted.

This research indicated that there is a potential for emergence of confirmation bias in strategic decision-making. Moreover, it was observed that newly introduced design-thinking tools did not have the expected positive influence on strategic decision-making, though the use of the tools was seen to be beneficial. The intervention was only short-term, and to achieve the long-lasting effect, one needs to work more with the mindset to change approaches for tackling strategic issues. Thus, there is a potential that if these tools are to be applied for a longer period of time, there likely could be a positive change in decision-making process. The research contribution is the new framework on how to identify and mitigate confirmation bias in strategic decision-making. It can be used further by researchers, as well as by managers in preparation of decision-making sessions.

Strategic decision-making and collaborative sensemaking

Strategic decisions reflect the inner corporate context (psychological, structural, cultural and political factors) and the outer context (for instance, competitive factors) (Pettigrew, 1992) and interaction with external environment (Ginsberg, 1988). They differ from routine decisions because they are mostly unstructured, as decision maker should utilise judgement, evaluation and insights when dealing with the challenge (Stahl & Grigsby, 1992). Strategic decisions usually involve a large proportion of corporate resources, as well as risk and trade-offs, they are difficult to assess in terms of performance; they are political, and rarely have one best solution (Wilson, 2003). It is essential that decision makers choose an optimal strategy when they face risk and uncertainty. Such frequently used management science techniques as linear programming, integer programming, network models, and simulation are used to improve decision-making. However, decision-makers have both limited capabilities for assessing consequences and a limited period of time for making decisions (Jones, 1999), as well as comprehensive information is not available for them (Liedtka & Ogilvie, 2011).

Strategic decision-making in organisations implies both individual sensemaking and collaborative sensemaking – communication of information, shared understanding, and interpretation of other's interactions with information which helps to overcome individual limitations (de Terssac, 1996; Dervin, 2003; Paul, 2010) of decision makers. It is important for improving decisions through better information acquisition, different perspectives and options, perception, and consensus formation (Weick, 1995).

Confirmation bias in strategic decision-making

Biases are widely acknowledged in decision-making. For example, Bazerman (1994) discusses 13 types of cognitive biases occurring in managerial decision-making. Strategy scholars also identify several biases that could occur in strategic decision processes. For instance, Schwenk (1984, 1995) identifies 11 cognitive biases, including confirmation bias, single outcome calculation, illusion of control, etc. He then classifies and maps these biases onto the three specific decision stages (i.e. goal formulation, alternative generation and alternative selection). According to Barnes (1984), five biases occur among managers and strategic planners: availability, hindsight, misunderstanding the sampling process, judgments of correlation and causality, and representativeness. According to Liedtka (2014), during design-thinking process several biases occur that can affect decision-

making, including confirmation, projection, egocentric empathy, focusing illusion, and hot/cold gap biases.

One type of cognitive bias appears when people tend to defend their attitudes, beliefs, and behaviors from challenges (e.g., Festinger, 1957; Olson & Stone, 2005). Selectivity of this type has often been called a congeniality bias (e.g., Eagly & Chaiken, 1993, 1998, 2005), positive hypothesis testing (Klayman & Ha, 1987), confirmatory (e.g. Rabin & Schrag, 1999) or confirmation bias (e.g., Jonas, 2001). Confirmation bias is the human tendencies to search for, collect, interpret, analyse and/or recall information in a way that confirms one's prior beliefs or wishes (Jorgensen & Papatheocharous, 2015).

Confirmation bias emergence is closely linked to the selective exposure to information. Hart et al. (2009) name the following motivational forces behind exposure decisions: defense motivation and accuracy motivation (Chaiken, Wood, & Eagly, 1996; Eagly, Chen, Chaiken, & Shaw-Barnes, 1999; Johnson & Eagly, 1989; Prislin & Wood, 2005; Wyer & Albarracin, 2005; Baumeister, 2005). People tend to believe in the accuracy of their views (defense motivation) because it gives them psychological stability and personal validation, but also cross-check their views with external reality (accuracy motivation), because they need accurate perceptions of the world around them. Current evidence shows, however, that people are almost two times more likely to select information, confirming, rather that disconfirming, their pre-existing beliefs (Hart et al., 2009).

Attributes of defense motivation such as commitment, value relevance, confidence, and challenge or support, closed-mindedness increase the selection of confirming information. On the contrary, information utility and open-mindedness lead to increase of accuracy motivation and therefore, mitigation of confirmation bias (Hart et al., 2009).

Past research has examined whether confirmation biases emerge at different information processing stages, like exposure, interpretation, and memory. However, so far meta-analysis has been conducted solely on emergence of confirmation biases at exposure and memory stages of information processing (Das, 1999), and there is not much information and research found about the emergence of confirmation bias at information interpretation stage (Bargh, 1999; Bruner, 1957; Darley & Gross, 1983; Duncan, 1976; Hastorf & Cantril, 1954; Lord, Ross, & Lepper, 1979), which in this paper is also referred to as sensemaking stage.

In a business context, there is also not much research done on biases. Some existing studies explore how managers systematically ignore disconfirming information and seek information that confirms their initial values and views and thus are prone to confirmation bias (Hogarth, 1987; Schwenk, 1988). Managers have a tendency to see the sources of confirming information more trustworthy than sources of disconfirming information (Schwenk, 1984). Biases also impact investment decisions and strategies (Verma, 2016). Belief revisions in auditors and search for evidence have also been connected to confirmation bias (McMillan, 1993), and professionals have a tendency to sell winning stocks too quickly and hold on to losing stocks too long (Shefrin and Statman, 1985). There has also been research (Krieger & Fiske, 2006) on unintentional discrimination in hiring and promotion practices. Confirmation bias affects due diligence in business contexts (Benoliel, 2015), justification of the deal when top-management "falls in love" with it (Aiello & Watkins, 2000) and builds optimistic assumptions (Eccles et al., 1999). Kahneman et al. (2011) also refer to the effects of confirmation bias and the tendency to minimise

the risks and costs of something that one likes and exaggerates its benefits. Jorgensen and Papatheocharous (2015) review empirical studies from the software engineering field connected with confirmation bias, and present a study examining how the prior belief in the benefits of a contract type among experienced software engineering managers affects the interpretation of evidence.

Most studies have been conducted with students as the subjects of research. Few studies have examined professionals and managers (Hart et al., 2009).

Design thinking as a method to mitigate confirmation bias

More traditional methods that could potentially mitigate cognitive biases include some methods leading to increase of accuracy motivation, for instance, two-system models of reasoning (Kahneman, 2011; Lilienfeld, Ammirati, & Landfield, 2009; Milkman, 2009; Morewedge, Yoon, & Scopelliti, 2015). In these models of reasoning, individuals first make an intuitive judgment that can further be altered after more systematic thinking was utilized: through "System 1" and "System 2" processes, respectively (Evans, 2003; Morewedge & Kahneman, 2010; Sloman, 1996). In effective debiasing training, information that could be overlooked during the "System 1" evaluation, is encouraged to be considered (e.g., Hirt & Markman, 1995), or individuals are encouraged to utilise statistical reasoning and normative rules (e.g., Larrick, 1990). Also, people utilise such debiasing methods as timesaving recommendation systems (Goldstein, 2008) and commitment devices when they cannot make choices appealing now but that could be beneficial to them in the long run (e.g., Schwartz, 2014; Thaler & Benartzi, 2004). However, Morewedge et al. (2015) note that it is not evident so far whether training effectively improves general decision-making (Arkes, 1991; Milkman, 2009; Phillips, 2004).

There has been some recent discussion about use of design-thinking practices to mitigate sets of cognitive biases in different stages of decision-making process in both personal and structural (organisational) systems (Liedtka, 2014; McCollough, Denmark, & Harker, 2013). In their review, Liedtka et al. (2014) discuss that, for instance, at idea generation stage, such design-thinking tools as ethnography, visualisation, team collaboration lessen the effects of the projection, ego-centric empathy, and focusing illusion biases. Bias introduced by customers (say/do gap) can be mitigated with the help of research methods like journey mapping and tools like prototyping where one can precisely describe their experience and see what needs are not met. Other tools, for instance participant observation, could be argued to reduce the reliance on self-reports. Prototyping, explicit identification of detailed assumptions, market feedback collection, and reflection to stimulate solutions iterations mitigate the effects of testing biases. If they are combined with ethnographic methods, they lessen the effects of such biases as planning fallacy, confirmation bias, endowment effect, and availability bias, which positively influences the array of proposed solutions and supports desire to test different novel ones (Liedtka, 2014). A number of studies have highlighted how individuals rely on a variety of material practices and artefacts, such as drawings and prototypes (Bechky, 2003; Carlile, 2002; Sutton & Hargadon, 1996), slide presentations (Kaplan, 2011), visual maps (Doyle & Sims, 2002), and Lego bricks (Oliver & Roos, 2007; Heracleous & Jacobs, 2008), to support the conversational practices through which they exchange, combine, and construct interpretations as they engage in collaborative sensemaking (Gioia, Thomas, Clark, & Chittipeddi, 1994; Gioia & Mehra, 1996) underpinning future-oriented group processes, such as strategy making, new product development, and planning of organisational

change. Such material artefacts are important “sensemaking resources” (Gephart, 1993) that facilitate transitions from individual to collaborative sensemaking.

The study: using prototyping to mitigate confirmation bias during collaborative sensemaking

Description of typical confirmation bias study

A typical confirmation bias experiment looks like as follows (e.g., Frey, 1981): the participants are confronted with a decision case and are asked to reach a preliminary or a final decision. Next, participants are offered additional pieces of information that they can select (sequentially or simultaneously). In most experiments, these pieces look like comments of experts or former participants. In experiments with confirmation biases, the participants are sometimes asked to answer a set of questions prior to the experiment about their general views, their experience (Dow, 2012; Jorgensen & Papatheocharous, 2015), demographic and self-report assessments, or write an essay about the proposed topic; in some cases, participants are even told that their ideas will be later discussed in a group (Canon, 1964; Freedman, 1965) to see how the degree of confirmation bias changes. After that, the intervention activity is happening, and later post-evaluation phase is conducted.

In design-thinking experiments on prototyping (Dow et al., 2012), participants are requested to prepare from one to several prototypes (e.g. online ads) to share with their peers. Sometimes, participants need to rank the choices (Artiz & Walker, 2010; Kress, 2012) to better understand their initial preferences.

In both studies, after the experiment, the participants fill in follow-up forms and answer questions how their decision changed (Jorgensen & Papatheocharous, 2015), on the basis of what it changed, what was the group dynamics at the end of group discussion (Dow et al., 2012), or, in some cases, if they were told about the biases and their influence, whether they will support their decisions with debiasing techniques in future decision-making situations in similar or other fields (Morewedge, Yoon, & Scopelliti, 2015). In design thinking (Dow et al., 2012), participants’ joint prototypes are evaluated by experts. In these experiment designs, confirmation bias could manifest itself as a change of attitude, belief or behaviour the participant experiences during the experiment, according to accuracy or defense motivation behaviours noted by the researcher. The degree of confirmation bias is matched as well with the level of experience of the participant.

Jonas et al. (2001) argue also that degree of confirmation bias in experiments is influenced by how the additional information on the topic is presented and / or processed: sequentially or simultaneously. In business or political contexts, the decision maker seeks information sequentially, as he or she usually does not have all necessary information at hand in the beginning of the decision-making process (Vertzberger, 1990). When information is gathered like this, it is not possible to determine in advance how many pieces of confirming or disconfirming information one will request, as well, it is not possible to delay processing the information before the selection finishes. However, as the questions are asked retrospectively, systematic memory distortion may emerge, thus being an alternative explanation for the study findings. Also, participants when receiving

pieces of information sequentially would more focus on their decision, but if the participants receive pieces of information simultaneously, focus is more on the evaluation and comparison of the information pieces, not on the prior decision.

Dow et al. (2012) used open-ended questions at the icebreaker and follow-up stages to evaluate team dynamics. Four questions were from the Subjective Value Inventory (SVI), an assessment of viewpoints on negotiation (Curhan, 2006). The relationship questions from the SVI provided good overview of the team rapport in terms of overall impressions, satisfaction, trust, and foundations for future interaction. The fifth question derived from the Inclusion of Self in Others Scale, a measure of someone's sense of connectedness with another individual (Aron, 1992).

It is also important to note that homogeneous groups (i.e. groups consisting of individuals with the same initial opinions) show a stronger confirmation bias when selecting decision-relevant information than heterogeneous groups (consisting of individuals with varying initial opinions) (Frey, 2009). For homogeneous groups, it was found that the larger the group was, the greater their perceived confidence in their decision was, and therefore, larger confirmation bias was observed. The larger the minority with different opinion within a group, the less confirmation bias is observed. Also, if in the group there is a representative who is to articulate group decision, the confirmation bias is larger among such representatives than among non-representatives. Based on the findings above, we can propose a conceptual framework (Fig.1) illustrating how confirmation bias manifests and might be mitigated at different stages of the study:

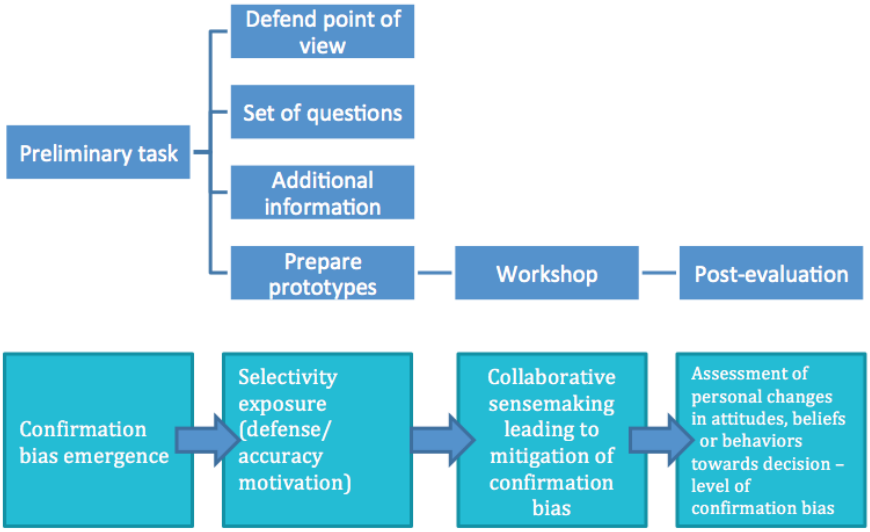

Figure 1 Confirmation bias manifestation in strategic business decision-making

Study design

After the framework was developed, we applied it to the chosen case company. The company was a Russian small-sized biotechnology company. Seven participants (referred to here as C1F1-C1M5) were asked to find a solution to a company-provided strategic business challenge during a design-thinking workshop. Before the experiment and after it, interviews with the top-manager were conducted to clarify the challenge (before the

experiment) and assess the implications of the experiment (after it). During the experiment, the participants were asked the following question: how can the company increase the value of its products and scientific projects to be more attractive for potential partners?

Drawing on the protocol for design thinking experiments on prototyping (Dow, 2012), each participant was requested to prepare written pre-sessional response to the question and prototype to share with their peers afterwards. Prototypes sketches were collected to check their consistency with the replies the participants gave before and during oral responses while sharing their ideas with others. Demographic parameters were calculated (average age, median age, gender, sex); educational background parameters (how many participants have higher education); and professional experience parameters (average length of stay in the company and position). This information was collected to check whether multidisciplinarity could be connected to the reported solutions preferences, as well as disposition for confirmation bias. The similarity and degree of inclusion of other participants' comments was analysed.

After the differences between the participant pre-response and transcribed oral response were analysed, we thematically categorized the ideas based on the thematic similarity of content. Each solution idea was encoded with a specific name like "participation in the exhibitions", "searching for the market news", and "uniqueness of solutions" (altogether 47 distinct ideas were identified, discounting the repetitions). Then these ideas were clustered into 21 subcategories, which were then formed into seven big categories (IP, Partnerships, Marketing, Offering, Staff, Sales, Funding).

It was checked how these categories and subcategories appeared in pre-responses and in the responses in the post-questionnaire that took place a month later after the experiment. In addition, for the post-questionnaire, mean value of self-originated opinions, mean value of other-originated opinions, and the ratio between them were calculated, to understand participants' preferences towards either their own or other-originated opinions.

Moreover, the following classification of participants' responses was performed: generalist verses specialised responses. The unit of analysis for generalist/specialised responses was the whole response given by the participant. The cut-off point between generalist and specialised responses was in the level of solution detalization. Generalist responses were those that included discussion by participants of different solution methods from multiple fields ("themes") with the same level of detail. If the person went into more details in the specific field of discussion (like "marketing") and gave more examples on this one specific field, then the reply was categorised as specialised. It was checked whether "generalists" were less prone to confirmation bias than "specialists".

From the follow-up questionnaire, the average rating that participants gave each idea was calculated, and self-originated verses other originated statements comparison was performed. The ratio of mean value of self-originated opinions to mean value of other-originated opinions was calculated. The analysis performed was to check whether in the post-response participants rated their initial ideas higher than others' ideas, or were complementary with other-originated opinions. Moreover, the mean rating of the self-originated statements was compared to everyone's other-originated statements. The

means of self-originated responses were compared to other-originated responses statistically with the use of Mann-Whitney U-test[1].

Further, to estimate how the solutions list of participants changed from initially preferred solutions (during the workshop) to solutions chosen a month later (in post-questionnaire), the subcategories named during the workshop were listed, and then compared to the list of subcategories rated by participants as of most importance in post-questionnaire. In addition, after the results from the post-questionnaire were received, average ratings of the categories were calculated to find out the most "popular" solutions.

Further, to relate participants' responses to the confirmation bias discussion, the participants' responses were analysed against motivational forces that mitigate or strengthen confirmation bias. The selected unit of analysis for the motivation categorisation was the whole post-response of the participant in the workshop session. The response of each participant was analysed in terms of 1) Repeating/confirming/adding/questioning of pre-response in oral response; 2) Generality/Specialisation of response; 3) inclusion of others' comments or solutions; 4) degree to which the participant changed his/her opinion between responses; 5) focus of response (one idea or several ideas); 6) qualitative check of whether there were clear differences across groups based on age, sex, position, and career experience.

Study results

A total of 96 segments were identified in the responses, and categorised according to content.

Table 1 Categories and subcategories of solutions identified

Category	Subcategory	Number of segments	Example of reply
IP	focus on the uniqueness of our biotechnology methods	4	«idea that is our product should match 2 main criteria – uniqueness and demand»
	protect our IP	5	«patent therefore should also be unique and on demand»
	Total	*9*	
Partnerships	partner with external professionals and scientists	6	«attraction of scientific experts for evaluation»
	partner with external laboratories to create new IP	4	«for sales, it is important to increase its real (scientific) value - attracting outsourced laboratories for the expertise of the IP»
	form good partnerships	5	«also, there is the way to

[1]Mann-Whitney U-test estimates that it is equally likely that a randomly selected value from one sample will be less than or greater than a randomly selected value from a second sample.

			increase the value of IP is to use it in a real project by ourselves and then sell it to partners»
	build good connections	2	«it is connections, scientific potential»
	Total	*17*	
Marketing	participate in conferences	3	«participation in conferences, invited lecturers, advertising of projects and products (they should not be necessary scientific, they should be at least of image value)»
	promote the IP we already have	6	«repetition of the experiments for IP on hand»
	follow the development of demand in the field	5	«prognosis of field development, following trends of novel methodologies»
	search for new emerging needs	3	«we can develop something like a mix - a product on demand with an interesting package»
	have clear and active marketing strategy	16	«to increase the value of IP, one needs to develop the clear "cover" of the company - site, marketing materials, precise branding on B2B market»
	inform the scientific community of our patents	2	«it is not only important to patent something, but to inform scientific community about it»
	Total	*35*	
Offering	have a great product	4	«all of this should be summed up, and the great product will be developed»
	check other products on the market and create similar products by ourselves	2	«it is important to know market news, see what is proposed in packaging, constituents, nosology, what people are creating»
	develop more services and/or product on demand	5	«creation of new direction - service is to increase the value of intellectual property»
	create new services for other companies who also want to protect	2	«one more thing is to develop the new direction of activities - services for increasing the value

	their IP		of IP for Russian companies in the scientific fields»
	have many projects	2	«there should be a lot of projects»
	Total	*15*	
Staff	focus on our staff	3	«I can say that the first effort that the company should do is staff»
	showcase success within the company	2	«catch the employees on their successes»
	Total	*5*	
Sales	target specific client groups	5	«institutions, universities and scientists»
	Total	5	
Funding	secure funding	10	«investments are needed»
	Total	*10*	
Total		**96**	

All participants during the oral response presented the same information they had previously written in their individual questionnaire. They did not refer to other speakers' responses while presenting their prototypes. After oral presentations, in the follow-up questionnaire, four participants noted that some of the specific steps suggested by the others were good for solving the problem. Also, in their follow-up questionnaire, six participants stated that their initial solution was correct. Two people included parts of others' solutions in their plans. Two engineers and the marketing person were more specialised in their approach and focused on some particular solution, whereas four participants with more "generalist" approach (economists, managers) provided more general ideas. Generalist approaches were found in both young and old participants, as well as in participants who worked in the company for different amounts of time. However, the assumption that "generalists" could be less prone to confirmation bias than "specialists" was not proved, at least for this study sample.

During the pre- and post-interview with top-manager, the main focus of his response was the personnel. However, he changed his emphasis from "more "generalists" are needed" to emphasis on including more creativity into corporate life and that people need to be praised for their successes.

The studied team had rather diverse demographics with the age of participants ranging from 28 to 61, highly educated, with different career experience. However, the analysis shows that the degree of preference in post-questionnaire a month later after the workshop of own verses others solutions is similar among all participants:

Table 2 Preferences of participants towards specific solutions in post-questionnaire (self-originated ideas are highlighted in blue)

Solutions / Participant's response	C1F1	C1F2	C1M1	C1M2	C1M3	C1M4	C1M5
focus on the uniqueness of our biotechnology methods	1	2	1	4	1	2	3
partner with external laboratories to create new IP	2	2	4	2	1	4	3
form good partnerships	1	1	2	2	2	1	3
partner with external professionals and scientists	1	1	2	2	1	1	1
secure funding	3	1	1	1	1	3	3
participate in conferences	1	1	1	2	3	1	1
build good connections	1	1	1	3	1	1	1
promote the IP we already have	1	1	1	1	2	1	1
have a great product	1	1	1	1	1	1	1
follow the development of demand in the field	1	1		2	2	1	1
check other products on the market and create similar products by ourselves	2	5	4	1	2	2	2
search for new emerging needs	1	1	1	1	4	1	2
have clear and active marketing strategy	1	1	1	3	1	3	1
protect our IP	1	1	1	3	1	1	1
target specific client groups	1	1	2	1	1	4	1
develop more services and/or product on demand	1	1	1	2	1	2	1
create new services for other companies who also want to protect their IP	2	2	1	5	3	3	2
have many projects	2	2	2	4	5	3	2
focus on our staff	1	2	2	2	1	2	1
inform the scientific community of our patents	1	1	1	1	1	1	1
showcase success within the company	1	1		2	1	3	1

When the mean ratings were calculated for self- and other-originated statements, and ratio of mean value of self-originated opinions to mean value of other-originated opinion, the calculated average rating of own responses by participants was 1.25, and of others' responses 1.75. The average ratio of own responses rating to the others' responses rating was 0.70, which means that still the participants found their previously held opinions more important than their colleagues' solution suggestions in the post-questionnaire. A Mann-Whitney U-test showed that this difference was statistically significant (U=1196.5, p=0.013). However, as six out of seven participants gave the top importance rating to more solutions in their post-response list of solutions than they had generated themselves in their workshop, they could still be argued to see after the experiment a broader picture than before.

After the results from the post-questionnaire were received, average ratings of the ratings groups in total were calculated to find out the most "popular" solutions. Figure 2 shows average ratings of the proposed solutions with the participants' preferences calculated. The participants' preferred solutions were: inform the scientific community of our patents (Marketing category), have a great product (Offering category), promote the IP we already have (Marketing category), develop more services and/or product on demand (Offering category), protect our IP (IP category), build good connections (Partnerships category), partner with external professionals and scientists (Partnerships category):

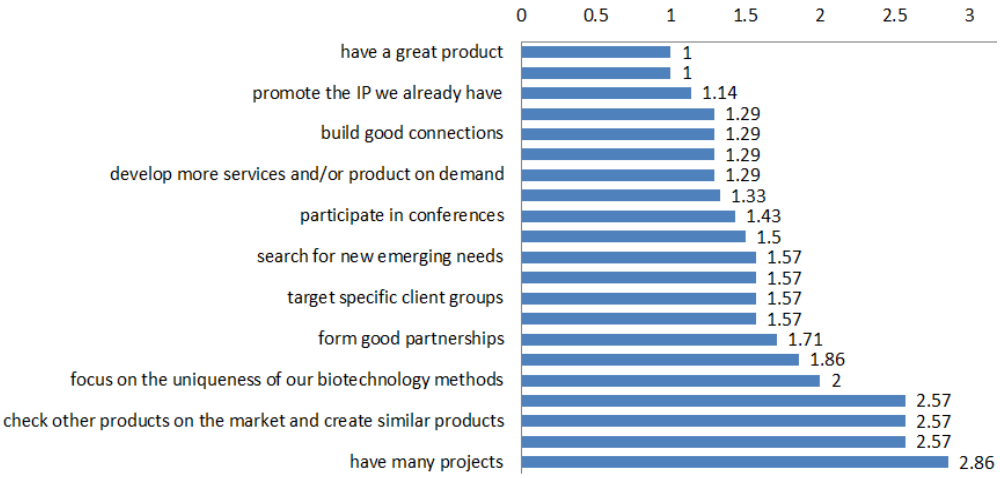

Figure 2 Average rating of solutions among participants

When the responses of participants were analysed against prevalence of factors potentially increasing defense or accuracy motivation to showcase how the confirmation bias manifests itself in the experiment, the presence of the following elements was showcased as potentially strengthening confirmation bias (defense motivation): commitment, reversibility, closed-mindedness, and overconfidence. Another defense motivation factor according to Hart et al. (2009) – quality of information available (disconfirming rather than confirming information of high quality) – was not found in participants' responses. On the other hand, open-mindedness, the element that potentially mitigates confirmation bias (accuracy motivation), was showcased in participants' responses. Other factors potentially mitigating confirmation bias – outcome

relevance, utility and quality of information available – were not found in participants' responses.

Discussion

The literature review showed that there is a potential for emergence of confirmation bias in business decision-making, and there are several cases that can be referred to (e.g., Jorgensen & Papatheocharous, 2015; Verma, 2016). The literature analysis also suggested that design thinking and its practices and tools can help strategic decision makers to deal with challenges and mitigate cognitive biases, including confirmation bias. These tools encourage team members to withhold from judgment and avoid debates, thus helping to create more innovative solutions (Liedtka, 2014). However, limited theoretical and empirical research has been done on this topic.

The empirical study conducted might showcase the selectivity exposure (Cotton, 1985; Frey, 1986), prevalence of defense motivation, and emergence of confirmation bias in strategic decision-making. The study indicated that applying isolated elements of design thinking without an awareness of interdependencies of its mindset and tools did not have the expected positive influence on strategic decision-making in such a short intervention. Many factors increasing the levels of confirmation bias were present during the workshop (presence of top-manager, short timing, stress due to uncertainty about the topic and methods used, no prior experience with prototyping and group work, highly skilled specialists familiar with only their fields of work).

The participants perceived the idea of giving follow-up comments on others' prototypes as an opportunity to showcase that their particular initial solution was correct, adding that some details from others' answers were appropriate as well. In the conducted workshop noteworthy is the connection between the participants' typical role in the company and the initial preference of challenge solution (pre-response and oral response).

The most positive outcome is that the top-manager noticed the importance of such group sessions and creative techniques and decided to focus more on employees' wellbeing and recognition of their successes. Also, according to the results of post-questionnaire, participants' knowledge about the challenge subject has been broadened. To us, it seems reflective of the intangible value that design thinking could bring to organisations and impact collaborative sensemaking.

Conclusions

In this paper, we discussed the challenge of identification, classification and mitigation of confirmation bias in the sensemaking stage of strategic decision-making. The current research served as a contribution towards grounding design-thinking research in the cognitive bias framework (Liedtka, 2014) by introducing the conceptual framework of how confirmation bias can be identified and targeted in strategic decision-making. That could be utilised further in other research design, and by managers in preparation of decision-making sessions. This could help managers to support holistic integration of design thinking in the organisational culture, and clarify design thinking's utility as a method for improving organisational decision-making processes and outcomes. The conducted empirical study resulted in increasing awareness of the top-management in the case

company of the opportunity associated with integrating design-thinking tools in the problem-solving sessions.

The literature analysis and empirical study showed that confirmation bias could be identified and classified in strategic decision-making (Das, 1999; Krieger & Fiske, 2006; Benoliel, 2015). That being said, the introduction of design-thinking tools did not have the expected positive influence on strategic decision-making: the lasting effect was not achieved, though the use of the tools was seen to be beneficial, from the received responses from top-manager and other participants. Therefore, while we managed to investigate how to identify and classify confirmation bias, more research is needed to study the potential and ways of its mitigation with the help of design thinking. There is a possibility that if design-thinking tools are to be applied for a longer period of time, they could positively impact strategic decision-making.

The limitations of the conducted study include limitations of qualitative method chosen (poses some restrictions for analysis), sample size, language barrier for assessment of study results, lack of prior research studies on the topic, and self-reported data (one researcher designed the study, made observations and analysis). It could be inferred that more elaborate studies with extensive data collection, and utilization of in-depth qualitative approaches and quantitative approaches, could contribute to the chosen field of study. Moreover, it would be beneficial to collect qualitative data on how design thinking manifests itself at different stages of strategic decision-making process in companies to help utilise design thinking, and what difficulties managers express at different decision-making stages. This will help broaden the implications of proposed bias mitigation framework, as well as see bigger picture of what difficulties managers experience (other biases and cognitive limitations), and where they can use design thinking more to impact strategic decisions being made.

It is suggested that comparative workshops could be done with different purposes: one, for instance, without management representative, and one where the purpose of the study is explained (Morewedge, Yoon, & Scopelliti, 2015). It could be noteworthy to compare results in company already utilising design-thinking methods, and in the companies that are unfamiliar with the topic. To add, it would be important to try different research designs, like creating several prototypes at once and measuring the degree of confirmation bias, giving specific pieces of information about the challenge before the workshop to participants that could bias them towards their chosen solution, propose awards (Dow et al., 2012). It would be as well important to work with the challenges, solutions to which will be implemented certainly, to check the change in accuracy and defense motivations among participants and the degree of confirmation bias. It could be suggested that further research could be done to check whether still some difference between “generalists” and “specialists” thinking exists to assess confirmation bias emergence. It is as well noteworthy to tie open-mindedness or closed-mindedness and presumably other potential accuracy or defense motivation factors to confirmation bias mitigation.

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