MASTER THESIS
DECISION-MAKING IN A
TIME OF INFORMATION
OVERLOAD

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1. Introduction

The amount of information that most people have to process on a daily basis is vast and ever increasing. In the beginning of the 20th century, the key characteristic of information was its scarcity (Standage, 1998, Shapiro and Varian, 1999). The few information sources, high costs of information production and re-production, and a relatively stable socio-economic environment resulted in the modest growth of information supply (Iastrebova, 2006). Also, the high degree of fragmentation of early societies, the existence of territorial and economic borders between nations, the low level of education, and the dominance of social institutions (e.g. local governments, church etc.) that performed the functions of information gatekeepers, all restricted the transmission and accumulation of information (Iastrebova, 2006).

Defragmentation of the society through shifts in political, economical, social, technological and ethical rules had serious influence on the amount of information produced annually. The amount of data stored now doubles every 18 months (Roland Berger Strategy Consultants, 2011).

This growing amount of information creates extraordinary opportunities for learning, creativity, innovation and performance. Progress in information technology, mobile communications, big data collection and storage means that more people and firms have access to more information than ever before (George, Haas & Pentland; Hilbert and Lopez, in Knippenberg et al., 2015). The progresses in information- and communication technologies (ICT) have been seen as a new reason for information overload and are also seen as the only countermeasure against it (Schultze and Vandenbosch, 1998). Thus, information processing possibilities are greater than ever before, but so are information processing demands (McKinsey Global Institute, 2011). Yet, our frameworks of attention and decision making have not seen corresponding radical shifts (Knippenberg et al., 2015).

Herbert Simon recognized early that the amount of information is growing fast and gaining access to information is not the biggest challenge organizations are facing. It is a challenge to make strategic decisions under information overload instead of information scarcity (Knippenberg et al., 2015).

However, processing information requires attention. If attention would be unlimited, more information should be better. Growing evidence of the limited attention of individuals (e.g.,
Chetty et al. (2009), Dellavigna and Pollet (2009), and Abaluck and Gruber (2011) makes it clear that attention has become the scarce factor when processing information.

The constantly changing environment in the digital economy has challenged traditional economic and business concepts (George, Haas & Pentland, 2014). Information technologies create an explosion in the world’s capacity to store, communicate, and compute information that is fundamentally changing the way individuals, groups, organizations and industries work (Hilbert & Lopez, 2011).

Different studies (Speier, Valacich & Vessey, 1999, Shenk, 1997, Eppler & Mengis, 2004; Bazerman & Moore, 2008; Hilbert & Lopez, 2011) suggest that information overload seriously impacts both individuals, groups and organizations. The rising amount of information causes more competition for attention of individuals, groups and organizations, increases sub-optimal decision making, wasted effort, and decreased productivity. So, there is reason to believe that overload of information in organizations negatively influences strategic decision making.

Previous studies (Lipowski, 1975; Klapp, 1986; Lawrence, 1974) have shown that information overload, previously understood as the side effect of ‘sensation overload’, has expanded into all spheres of human life and suggests for serious adjustments in human behavior. The issue of information overload can be divided into three main perspectives. Information overload can be viewed from a technology perspective (Hilbert & Lopez, 2011), a human information processing perspective (Eppler & Mengis, 2004), or as an organizational subject (Bazerman & Moore, 2008). This research mainly focuses on information overload from an organizational perspective, more specific on the influence of information overload on strategic decision making from an organizational perspective.

The problems framed in academic literature lead to some challenges about information overload in organizations. Three main challenges exist at multiple levels when enduring information overload. Starting with micro-level challenges for example switching attention across tasks (Altmann & Gray, 2008; Leroy, 2009). Secondly, meso-level challenges such as handling multiple team assignments simultaneously (O’Leary, Mortensen & Woolley, 2011). The third level, macro-level challenges, are for example ensuring electronic databases are
valuable resources instead of expensive investments that are quickly ignored (Hansen & Haas, 2001).

To address these, often complex, problems, individuals develop rules of thumb, or heuristics, to reduce information processing demands of making decisions. When organizations provide managers efficient ways of dealing with complex problems, heuristics produce good decisions a significant amount of time (Bazerman & Moore, 2008). Nevertheless, heuristics can also lead managers to make systematically biased judgements. Biases result when an individual inappropriately applies a heuristic when making a decision (Bazerman & Moore, 2008).

These problems encourage to find new ways of dealing with information overload in organizations. The awareness, access and usage of information in this information age ask for more insights in the way people in the workplace can make better decisions instead of experiencing information overload. Research (Posner, 2010) on decision-making shows the importance of understanding that decision makers operate with varying amounts of information – sometimes too much (overload), sometimes not enough (uncertainty). Thus, an important and necessary goal to make better decisions is getting the feeling of confidence properly calibrated with the accuracy of the analysis rather than with the quantity of information at hand (Posner, 2010).

Recent evidence (Kannadhasan, Aramvalarthan & Pavan Kumar, 2014; Mishra, Allen & Pearman, 2015) suggests that all businesses face a more unstable business environment with high levels of uncertainty, which makes decision making more complex than ever before. By the time all the information is analysed and the decision is made, there is a possibility that the opportunity would not exist anymore, that’s why heuristics play such an important role in fast decision making in complex situations (Kannadhasan & Nandagopal, 2010a, b).

As earlier research (Posner, 2010) suggests, it is important and necessary for managers to get the feeling of confidence properly aligned with the accuracy of the analysis, rather than with the quantity of information at hand. Thus, operating with varying amounts of information – sometimes too much (overload), sometimes not enough (uncertainty).
To get more insight in the way decision makers in organizations can positively align between information overload and uncertainty, it can be helpful to look at a group who consistently engages in risky events while dealing with inordinate amounts of information and uncertainty, namely entrepreneurs. In this study an entrepreneur is someone who has founded their own firm and is currently involved in the strategic decision making process of the company. Empirical evidence (Busenitz and Barney, 1997; Busenitz, 1999; Arend et al., 2016) indicates that entrepreneurs tend to use heuristics more extensively in their decision making than managers in large organizations do. So, both entrepreneurs and managers of large organizations are facing challenging tasks to both take on available opportunities and make the right decisions by utilising all available information at the same time (Kannadhasan et al., 2014). Under increasing conditions of environmental uncertainty and complexity, which both entrepreneurs and managers of large organizations face, heuristics can be an effective and efficient guide to decision making (Busenitz & Barney, 1997).

Studies (Busenitz & Barney, 1997; Busenitz, 1999; Curseu & Vermeulen, 2008, Arend et al. 2016) show that entrepreneurs are uniquely characterized in how they think, they are particularly more prone to the representativeness heuristic and the overconfidence bias when making decisions. Biases and heuristics, such as the representativeness heuristic and the overconfidence bias, may enable individual decision-making with incomplete information (Busenitz, 1999). The representativeness heuristic and overconfidence bias are critical in better comprehending strategic decision-making (Tversky & Kahneman, 1974; Busenitz, 1999; Arend et al. 2016). This leads to the following research objective and research question:

**Research objective:**
*The objective of this study is to get insight into the effects of information overload on the use of the representativeness heuristic and associated overconfidence bias in strategic decision making in organizations.*

**Research question:**
*What is the effect of information overload on the use of the representativeness heuristic and associated overconfidence bias in strategic decision making in organizations?*
It is important to get a better understanding of deviations from rational decision-making models, which tend to focus on biases and heuristics (Schwenk 1988; Stevenson et al. 1990; Kahneman et al., 1982). A study by Busenitz (1997) recommends undertaking further research into the link between information overload, heuristics and biases, and strategic decision making. After this study, several studies (Curseu & Vermeulen, 2008; Arend et al. 2016) around strategic decision making and the use of heuristics and biases have been conducted. It is important to understand that heuristics, rules of thumb, are usually very effective mental shortcuts and provide a simple way to deal with complex issues. The problem arises when we rely too much on those heuristics, which can lead to biased thinking and as a result sub-optimal decision-making.

Several studies (Kannadhasan, Aramvalarthan & Pavan Kumar, 2014; Mishra, Allen & Pearman, 2015) in which information overload and strategic decision making were researched show the importance to better understand how people make decisions in the ever-increasing complexity of organizational environments. Mostly, because in organizational context there is a need for fast decision-making, in other words, using heuristics is often necessary (Kannadhasan & Nandagopal, 2010a, b; Bazerman & Moore, 2008; Curseu & Vermeulen, 2008). That’s why it is relevant to focus this research about information overload in organizational strategic decision making on the important role of heuristics and biases in this context.

The structure of the thesis is as follows. In chapter 2 the theoretical background will be discussed and relevant theories and perspectives with regard to the problem will be included in this chapter. The conceptual model is also presented in this chapter. In chapter 3, methodology, the applied method and reasoning will be discussed. After that our samples, data sources and measurement methods will be explained.
2. Theoretical background

This chapter provides an outline of relevant theories and perspectives with regard to information overload, heuristics, biases and strategic decision making. Key concepts, central cause and consequences, assumptions and conditions will be discussed. The purpose of this literature review is threefold: provide an outline of relevant theories and perspectives regarding strategic decision-making, review relevant literature related to information overload, and explore the use of heuristics and biases in the context of strategic decision-making.

2.1 Concept of Strategic Decision-making

This study tries to better understand the use of heuristics in the context of strategic decision making. Decision-making is a cognitive process which involves the selection of a specific course of action that is supposed to bring us to a certain result (Curseu & Vermeulen, 2008, p. 1). One of the key challenges in decision-making is the reduction of uncertainty, because most of the time the exact outcomes aren’t clear. To get a better understanding of strategic decision making, it is important to understand that purely rational decision making models often fall short (Haley and Stumpf, 1989). Because purely rational decision making is hardly ever the case, an outline of possible perspectives regarding decision-making is critical to better understand the identified problem of information overload and strategic decision-making.

Existing research by Busenitz (1997) recognizes the role of several factors which prevent purely rational decision-making:

1. The high cost of decision-making efforts (Simon, 1979)
3. Differences in decision-making procedures adopted by managers (Shafer, 1986)
4. Differences in the values of decision-makers (Payne et al., 1992)

Most models that try to give a reason for deviations from rational decision-making models tend to focus on biases and heuristics (Schwenk, 1988; Stevenson et al., 1990; Kahneman et al. 1982). Because heuristics tend to be an effective way to make decisions (Pitz & Sachs, in Busenitz, 1997).
There is a lot of evidence of decision-makers using heuristics with a lot of decisions (Bateman & Zeithaml, 1989; Jackson & Dutton, 1988; Kahneman et al., 1982; Zajac & Bazerman, 1991). Research into such behaviour is thus critical to better understand strategic decision-making (Busenitz 1997).

Although decision-making within organizations is often complex, the steps of the underlying process are very much alike: we recognize a problem situation, we generate alternatives, we evaluate the various alternatives based on these evaluations, and we select the one that best satisfies our evaluation criteria (Simon, 1965). There are two key ways to reduce uncertainty in both individual and organizational decisions. The first way to reduce uncertainty is to gather relevant information, based on this information look for alternatives and then make a decision (Curseu & Vermeulen, 2008, p.1). The second way to reduce uncertainty is to apply pre-existing heuristics (cognitive short cuts developed through experience) and to use only a limited number of signals when making a decision (Curseu & Vermeulen, 2008, p. 1).

So, there are two related concepts where a distinction can be made between effortless intuition (System 1) and deliberate reasoning (System 2). Stanovich and West (2000) clearly defined characteristics that tell the difference between the two types of cognitive processes that are labelled as System 1 and System 2. This distinction between System 1 and System 2 refers to System 1 thinking as our intuitive system, which is fast, automatic, effortless, implicit, and emotional. Most of our decisions are based on System 1 thinking, where the interpretation of information happens automatically and unconsciously. The intuitiveness is formed by the use of heuristics. System 2 refers to a slower, more conscious, explicit and logical reasoning process (Kahneman, 2003). Figure 1 (Kahneman, 2003) clearly visualizes the distinction between the two systems. It is based on an analytical process before making the decision. In most situations System 1 thinking results in sufficient results. The busier people get, the more they tend to rely on their System 1 thinking (Chugh, 2004). Although System 1 thinking is sufficient most of the time, it can be very risky to fully rely on this thinking, especially when making strategic decisions. Biases are much more likely to occur in System 1 thinking than with System 2.
thinking (Bazerman, 2008). The systems tend to work together, with adjusting the System 1 response after thinking more in-depth by using System 2 thinking.

Next to the individual differences in processing information and making decisions based on intuition (System 1) and reasoning (System 2), it is also important to take a look at the context in which the decision is made. In order to better understand the context of decision making, it is important to understand the difference between decision-making under certainty, decision-making under risk and decision-making under uncertainty. A considerable amount of research is done and literature has been published on the context in which information behaviour (IB) takes place (Fisher, Landry, & Naumer, 2007; Bawden & Robinson, 2013; Julien, Peckoskie & Reid, 2011). From this perspective, it has been argued that research into IB was mainly concerned with groups in the same social context and using the same technological artefacts to mediate their behaviour, students, scholars, and professionals for example. For instance, research about work tasks tends to be generally relatively simple and not time pressured, which makes it hard to generalize findings within this context into other environments (Wilson, 2008). However, especially in organizational environments, information behavior is explored in other contexts (Byström & Hansen, 2005; Byström & Järvelin, 1995; Ellis & Haugan, 1997). From this point of view focus on the context is important. Mishra et al. (2015) takes in mind that the context in which work tasks are executed is dynamic, complex, uncertain and time pressured. Their research recognizes the critical role played by both the context of the activity and individual differences that influence the way of decision making and use of information. So, both the context of strategic decision making and the individual differences determine how information is processed before making a decision.

2.1.1 Decision-making Under Certainty

If a decision-maker has a reasonable certainty about the alternatives, the associated conditions of each alternative and the outcome of each alternative, a condition of certainty exists (Rawat, 2010). Under conditions of certainty, accurate, measurable, and reliable information on which to base decisions is available. That means that the cause and effects of the different relationships are known and the future is highly predictable under these conditions of certainty. Conditions of certainty arise in the case of routine and repetitive decisions concerning day-to-day operations of the business (Rawat, 2010). It is important to
understand decision-making under certainty because one of the biases that will be part of the research, the overconfidence bias, refers to ‘an overestimation of one’s certainty regarding the current information’ (Simon et al., 2000). This means that the decision-maker has too much certainty with regard to the information at hand.

2.1.2. Decision-making Under Risk
Decision making under risk arises whenever perfect information lacks or whenever information asymmetry exists. The asymmetry between options can introduce systematic biases (Tverksy & Kahneman, 1979). Under risk, the decision maker has incomplete information about available alternatives, but has a good idea of the probability of outcomes for each alternative (Hewig et al., 2009). Therefore, it is important to take risk into account when analysing strategic decisions within an organizational context. Indeed, many researchers agree that it is perceived, rather than objective, risk drives that decision-maker to behavior in SDM (Dowling & Staelin, 1994). For this research, it is important to understand this difference between perceived risk and objective risk, because perceived risk is what drives the decision-maker and objective risk is the risk we can analyse while conducting this research. Therefore, the perception of risk seems to be of serious influence when making strategic decisions.

Next to risk it is also important to understand decision-making under uncertainty. Lipshitz & Strauss (1997) describe perceived uncertainty and perceived risk as related concepts which both are obstacles for accurate strategic decision-making. Thus, the perception of risk and uncertainty is a core element with regard to SDM.

2.1.3. Decision-making Under Uncertainty
Uncertainty relates to the inability of the decision-maker to know all the possible outcomes for all the alternatives (Duncan, 1972; Bakker et al. 2007). Under conditions of uncertainty, people tend to try to reduce the uncertainty by looking for additional information, using heuristics or including other agents in the decision-making process (Curseu & Vermeulen, 2008). Previous studies have reported that managers in large organizations, on average, face a lower level of uncertainty when making decisions than entrepreneurs (Hambrick & Crozier, 1985; Covin & Slevin, 1989). Lower uncertainty for managers is caused by for example, historical trends, past performance and other information which helps reduce the uncertainty level when making decisions (Mintzberg, 1973). Entrepreneurs often have to make decisions
without this uncertainty reducing information (Miller & Friesen, 1984) (Simon et al., 2000; Cheng & Dong, 2007, in Kannadhasan et al., 2014). Comparing how both groups behave in the context of strategic decision making, can result in valuable information for this research. So, that is how both entrepreneurs and managers of large organizations can be related to each other in the field of strategic decision making.

Busenitz (1997) states that efforts by entrepreneurs to reduce their uncertainty in decision-making are likely to be very costly and usually not very effective. That why Busenitz (1997) regarding uncertainty and decision making argues that people who are susceptible to the use of heuristics in decision-making are the very ones who are likely to become entrepreneurs and the more cautious decision-makers will tend to be more attracted to larger organizations. ‘Entrepreneurial activities simply become too overwhelming to those who are less willing to generalize through the use of biases and heuristics’ (Busenitz, 1997).

When facing uncertainty, people tend to seek information to reduce the uncertainty (Belkin, 1980; Kuhlthau, 1993). The more uncertainty in a given situation, the greater the frequency of information seeking (Sawyerr, 1993). Uncertainty also links with task complexity (Daft, Sormunen, & Parks, 1988; Altmann & Gray, 2008; Leroy, 2009). Complexity and uncertainty are associated with each other, because uncertainty arises from the human inability to solve complex problems, which makes that the complexity of a task influences the amount of uncertainty (Culnan, 1983; Vakkari, 1998). Another way people reduce uncertainty is through experience as a source of information (Allen, 2011).

Thus, risk is made of two parts: the probability of something going wrong, and the negative consequence if it does. Risk can be hard to see, prepare for or manage and when hit with negative consequences, it can cost a lot of time, money and reputation for an organization. Risk analysis is a process to help identify and manage potential problems.

2.2 Information Overload and SDM

In the context of organizational decision-making, risk analysis is an important part where managers often have to deal with information overload while analysing the risks. Decisions are usually guided by immediately available information and a significant amount of experience and judgment (Busch et al., 2009). That makes risk analysis complex, especially in the case of information overload. In order to better understand all the elements that are
related to information overload and strategic decision-making, it is important to understand why strategic decision-making (SDM) is important and how information overload and SDM can be defined.

2.2.1. Information overload

The objective of this research is to better understand the effect of information overload on strategic decision-making in the context of organizations, therefore it is important to clearly understand the term of information overload. Information overload is a phenomenon that many people face in our world of easily accessible knowledge and information (Shenk, 1997). The phenomenon of information overload has been studied in many different fields, leading to various constructs, synonyms and related (Kock, 1999; Kerren et al., 2007). Therefore, it is important to understand the context of information overload in this research.

As stated in the introduction the issue of information overload can be divided into three main perspectives; technology perspective (Hilbert & Lopez, 2011), human information processing perspective (Eppler & Mengis, 2004) and an organizational subject (Bazerman & Moore, 2008). This research is clearly focused on the organizational perspective. Before defining information overload, it is also important to keep the three main challenges of information overload in mind (micro-, meso- and macro-level challenges). Micro-level challenges involve switching attention across tasks (Altmann & Gray, 2008; Leroy, 2009), meso-level challenges are for example handling multiple team assignments simultaneously (O’Leary, Mortensen & Woolley, 2011). Macro-level challenges are for example ensuring that electronic databases are valuable resources instead of expensive investments that are quickly ignored (Hansen & Haas, 2001). Now that the organizational perspective is clear and the different levels are elaborated, the concept can be defined properly.

Traditional concepts of information overload define information overload in different ways. Miller (1956, p. 95) defines it as the “span of absolute judgement and the span of immediate memory which causes severe limitation on the amount of information that we are able to receive, process and remember”. Krugman & Ferrell (1981) describes information overload as information immersed at a speed too fast for a person to understand (Krugman & Ferrell, 1981). Another concept of information overload is the amount or volume of information a subject is given that is more than the individual can handle which causes information overload (Evaristo, 1993).
Too much information at one time can result in loss of information or incorrectly decoded information. High levels of information overload will confuse the individual, affecting their ability to set priorities, or make prior information harder to recall (Schick et al., 1990). Eppler & Mengis (2003) summarize the following five categories that can cause information overload: a subject receiving the information and their personal traits; characteristics of the information (quality, frequency or intensity, ambiguity e.g.), task & process parameters as in the state the information is given; the organizational design and the information technology (technology used to get the information).

Another important factor with regard to information overload is time. The amount of time can severely impact the information load and can cause information overload (Bettman, Johnson & Payne, 1990). If the time to complete a task is limited, adjustments to compensate the lack of time will result in inaccuracies of the performed task (Evaristo, 1993).

Thus, with regard to information overload and this research it is important to understand that information overload arises when people are unable to receive, process and remember all the information that is needed to make optimal strategic decisions within organizations with regard to the subject they have to make a decision on. But before understanding why people who encounter information overload are usually not rational when making decisions (using heuristics e.g.), it is important to define what the concept of strategic decision-making is.

2.2.2 Strategic decision-making

Before SDM can be defined it is important to notice that SDM has its roots in decision science from behavioural decision theory. Schwenk (1995) was one of the first to notice that the definition of SDM created its own path. SDM tackles new, complex and ill-structured issues (Schwenk 1998). SDM seems to emerge as one of the most alive areas of research in strategic management.

The early, more classical, viewpoints in the literature of SDM can are from Mintzberg et al. (1976), Simon (1947, 1957), Cyert and March (1963, 2002), Eisenhardt and Zbaracki (1992), Frederickson (1984) and Nutt (2005). Those classical views of SDM are based on normative or descriptive studies of which a lot of assumptions still have to be tested, while the idea of SDM as a definition in the decision-making science is still relatively new.
Another more elaborate way of looking at SDM by Dean & Sharfman (1996) and Nutt (1999) they describe SDM as concerning with strategies from design and planning, initiatives for mergers and acquisition, large investments in new markets or products, required disinvestments, to make or buy options and internal reorganizations.

Papadakis and Barwise (1998b) describe four reasons why there are limitations with regard to existing research on the context and process of SDM. Papadakis and Barwise have four reasons for these limitations:

1. There has been little research on the influence of the broader context on SDM
2. Although many attempts seem to come-up with SDM-models, most of these models have been underspecified
3. Although SDM is multidimensional, most research is focused on only one attribute
4. A lot of research is contradictory to each other which does not lead to the establishment of a coherent theory

Next to these limitations Bell et al. (1998) describe four elements of SDM: context, content, process, and outcome. The context is concerned with organizational and environmental factors. The content is about the topic of the strategic decision. The process is about what the people who are involved in the process do. The outcome is about the results or the consequences with regard to the strategic decision. This research mainly focuses on the context of SDM as is shown in the conceptual framework in paragraph 2.4.

After analysing the most important elements with regard to SDM it is important to understand that the definition by Papadakis and Barwise (1998) is how SDM will be viewed in this research. Next to that it is very important to keep in mind that this research focuses on only one of the four elements of SDM, namely the context of SDM as described by Bell et al. (1998) and that the quality of decision-making will be used as a variable in the conceptual model.

2.2.2.1. Quality of decision-making

The quality of decision-making according to Amason (1996) has two principal antecedents: the cognitive capabilities of a top management team and the interaction process through which the team produces its decisions. Research (Hoffman, 1959; Hoffman, Harburg & Maier, 1962; Hoffman & Maier, 1961; Wanous & Youtz, 1986) shows that a team’s
cognitive capability is strongly related to its cognitive diversity. Diversity provides a various amount of capabilities upon which a team can draw when making complex decisions. The second principle, the interaction process of teams, is of at least equal importance to produce a team’s result. Every strategic decision represents a unique combination of diverse skills, knowledge, abilities, and perspectives (Bantel and Jackson, 1989). Decision quality thus also depends heavily upon the process that the group actually employs (Steiner, 1972). Therefore, when assessing the quality of the strategic decision-making it is important to keep those two principals in mind. Although cognitive diversity represents the potential for high-quality decision-making, the potential is only realized with critical and investigative interaction processes between team members, where they can identify, extract and synthesize their perspectives with regard to a decision. Thus, similar to previous studies, the strategic decision-making quality measures perceptions of decision-makers concerning the quality of the strategic decisions they make (Amason, 1996; Carmeli et al. 2011; Olson et al., 2007).

2.3 Heuristics, biases and SDM

2.3.1 Heuristics and SDM

Since the challenge is no longer to make decisions under conditions of information scarcity, but increasingly making decisions under conditions of information overload, it is important to understand the way information is processed (Knippenberg et al., 2015). Processing information requires attention. If attention would be unlimited, more information should be better. However, attention of individuals is limited and therefore increasingly becoming the scarce factor in strategic decision making context (e.g., Chetty et al. (2009), Dellavigna and Pollet (2009), Abaluck and Gruber (2011)).

Even with the ICT developments, people are still limited in their attention and processing capabilities, as well as in their motivation to acquire and absorb information (Cohen & Leventhal, 1990; Zahra & George, 2002). Individuals, groups and companies are limited in their rationality and capability to pay attention to information when processing information (Cyert & March, 1963; Simon 1957). Both companies and individuals have cognitive and motivational biases and heuristics in their attention to information and in their decisions based on information (Baron, 1998, De Dreu, Nijstad, & van Knippenberg, 2008, Tversky & Kahneman, 1974), leading to sub-optimal decision making (Schick, Gordon & Haka, 1990) and increased information anxiety (Bawden & Robinson, 2009), which can negatively impact
self-efficacy (Conger & Kanungo, 1998, Bandura, 1977). Biases and heuristics are
judgemental rules, cognitive mechanisms and subjective opinions that people use help make
decisions (Barnes, 1984; Schwenk, 1984; Busenitz and Barney, 1997). Heuristics are used to
enable fast decision making (Busenitz & Barney, 1997; Busenitz, 1999; Keh et al., 2002).

Thus, heuristics provide people a simple way to deal with complex issues. In general, the
judgements that heuristics produce are correct or at least partially correct. It may be hard to
avoid any kind of simplification of decisions (Abelson & Levi, 1985), but pure reliance on
heuristics can create problems. Starting with the fact that most people are unaware that they
use heuristics when making decisions. Creating awareness of the use of heuristics, by for
example managers, can severely impact the way in which decisions are made and can
definitely improve the decision-making quality, because managers are more aware of
deciding when and where to use heuristics.

Bazerman (2008) describes four general heuristics that are not specific to particular
individuals, but heuristics that are applicable across the population. The heuristics are (1) the
availability heuristic, (2) the representativeness heuristic, (3) the conformation heuristic, and
(4) the affect heuristic. Tversky and Kahneman (1974) describe three heuristics, (1) the
availability heuristic, (2) the representativeness heuristic, (3) the anchoring and adjustment
heuristic. In order to be able to better understand heuristics in general and understand the
choice for using the representativeness heuristic for this research, the most important
heuristics regarding decision-making are elaborated below.

2.3.1.1. Availability heuristic

The first heuristic is the availability heuristic. This heuristic is a mental shortcut that relies on
immediate examples that come to a person’s mind when evaluating a specific topic, concept,
method or decision (Tversky & Kahneman, 1973). The heuristic is based on the idea that if
something can be recalled, it has to be important, or at least more important than alternative
solutions which are not as easy recalled (Esgate & Groome, 2005; Richie and Josephson,
2018). With this heuristic people tend to rely their judgement towards more recent
information, while basing opinions biased towards the latest news. This heuristic can be a
very useful decision-making strategy, because our minds generally recall instances of events
of greater frequency more easily than rare events (Bazerman, 2008). Therefore, using this
heuristic will often lead to accurate judgement. However, sometimes people make biased
judgements while using the availability heuristic. For example, they may feel that flying is more dangerous than driving because lurid publicity makes it easier for people to imagine a plane crash than a traffic accident (Lichtenstein, Slovic, Fischoff, Layman & Combs, 1978; Davis & Palladino, 2000).

2.3.1.2. Confirmation heuristic

The Conformation Heuristic, or Positive Hypothesis Testing, consists of the tendency to search for, interpret or recall information that confirm, or in a way that confirms, individuals pre-existing beliefs or hypotheses, while paying less attention to alternative possibilities. The confirmation heuristic is also called positive hypothesis testing (Klayman and Ha, 1987) or the congruence heuristic (Baron, Beattie, and Hershey, 1988). The tendency to search for, interpret, favor, and recall information in a way that confirms one’s pre-existing beliefs or hypotheses is the core of the conformation heuristic (Plous, 1993). This heuristic occurs when people selectively gather or remember information, or interpreted it in a biased way, when testing hypotheses.

People use the conformation heuristic, mostly subconscious, because they don’t like to be wrong and therefore are not looking for information in a neutral way. Research also suggests that even scientists can be influenced to the conformation heuristic (Lee et al., 2013; Mahoney & DeMonbreun, 1977; Mitroff, 1974). The conformation heuristic tends to contribute to overconfidence in personal beliefs and even in the face of contradicting evidence, it can strengthen a person’s belief. Several researchers found that the conformation heuristic attributes to poor decisions in political and organizational contexts (Nickerson, 1998; Tuchman, 1984).

The conformation heuristic is used for two main reasons. The first reason by Gilbert (1991) describes the consideration of certain hypotheses that is consistent with the hypotheses more accessible. The second reason by Kunda (1990) who focuses on the fact that our attention and cognitive processing capacity is limited and therefore we have to search for information selectively. This selective search gives people information that allows them to come to the conclusion they would like to have.

2.3.1.3. Affect heuristic
The affect heuristic is a mental shortcut that allows people to make decisions and solve problems quickly and efficiently, however current emotions such as fear, pleasure and surprise can severely influence decisions. Affect has played a key role in many behavioural theories, but it has rarely been recognized as an important component of human judgement and decision making (Slovic, 2007). This heuristic is part of the fact that most of our judgement is stimulated by an emotional or affective evaluation of the situation that occurs even before any higher-level reasoning takes place (Kahneman, 2003). This means that the affect heuristic, which often is used not conscious, is used as the basis of their decisions instead of engaging in a more complete analysis and reasoning process (Slovic, Finucane, Peters, and MacGregor, 2002).

The core of the affect heuristic is the emotional response (the affect) that plays a big role in decision making. It allows people to function without having to complete an extensive search for information, which makes it easier to make decisions. The heuristic is usually used when people try to determine the risk and possible benefits involved in a certain decision, depending on the positive or negative feeling that is associated towards a certain event. If feelings are positive towards a certain event, people are more likely to judge the risks as low and the benefits high. On the other hand, negative feelings are more likely to perceive low benefits and high risks towards events (Finucane et al., 2000).

The affect heuristic is an expression of System 1 thinking, our intuitive system, is more likely to be used when people are busy or under time constraints (Gilbert, 2002). Environmental conditions can also influence decision-making because of a change in affect. It has been shown that stock prices rise on sunny days, likely due to a better mood and more optimism induced by the weather (Bazerman, 2008). Thus, affect can be a good guide for decision-making, but when it replaces more reflective decision-making (System 2), it can result in suboptimal decision-making.

2.3.1.4. Anchoring and Adjustment heuristic

The anchoring and adjustment heuristic is a way in which individuals base their initial ideas and responses on just one point of information and make changes form that starting point (Northcraft & Neale, 1987). The heuristic describes the phenomenon in which that single piece of information therefore strongly influences a decision, particularly data encountered
early in a given situation (Richie and Josephson, 2018). ‘In information integration tasks, anchoring is a prominent heuristic, such that the first few arriving information sources (cues) tend to be given greater weight on the final integration product, than those cues following’ (Wickens et al., 2010).

Once the value of this anchor is set, all future negotiations, arguments and estimates are discussed in relation to this starting point (the anchor). The anchoring bias may be particularly problematic in dynamic situations, which leads to earlier arriving cues that are more likely to have changed and therefore are less reliable for final integration judgement (Wickens, 2010).

There are two reasons why anchors affect our decision-making. The first reason is that people often estimate an initial anchor that is based on whatever information is provided and adjust from that anchor (Epley, 2004; Epley & Gilovich, 2001). However, Tversky & Kahneman (1974) noticed early that adjustments from this anchor are usually not sufficient. That is also the reason why the anchoring and adjustment heuristic is often called the anchoring bias, because the decisions that are based on an anchor are usually not sufficient.

The second reason shows that an anchor lead people to a biased search of information that is in line with the anchor, instead of looking for information that is inconsistent with the anchor. (Mussweiler and Strack, 1999, 2000, 2001). This happens for both conscious and unconscious thinking (Mussweiler & Englich, 2005). For example, when you look at a car which is listed way above its market value, the high anchor will likely result in seeing positive features of that car that are in line with the high list price. The second reason of why anchors affect our decision-making is in line with the conjunctive bias which will be discussed later.

A classic example of anchoring in life is the first-impression syndrome (Dougherty, Turban & Callender, 1994). People tend to place so much emphasis on initial impression anchors that they often fail to adjust their opinion later on. The anchoring heuristic thus are cognitive anchors that are central to our judgment processes (Nisbett and Ross, 1980). Changing those cognitive patterns only works if the new information is presented and understood in a way that breaks through the existing cognitive anchors.
2.3.1.5. Representativeness heuristic

One of the most related heuristics to strategic decision making is the representativeness heuristic (Busenitz, 1997). Tversky and Kahneman (1971) where the first to describe the representativeness heuristic, which is widely used in decision making. The representativeness heuristic focuses on probabilistic judgements on uncertain events (Tversky & Kahneman et al. 1982; Tversky & Kahneman, 1982, Laibson & Zeckhauser, 1998). Bazerman (2008) describes this heuristic decision makers who are willing to generalize about a phenomenon based on only a few attributes of that person or only a few observations of a specified phenomenon. The representativeness heuristic is the one this research focuses on, because it is one of the most determinative heuristic when it comes to decision-making (Curseu & Vermeulen, 2008).

The core of this heuristic thus is the willingness to generalize from small, non-random samples. The most used non-random sample is personal experience (Kahneman et al., 1982). Fortune and Adams (2012) describe the problem of this heuristic that people overestimate their ability to accurately predict the likelihood of an event, which can result in neglect of relevant base rates and other cognitive biases. Think for example about a very bad experience while using a certain product of a brand for the first time. Using the representativeness heuristic would result in never buying a product from that brand again. Katz (1992) highlights that the representativeness heuristic is particularly suitable for dynamic and entrepreneurial settings, in order to be fast enough to respond to certain situations.

In Strategic decision-making, the representativeness heuristic is used a lot. For example, if a manager thinks that great salespeople are well-dressed, extroverted, white man, then a manager will favour these sorts of people for their sales jobs (Bazerman, 2008).

So, most of the time, this heuristic leads us in the right direction and limits our attention to only the best options. This saves time and makes it easier to decide between different options. However, sometimes this heuristic can lead to serious errors. The representativeness heuristic can also work on a subconscious level, which can cause a person to engage in different forms of discrimination that he or she would see as morally unacceptable on a conscious level (Bodenhausen, 1990). Thus, people sometimes rely on insufficient information to make a correct judgement.
2.3.2. Biases and SDM

As stated in the introduction Simon’s (1955) work recognized that decision-making often falls short of purely rational decision making. The factors that prevent rational decision-making are:

1. The high costs of decision-making (Simon, 1979)
2. Information processing limits of decision-makers (Abelson and Levi, 1985)
3. Differences in decision-making procedures adopted by managers (Shafer, 1986)
4. Differences in the values of decision-makers (Payne et al., 1992)

It is important to keep these factors in mind, because most of the time those factors are the cause of the use of heuristics. After discussing the heuristics that are mostly associated with decision-making, it is also important to understand what kind of biases can emerge from non-rational decision making. Whereas heuristics usually lead to good decisions, biased decision-making usually leads to bad or suboptimal outcomes (Busenitz, 1997). Inappropriately applied heuristics can lead to systematically biased judgements (Caplan, 2002). In the upcoming paragraphs, different biases that are related to some heuristics will be discussed in order to better understand the negative side of the use of heuristics.

2.3.2.1. Biases derived from the Availability Heuristic

This part focusses on the Availability, which is a mental shortcut that relies on immediate examples that come to a person’s mind when evaluating a specific topic, concept, method or decision (Tversky & Kahneman, 1973). As Esgate & Groome (2005) describe, the availability heuristic states that if something can be recalled, it has to be important, or at least be of some kind of importance. In the next few paragraphs the most important associated biases with regard to the availability heuristic will be discussed. It is important to understand that the heuristics, the rules of thumb, are usually very effective mental shortcuts that are used to simplify decision-making, but when we rely too much on these heuristics, they can result in biased thinking and decision-making. It is also important to notice that more than one heuristic can be used at the same time and that more than one bias can occur at the same time. In the next few paragraphs the ease of recall bias and the retrievability bias will be discussed.
Ease of recall
The ease of recall bias is based on the fact that individuals judge events that are more easily recalled from memory, based on vividness or recency, to be more abundant than events of equal frequency whose instances are less easily recalled (Bazerman, 2008; Schwarz et al., 1991). In other literature, the recall bias is also called the reporting bias or response bias. The bias is a systematic error that is caused by a discrepancy in the accuracy or completeness of the information that is recalled from past experiences or events (Last, 2000). Research by Simonsohn et al. (2008) shows that people are more likely to purchase insurances for instances they have just experienced (a natural disaster for example), than they would have before the instance occurred. The risk of experiencing this instance becomes more vivid and salient, even if the risk of another earthquake in that location diminishes (Lindell & Perry, 2000; Palm, 1995 in Bazerman, 2008). Of course, it sounds logical that our recent experiences influence our decision-making a lot, but it therefore is very important to be aware of this bias when making decisions.

The recall bias can be prevented by introducing a ‘wash out period’. This means that there has to be a serious time period between the first and subsequent observation of that event (Mukhopadhyay, Feldman, Abels, 2017).

Retrievability
The retrievability bias is a bias which states that individuals are biased in their evaluation of the frequency of events based on how their memory structures affect the search process (Bazerman, 2008). The retrievability bias is a result of a misuse of the availability heuristic, which leads to systematic errors in judgements. Therefore, it is important to recognize when intuition leads us away from correct actions in order to be able to not fall in the trap to only pick the available options which you have in mind when making a decision (Schwarz, 1991).

Tversky and Kahneman (1983) showed that the retrievability bias can lead to systematic errors in managerial judgement. When managers rely too much on their intuition, chances are that the available information of their own experiences is not really representative of the larger pool of events that exists outside of our range of experience (Bazerman, 2008). Therefore, it is important to avoid the trap of choosing the most mentally available option.
2.3.2.2. Biases derived from the Confirmation Heuristic

This part focuses on the Confirmation heuristic, which is a mental shortcut that relies on the tendency to search for, interpret, favor, and recall information in a way that confirms one’s pre-existing beliefs or hypotheses is the core of the conformation heuristic (Plous, 1993). In the next few paragraphs the most important associated biases with regard to the confirmation heuristic will be discussed. In the next few paragraphs the anchoring or focalism bias, the overconfidence effect, the hindsight bias, the conjunctive and disjunctive events bias, and the confirmation bias will be discussed.

Anchoring or focalism

The anchoring bias occurs when individuals make estimates for values that are based upon an initial value (obtained from past events or just information that is available) and from this point (anchor) make insufficient adjustments (Northcraft & Neale, 1987). The Anchoring heuristic (or focalism) is already discussed in paragraph 2.3.1.2. and therefore, will not be discussed here. The important part is that the heuristic (using an initial piece of information known as the ‘anchor’) usually leads to a good outcome or decision which has a sufficient result. However, the bias arises when an individual relies too heavily on that initial piece of information, which can be unreliable or false. In order to make better decisions it is important to change cognitive patterns. But that only works if the new information is presented and understood in a way that breaks through the existing cognitive anchors of the decision maker.

Overconfidence effect

The overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future (Bazerman, 1986; Busenitz, 1999; Camerer and Lovallo, 2000; Juslin et al., 2000; Alpert & Raiffa, 1982; Fischhoff, Slovic & Lichtenstein, 1977; Oskamp, 1965). Overconfidence tends show that people are poorly calibrated when estimating one’s probabilities. The bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem (Erceg & Galic, 2014). Schwenk (1988) argues that decision-makers are usually overconfident in their initial assessment and tend to edit that initial assessment after new information becomes available. Camerer and Lovallo (1999) found that overconfidence can lead to disproportionate amounts of business entries, i.e. people who are overconfident and
optimistic about their relevant skills tend to enter a business and quit later because of failure of the business. Cooper et al. (1988) found that overconfidence is also more related to people with an entrepreneurial mindset. Entrepreneurs tend to estimate their own ventures to be substantially more successful in the future than other ventures like theirs. However, in entrepreneurial environments, a great sense of overconfidence is likely to result in a better outcome, because decision-makers will be less overwhelmed with the more chaotic environment (Busenitz, 1997).

Pikulina, Renneboog, Tobler (2017) also confirmed a positive relation between overconfidence in one’s financial knowledge and choice of investment. More precisely, strong overconfidence results in excess investment, under confidence induces underinvestment, whereas moderate overconfidence leads to accurate investments. This means that overconfidence is not necessarily bad with regard to decision-making, only too strong overconfidence results in sub-optimal decision making. So, from a positive point of view, with overconfidence, the decision-making speed is high, decisions can be made before all the information is studied and individuals are more willing to make risky decisions (Eisenhardt, 1989; Heath & Tversky, 1991).

The anchoring bias and overconfidence bias are both related to the confirmation heuristic, both biases are focused on a search for or interpretation of information in a way that confirms the pre-existing beliefs or hypotheses of the decision-maker (Plous, 1993). The adjustments that are made from the anchor that is set, usually lead to inadequate results (Epley & Gilovich, 2001), because people tend to be overconfident in the anchor (Block & Harper, 1991). The initial information leads to the tendency to search for, interpret, or recall information that confirms the individuals pre-existing beliefs or hypotheses (confirmation heuristic), while paying less attention to alternative possibilities (Maheswaran, Mackie, Chaiken, 1992), which leads to overconfidence (Klayman, Soll, Gonzalez-Vallejo, & Barlas, 1999; Soll & Klayman, 2004; Berner & Graber, 2008).

Thus, confidence is necessary for achievement and can be inspiring, but overconfidence can lead to suboptimal decision-making. It is important to keep in mind that these processes that lead to biases tend to happen automatically and unconscious. When people are made conscious about the processes they are often able to adjust their biased thinking (and
decision-making) regarding the confirmatory heuristic in a positive way (Griffin, Dunning & Ross, 1990).

**Hindsight bias**

The hindsight bias is also called the knew-it-all-along effect or creeping determinism. The focus is on the tendency to see events as having been predictable afterwards, despite there has been little or no objective basis for predicting the event (Hoffrage & Pohl, 2003). After knowing what happened in a certain event, makes it difficult to reconstruct one’s prior prognosis. The hindsight bias is one of the most widely studied bias. Groß, Blank & Bayen (2017) and Roese & Vos (2012) describe different events in which we overestimate in hindsight what we predicted in foresight regarding the outcomes of, for example, football matches (Roese & Maniar, 1997), elections (Blank, Fischer & Erdfelder, 2003), medical assessments (Arkes, 2013) and scientific studies (Slovic & Fischhoff, 1977).

The hindsight bias is the third bias that is associated with the confirmation heuristic. Whereas the anchoring bias stimulates the overconfidence in decision-making situations, both the anchoring and overconfidence bias help produce the hindsight bias (Fiedler, 2000; Koriat, Fiedler, & Bjork, 2006). The “knew it all along” effect arises when an event’s outcome is in line with the anchor that is set by the person in prior judgments (mostly based on insufficient and selective information). In the case of a hindsight bias, the fact that adjustments from the anchor are inadequate are also confirmed (Mussweiler & Strack, 1999)

**Conjunctive and disjunctive events bias**

Research (Brockner, Paruchuri, Idson & Higgins, 2001; Bazerman 2008; Bar-Hillel, 1973) shows that individuals overestimate the likelihood of conjunctive events and underestimate the likelihood of disjunctive events. A conjunctive event is the probability that every component with regard to the decision will materialize (Brockner, Paruchuri, Idson, & Higgins, 2001). A disjunctive event is the probability that any one of the components with regard to the decision will materialize (Brockner, Paruchuri, Idson, & Higgins, 2001). Problems with conjunctive and disjunctive events that usually arise when multistage planning is required, for example with home remodelling, new product ventures, and public work projects (Bazerman 2008).
Confirmation bias

The confirmation heuristic, or positive hypothesis testing, is already mentioned in paragraph 2.3.1.2. It is important to understand that this bias arises when the search for and use of data is used to support a preselected belief (Glick, 2017). The same effect as with the anchoring bias takes place here. People tend to only hold on to beliefs or positions that support their beliefs or positions, while at the same time simply ignore evidence that is contrary or unsupportive (Block & Harper, 1991). The confirmation bias is also called the myside bias or the confirmatory bias. The systematic error in this bias occurs through the inductive reasoning, where people gather or remember information selectively and therefore interpret it in a biased way. The effect has more influence on decisions where emotions are strong (Scott, 1993). Scott (1993) also argues that the confirmation bias is the result of biased search, interpretation and/or memory of the decision maker. That is why the confirmation bias is also linked to for example the overconfidence bias with for example personal beliefs, where contrary evidence can maintain or even strengthen beliefs in the initial belief.

2.3.2.3. Biases derived from the Representativeness Heuristic

This part focusses on the Representativeness heuristic, which is one of the most related heuristics regarding decision-making and focuses on probabilistic judgements on uncertain events (Tversky & Kahneman et al. 1982; Tversky & Kahneman, 1982, Laibson & Zeckhauser, 1998). In the next few paragraphs the most important associated biases with regard to the confirmation heuristic will be discussed. It is still important to understand that the heuristics are usually very effective mental shortcuts that are used to simplify decision-making, but when relied too much on heuristics, they can result in biased thinking and decision-making. Next to that it is important to notice that more than one heuristic can be used at the same time and that more than one bias can occur at the same time. In the next few paragraphs the misconception of chance bias, the regression fallacy, the insensitivity to sample size, the base rate fallacy, and the conjunction fallacy will be discussed.

Misconceptions of chance

The misconception of chance bias, also called the gambler’s fallacy, is when individuals expect that a sequence of data generated by a random process will look ‘random,’ even when the sequence is too short for those expectations to be statistically valid (Bazerman, 2008).
Good examples of misconception of chance are playing a game of roulette or flipping a coin. After a run of reds in a roulette game, black will make the overall run more representative. This is of course biased thinking, since the chance for red or black are always the same.

The misconception of chance bias was originally introduced by Tversky and Kahneman in 1971. They found that almost every person is prone to the ‘law of small numbers’. This means that people have enormous intuitions about the laws of chance. In particular, they regard a sample randomly from a population as highly representative, that is, similar to the population in all essential characteristics (Tversky & Kahneman, 1971).

In 1974 they complemented this view: ‘people expect that a sequence of events generated by a random process will represent the essential characteristics of that process even when the sequence is short’ (Tversky & Kahneman, 1974, p. 1125). This means that people expect that the essential characteristics of the process will be represented, not only globally in the entire sequence, but also locally in each of its parts. The problem with the misconception of chance is thus that there are too many alternations and too few runs to correctly create validate the results in a statistical way.

So, people put too much faith in the results of small samples and overestimate how replicable the results are. This lead to inadequate sample sizes and over interpretation of findings (‘law of small numbers’). The misconception of chance bias therefore can be linked to the overconfidence bias.

**Regression fallacy**

The regression fallacy, also known as regressive fallacy, is a bias where individuals seem to ignore the fact that extreme events tend to regress to the mean on subsequent trials (Bazerman, 2008). This bias happens when an extreme value of some randomly varying event is accepted as the normal value. The bias here is the assumption that the extreme value has returned to a normal value, because of the corrective actions taken while it was abnormal. The regression fallacy usually arises with things that naturally fluctuate and usually regress towards the mean. An example of the regression fallacy is visiting a doctor when having a headache. When the headache disappears after just talking to the doctor it is not the doctor that healed the headache, it is mere the fact that headaches usually naturally come and go.

The regression fallacy is linked to the Representativeness heuristic, which is about making
judgments about the probability of an event under uncertainty (Tversky & Kahneman, 1972). The fallacy is that people tend to make predictions that exceptional results will continue as they were average. In their 1973 work, they complement this view with the idea that individuals normally assume that future outcomes will be directly predictable from past outcomes (e.g. sales and grades). This is a naïve thought process, because the assumption of perfect correlation with past outcomes is prone to a biased way of thinking and decision-making. For example, when the frequency of accidents declined on a road after a speed camera was installed creates the biased thinking that speed cameras improve road safety (Milton, 1992).

In the case of organizations, the regression principle can occur during employee’s evaluation period for example (Bazerman, 2008). When an employee performs exceptionally well during an evaluation period, he (and his boss) may inappropriately expect similar performances in the next period. However, chances are that this employee will regress towards the mean and this results in both the manager and the employee starting to make excuses for not meeting expectations. This fallacy thus creates inappropriate expectations for employee performance from both the employee and the manager (Bazerman, 2008).

**Insensitivity to sample size**

The insensitivity to sample size bias occurs when people assess the reliability of sample information, individuals frequently misunderstand the role of the size of the sample (Tversky & Kahneman, 1974). People tend to apply the representativeness heuristic when they evaluate the probability of a particular result in a sample drawn from a specified population. An example that Tversky & Kahneman (1974) describe is, that the average height in a random sample of ten men will be 180 centimetres, simply because this is the average height in the population of men. This is of course a biased way of thinking, because variation in the measure is more likely in smaller samples, but people often do not expect to see these variations.

The insensitivity of sample size is thus merely concerned with the generalizability to the overall population. In managerial decision making, decision-makers tend to be insensitive to sample size when making predictions (Schwenk, 1984). Information about a large number of past strategies is necessary to generalize the requirements for a successful strategy. However, strategic decision-makers are often unable to collect data on a sufficient number of strategies.
that were used in the past and therefore have to make decisions based on a small database. This severely hinders purely rational decision-making.

The insensitivity to sample size leads to the fact that managers tend to be overconfident in their predictions that are based on small amount of data, because they think that this small amount of data is representative for the whole population (Schwenk, 1984). So, the overconfidence effect, which is linked to the confirmation heuristic, is stimulated by the insensitivity to sample size.

Next to that, the insensitivity to sample size is also linked to the ‘law of small numbers’ or the misconception of chance, which is described above and is also linked to the representativeness heuristic (Tversky & Kahneman, 1974). Decision-makers are susceptible to the law of small numbers when only one or a few very vividly described cases are available (Nisbett & Ross, 1980). Nisbett & Ross (1980) give an example where a single vivid description of a new venture’s failure in a certain industry can severely influence the decision of entering that industry, even though statistical data indicates high success rates in the industry.

The insensitivity to sample size can therefore also be linked to the anchoring effect. When people first experience a failure for example, it is really hard to change this point of view, even though statistical data indicates high success rates. People tend to make insufficient adjustments from that point on (Northcraft & Neale, 1987).

**Base rate fallacy**

The base rate fallacy happens when individuals are disregarding base rates when other information is delivered, even if it is irrelevant. When they evaluate the likelihood of events (Bar-Hillel, 1980, in Bazerman 2008). The base rate fallacy is also called the base rate neglect or the base rate bias. People tend to prefer individuating information over general information when this is available (Tversky & Kahneman, 1985; Bar-Hillel, 1980).

Base-rate data is correctly used by participants when no other information is provided (Tversky & Kahneman, 1972). People tend to understand the relevance of base-rate information, but they also tend to disregard this data when individuating data is also available. When people ignore the general information, and prefer individuating information, a biased way of thinking can arise.
The conjunction fallacy

The conjunction fallacy occurs when individuals falsely judge that conjunctions (two events that are happening next to each other) are more probable than a more global set of occurrences of which the conjunction is a subset (Gigerenzer; Miyamoto, Gonzalez, & Tu; Shafir & Tversky; Wedell & Moro, in Bazerman, 2008). It is a formal fallacy which assumes that some specific circumstances have a higher probability of occurring that more general circumstances (Wells, 1985). The fallacy is proof that the cognitive limitations of both knowledge and cognitive capacity are similar to the principle of bounded rationality of Simon (1957). As discussed in the first chapter, bounded rationality is concerned about the ways decisions are actually made.

Also with this fallacy Tversky & Kahneman came up with the foundation of this fallacy (Tversky & Kahneman, 1982; Tversky & Kahneman, 1983). A famous experiment of Tversky & Kahneman involved a fictitious lady called Linda. She is described in the following way:

‘Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations’ (Kahneman, in Bazerman, 2008)

After this description, they gave two options. What is more probable?

1. Linda is a bank teller
2. Linda is a bank teller and is an active feminist

The idea of a conjunction fallacy, which states that people commit when they judge a conjunction of two events (for example, a bank teller and feminist) to be more probable than one of the events (bank teller) in a direct comparison. However, the conjunction fallacy is a biased way of thinking, because although option 2 seems more ‘representative’ based on the description, mathematically the changes that Linda is option 2 is far less likely than that Linda is option 1.

If the conjunction gives more intuitive matches with vivid events, acts, or people than a single component of the conjunction, the conjunction is likely to be perceived, falsely, as
more probable than the component (Bazerman, 2008). Tversky & Kahneman (1983) showed that the conjunction fallacy is likely to lead to deviations from rational judgements in for example criminal behavior, sporting events and international relations. The conjunction to more vivid events can relate this bias to the ease of recall bias which is connected to the availability heuristic. The main problem with the conjunction fallacy in decision-making is that the fallacy leads to poor estimates about the future, which makes it harder to deal with unanticipated events (Moro, 2009).

2.4 Conceptual Framework and Propositions

The previous paragraphs on the literature review examined different concepts that have an impact on heuristics and biases in the context of strategic decision making. This paragraph will illustrate the conceptual model of the research and provide the propositions.

2.4.1. Conceptual Framework

The conceptual model will function as the analytical lens through which this research will be conducted and guides the research design and execution. This conceptual model can also be used for further research on this subject. This research focuses on the effect of information overload, the use of heuristics and increasing biases in the context of SDM. The relation between the variables looks as follows:

![Figure 2: relation between variables](image)

Figure 2: relation between variables
In figure 2 the relation between the variables in this research is explained. The conceptual model provides a visual representation of a multiple case (multiple organizations) which has to deal with information overload, heuristics, biases and all of that in the context of SDM. In this study, the conceptual model is focused on the representativeness heuristic and the overconfidence bias, which leads to a simplified version of the conceptual model that is stated in figure 3. The conceptual model of this research looks as follows:

![Conceptual Framework](image)

Figure 3: conceptual framework

Based on this conceptual model, the propositions can be formulated in order to create valuable information with regard to the research question. In order to create valuable results, the propositions are necessary to create structure within the complex world of heuristics and biases.

### 2.4.2. Propositions

The propositions are based on the conceptual model. Each proposition directs attention to something that should be examined within the scope of the study (Yin, 1994). Based on the conceptual framework and the research question several propositions can be stated:

1. **Information Overload leads to increased use of the Representativeness heuristic within companies**

   The proposition is based on the effect that information overload increases risk and uncertainty with regard to the decision. According to the theoretical framework the high cost of decision-making efforts, the information processing limits of decision-makers, the differences in decision-making procedures by managers and the differences in values of decision-makers lead to risk and uncertainty which increases the probability of using the representativeness heuristic.
2. *The use of the representativeness heuristics leads to an increase in the overconfidence bias.*

As stated in this chapter, the representativeness heuristic has several associated biases that are related to strategic decision-making. Especially the misconception of chance and insensitivity to sample size seem to have a strong connection to the overconfidence bias that, at first, is related to the confirmation heuristic and emerges from the anchoring and adjustment heuristic. It seems that the first piece of information (the anchor) is much more important than the amount of information that is provided in a certain situation. More information leads to more risk and uncertainty and therefore less overconfidence with strategic decision-making.

3. *An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies.*

Based on theory chances are that suboptimal decision-making is the result of the use of heuristics, which lead to multiple biases, with the overconfidence bias as one of the strongest influencing biases. The strategic decision-making quality measures the perceptions of decision-makers with regard to the quality of the strategic decisions they make.

2.5 Chapter Summary

In this chapter, different parts regarding SDM are discussed. In the first paragraph the concept and definition of SDM are explained. The importance of and difference between decision-making under certainty, decision-making under risk and decision-making under uncertainty are elaborated. In the second paragraph the importance of information overload is highlighted and the definition of SDM is defined. Then, in the third paragraph, the most associated heuristics and biases regarding SDM are explained. The fourth paragraph focuses on the conceptual framework of the paper.

The first part discussed the difference in decision-making under certainty, risk and uncertainty. After that information overload was defined and the concept of strategic decision-making is elaborated on. Also, the quality of decision making is discussed in this part of the literature review.
This second part is about the heuristics, the rules of thumb, we use to simplify decision-making and the most common biases that are the result we rely too much on the heuristics without fully rationalize the decision-making process. Next to that it is important to notice that more than one heuristic can be used at the same time and that more than one bias can occur at the same time. The heuristics usually save us so much time that any loss in quality of the decision will be far outweighed by the time that is saved by not fully rationalize the decision. It is hard to only use heuristics at the moments when they are good to use, because most of the time people aren’t even aware that they use heuristics or have a biased thinking process. To avoid biases in instances where the decision quality is important or where the stakes are high, it is better to avoid the use of heuristics and make more rational decisions.

We examined two biases that are relatable to the availability heuristic, namely the ease of recall and retrievability bias. After that the anchoring or focalism bias, the overconfidence effect, the hindsight bias, the conjunctive and disjunctive events bias, and the confirmation bias are discussed, which are all related to the confirmation heuristic. After that the representativeness heuristic is discussed and the associated biases are the misconception of chance bias, the regression fallacy, the insensitivity to sample size, the base rate fallacy, and the conjunction fallacy.

After discussing the main concepts of this study, the conceptual model is presented in the fourth paragraph. This conceptual model functions as an analytical lens through which this research is conducted and guides the research design and execution. The relation between the variables is explained and based on the conceptual model the propositions are formulated in the fifth paragraph. The propositions direct attention to parts of the conceptual model that should be included within the scope of this research and how the constructs are connect to each other. Thus, how information overload affects the use of the representativeness heuristic for example or how the overconfidence bias affects the quality of decision-making. The main goal of the propositions is to be able to answer the research question after conducting the research.
3. Methodology

The methodology and general approach to the empirical analysis are discussed in this chapter. The choice of the research method will determine the results of the study, therefore it is important to explicitly explain the methodology that is used. The chapter is organized as described in figure 4. In the first paragraph, the research perspective and scope of the research is discussed. The goal of this paragraph is to make sure to discuss the methodology and explain why it is chosen. After that the selection of the cases will be explained. When the selection of the cases is made clear, the research design will be elaborated. In the fourth paragraph, the data collection & analysis will be discussed. Finally, the potential limitations and concluding remarks will be discussed in the fifth paragraph.

3.1 Research Method

In order to ensure that the knowledge gained from this scientific research is conclusive and credible it is important that an appropriate method of inquiry is chosen. This section describes the research approach that will be used to gather the information needed to answer the research question. The following paragraph will discuss why a quantitative study is the most appropriate research design for this study. In this study, a multiple case study will be conducted. A multiple case study will be performed, because in that way the results of this study will have a higher external validity, it is easier to generalize the data to the bigger population. Explorative research will be performed in order to answer the research question. An exploratory study describes the assessment of existing phenomena, searches for new insights and finds out what is happening (Saunders, Lewis and Thornhill, 2009, 133). The combination of scientific orientated papers and a questionnaire (Delphi Method) will be used to provide results. Using a questionnaire will enable to explore how strategic decision-making takes place in the organization that will be researched. The Delphi Method will be explained at the end of this paragraph. Other reasons to choose for a questionnaire are the time limitation of the data collection, the practicality of the format and of course the user anonymity (which is very important in a Delphi Method).
3.1.1. **Explorative research**

In general, the goal of explorative research is to gather information to help define challenges and provide valuable information for future research. Marshall and Rossman (2010) describe the goal of exploratory research as follows: ‘to investigate little understood phenomena, to identify/discover important variables, or to generate hypotheses for further research,’ then a case study or field study is an appropriate strategy and participant observation and interviewing are important data collection techniques (p. 41). That is why this case study has a quantitative explorative research method, because the goal of this research is to conduct a study of the decision-making process of managers within the context of an organization.

A literature study will be performed first, since a lot of theories exist around the subjects of information overload and strategic decision making, which may be helpful to explain the challenges in this decision-making process. After that, a questionnaire will be conducted.

3.1.2. **Multiple case study**

This research contains a multiple case study because in this way the research can be more in depth, which also means that heuristics and associated biases can be researched more in depth. Yin (1994) states that the case study contributes uniquely to our knowledge of individual, organizational, social, and political phenomena. Not surprisingly that the case study has been a common research strategy in psychology, sociology, political science, business, social work, and planning (Yin, 1983). The main reason why a case study is conducted is because ‘the distinctive need for case studies arises out of the desire to understand complex social phenomena’ (Yin, 1994). Understanding the use of heuristics and biases in the context of SDM is a complex social phenomenon and therefore is a case study a suitable method. In order to be able to choose the best method, three conditions are important to keep in mind, according to Yin (1994):

1. The type of research question posed
2. The extent of control an investigator has over actual behavioural events
3. The degree of focus on contemporary as opposed to historical events

In Figure 5 these three conditions are elaborated and show how they are related towards the five major research strategies.
With regard to the research question Yin (1994) argues the following: If research questions focus mainly on ‘what’ questions, there are two possibilities. The questions can focus on exploratory measures or they can focus on identifying outcomes. This research focuses on exploratory measures. A question like this is a reasonable sign for conducting an exploratory study, with the goal to develop pertinent hypotheses and propositions for further inquiry (Yin, 1994). As an exploratory study, any of the five research strategies can be used. Yin (1994) adds to that, that it is possible to use more than one strategy in any given study (for example, a questionnaire within a case study or a case study within a survey). To summarize, the most important condition for differentiating among the various research strategies, is to identify the research question that is being asked. The second important determinant of the strategy is the extent of control that is needed over behavioural events. In the case of this exploratory research, no control over behavioural events is needed. With regard to the third point, the degree of focus on contemporary as supposed to historical events, it is clear that this research focuses on contemporary events. So, if we take a look at Figure 5 of Yin (1994) we can conclude that a questionnaire within the multiple case study is the most appropriate design.

3.1.3. Questionnaire
In order to create a valid and reliable questionnaire it is important to create the right procedures. In this way conducting the questionnaire can have a major effect on the likelihood that the resulting data will describe accurately what they intended to describe (Fowler, 2009). A questionnaire is used because it is a cost-efficient, practical, fast, scalable, anonymous, confidential and it will cover all the aspects of the topics (Dörnyei & Taguchi, 2009). When a questionnaire is used as a data collection method, three different

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Form of Research Questions</th>
<th>Requires control over behavioural events?</th>
<th>Focuses on contemporary events?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>How, why</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Survey (questionnaire)</td>
<td>Who, What, Where, How many, How much</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Archival analysis</td>
<td>Who, what, where, how many, how much</td>
<td>No</td>
<td>Yes/no</td>
</tr>
<tr>
<td>History</td>
<td>How, why</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Case study</td>
<td>How, why</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 5: Yin (1994)
Methodologies have to be designed. First, the sampling method, then the questions have to be designed and after that the data has to be collected (Fowler, 2009). Those components will be described in the third paragraph, but first the method of this study will be discussed. In this study an e-Delphi Method will be used.

3.1.4. Delphi method

The Delphi method that will be used is usually focused on forecasting the occurrence of a single event or quantity (Goodwin & Wright, 2005). With Delphi decision groups, a series of questionnaires will be sent to selected respondents (the Delphi group) through a facilitator who oversees the responses of the experts. The group does not have to meet face-to-face. The communication will be mainly via e-mail. The members that are selected because they are experts or because they have relevant information (Custer, Scarcella, & Stewart, 1999).

In this case an e-Delphi method will be used. Chou (2002, p. 236) describes an e-Delphi method as follows:

‘The e-Delphi system is a less labor-intensive system than the traditional method, and is not paper-reliant; it retains the essence of traditional methods, but speeds up the execution process.’

With regard to this research a panel of experts will be asked to answer the questions that are stated above over a number of two rounds. The experts will exchange information in an anonymous way. After the first round, the data will be structured by the controlled exchange of information between the anonymous panellists over a number of two rounds (Goodwin & Wright, 2005). The expert panellists will then exchange their existing estimates. After that, the individual experts can hold, or change, their estimates on the basis of feedback of the estimates of other panellists. At last, the statistical average of the estimates on the final round is taken as the group judgement. The main goal of this method is to work towards synthesis and building consensus between the experts in the group.

3.2 Selection of cases

The cases will be selected based on a number of criteria in order to make sure the cases fit the scope of the study. Iastrebova (2006) has five criteria which controlled the selection of the cases.
1. **Feasibility of the research project**

In order for the project to be useful within the scope of the research (i.e. time, budget and access to organizations) it is important to be specific about the companies that are suited for this research. In order to be able to complete the research in time and within the scope of this thesis, it is important to target at medium-sized companies or independent divisions of larger companies.

2. **The principle of theoretical sampling**

The selection of the cases has to be in line with the principles of theoretical sampling according to Eisenhardt (1989). ‘The goal of theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory’ (Eisenhardt, 1989, p. 537). So, it is sampling based on non-statistical reasons.

3. **Transparency of the process**

In order to create results, the company should be aware of the problem that information overload can create at multiple levels in the company. The company should also be interested in creating solutions with regard to this problem they face.

4. **Access to multiple hierarchical levels**

The strategic decision-making takes place at an individual level, but has an effect on both the individual level and the organizational level. That is why this research is focused on decision-making in the context of organizations in order to be able to get a better overview of the problems that arise and the solutions that may result from the collected data. So, to have control on both the individual and organizational level, access to multiple hierarchical levels is required.

5. **The information-intensive type of work**

The participants of the questionnaire have to be connected to the strategic decision-making process of the organization and have to be aware what heuristics and biases are. Therefore, the focus is on strategic decision-makers within organizations.
3.3 Research Design (sample, data sources and measures)

The research design contains the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of a study (Yin, 1994). For a case study, it is important to explain the different designs that are relevant for this research. After that it is important to maximize four aspects which influence the quality of any design: construct validity, internal validity (for explanatory or causal case studies only), external validity and reliability. This means that in this case it is important to explain the construct validity, external validity and reliability.

Yin (1994) describes five components of a case study design: the research question(s), its propositions, its unit(s) of analysis, a determination of how the data are linked to the propositions and criteria to interpret the findings.

The research question is explained in the first chapter, the propositions of this exploratory research are explained in the second chapter, so it is also important to understand the other three components. The third component, unit of analysis, is related to the fundamental problem of what is the ‘case’, a problem that has plagued many investigators at the outset of case studies (Yin, 1994). In this research the ‘case’ will consist of multiple organizations that are prone to information overload in the context of SDM. The specific sample will be determined later on. ‘As a general guide, the definition of the unit of analysis (and therefore of the cases) is related to the way the initial research questions have been defined’ (Yin, 1994).

The fourth and fifth component, linking the data to propositions, and criteria for interpreting the findings are important to represent the data analysis steps in the case study research. In order to keep an overview of this study, the five components are summarized in figure 6.
<table>
<thead>
<tr>
<th>Components</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Research Question (Ch. 1)</td>
<td>Exploratory ‘what’ question: <em>What is the effect of information overload on the use of the representativeness heuristic and associated overconfidence bias in strategic decision making in organizations?</em></td>
</tr>
<tr>
<td>2. Propositions (Ch. 2)</td>
<td>The conceptual model is based on the literature review and propositions are formulated in order to connect the variables with each other and explain the connection between the variables.</td>
</tr>
<tr>
<td>3. Unit(s) of analysis (Ch. 3)</td>
<td>The unit of analysis is based on individuals, but has to be connected to the context of the organization.</td>
</tr>
<tr>
<td>4. Linking data to propositions (Ch. 3)</td>
<td>The data is linked to the propositions merely based on explanations and logic thinking.</td>
</tr>
<tr>
<td>5. Criteria for interpreting findings (Ch. 3)</td>
<td>The criteria for interpreting the findings are construct validity (3.4.5.1.), internal validity (3.4.5.2.), external validity (3.4.5.3.), reliability (3.4.5.4.).</td>
</tr>
</tbody>
</table>

A complete research design that covers all the five components that are described above requires the development of a theoretical framework (Yin, 1994). Yin (1994) argues that every good case study, regardless if the study is explanatory, descriptive, or exploratory, requires the development of a theoretical framework. Developing the framework, that is already developed in chapter two, is an immense aid in defining the appropriate research design and data collection and becomes the main vehicle for generalizing the results of the case study.
Before assessing the reliability and validity questions and designing the study, it is important to understand the goals of a multiple case study and the types of errors that can occur when performing the questionnaire. The two main goals of a questionnaire are to minimize error in the collected data and measuring the error that is part of the questionnaire (Fowler, 2009). Fowler (2009) also defines two fundamental premises. The first premise of the questionnaire process is to describe the sample of people who actually respond, can describe the target population. The second premise of a questionnaire research process is that the answers of the respondents can be used to accurately describe the characteristics of the respondents. It is therefore important to create a sample which is representative for the bigger population, which in this case are managers who are involved in strategic decision-making processes.

The representativeness of a sample depends on the sample frame, the sample size and the specific design of the selection procedures (Fowler, 2009). Therefore, taking these criteria in consideration when selecting the sample is of high importance. The major source of questionnaire error is failure to collect data from a high percentage of the selected sample (Fowler, 2009). The choice of data collection mode (mail, telephone, internet, personal interview or group administration) is directly related to the sample frame, research topic, characteristics of the sample, and available staff and facilities. This has effect on the response rates, question form and questionnaire costs (Fowler, 2009).

Some major issues with regard to choosing an appropriate strategy are sampling, the type of population, the question form, the question content, response rates, costs, available facilities, length of data collection and computer-assisted data collection (Fowler, 2009). So, it is clear that the choice for a research mode is a complex decision and depends on a lot of factors. This study will be based on a computer assisted data collection method because of the low cost of data collection, the potential for high speed returns, and the accessibility to a database of organizations at the Radboud University, which make it possible to gather the right information in a fast, reliable and valuable way. The questionnaire will be based on the Delphi method, a method in which experts will provide their opinions and reasoning with regard to certain issues. The Delphi method will be discussed in the following paragraphs. In
the next paragraphs, also the validity, reliability and generalizability of questionnaires will be discussed in order to establish quality within this empirical research.

3.4 Data Collection and Analysis

The data will be collected with the use of questionnaires that are operationalized in a way that the constructs (heuristic and biases) can be measured in a viable and reliable way. The empirical data will be collected in the period from July 2018 to August 2018. The questionnaires will be designed by the author and will be collected online.

3.4.1. Instruments

The main instrument for data collection is the use of questionnaires. It depends on the organizations where the case study will be conducted, but the sample size will be around four questionnaires at three companies, so twelve in total. The number of questionnaires for this multiple case study is determined in consultation with the supervisor. The goal of these questionnaires is to determine if the interviewees used heuristics and biases while enduring information overload in the context of strategic decision-making and what effect it had on them and the organization.

As stated in the second chapter, information overload is studied from an organizational perspective (Bazerman & Moore, 2008). In order to determine the amount of information overload that the respondents face, general questions with regard to information overload in an organizational environment will be asked.

The representativeness heuristic will be measured in the following way. Fong and Nisbett (1991) and Fong, Krantz, and Nisbett (1986) use an approach to measure this heuristic. They developed scenarios which represented real-life strategic decisions, which led to two alternatives. The first alternative is based on quantitative or statistical information; the other alternative is based on heuristic reasoning. Subjects were asked to make the strategic-decision and then describe the reasoning of how they came to their decision. After that one can determine whether one of the two reasoning types (statistical reasoning or heuristic reasoning) was used to make the decision. In this research the coding schema that will be used will be closely related to the Fong and Nisbett (1991) and the Fong et al. (1986) article
in order to be able to connect all the important parts with regard to the representativeness heuristic together.

The overconfidence bias will be measured by a study of Fischhoff et al. (1977) and Lichtenstein and Fischhoff (1977). The bias is measurable by making two responses to each item. The first response is about choosing between the alternatives that they face. After that, people had to guess their level of confidence. This level of confidence was used to determine the probability response across all items for each subject. In that way, the scores can be used to determine the amount of overconfidence or under confidence with regard to a certain decision.

Decision quality will be measured using the three items developed by Amason (1996) to assess the quality of the strategic decision made within the cases. In line with previous studies, the data will be collected from experts who are involved in the strategic decision-making process.

An objective measure of the quality of a single decision is hard to take in isolation, therefore a perceptual measure of the relative decision quality will be used. This is because a decision that is good in one context can create poor results when the context changes. When using an objective measure the different decisions imply that each decision has an equal chance of producing the preferred outcome. But that is not always true. Because when a team only has the option to choose between poor alternatives, an objective measure of decision quality would result in the impression that the decision quality of the team was worse, than a team that had better alternatives to choose from. However, this does not confirm that the first team choose wisely and emerged in a better way than expected, than the other team. Therefore, the best way to measure the quality of individual SDM is to ask those who have observed its effects and observe those who understand its context to judge, retrospectively and on several dimensions, how the decision turned out. Therefore, a perceptual measure is used.

3.4.2. Procedure

In this paragraph, all the steps with regard to the Delphi method and the questionnaire will be described. First the design of the research and the questions will be elaborated. After that the questions and instruments will be evaluated in order to be sure to create a questionnaire
which collects the data in a reliable and viable way and is able to answer the research question. Important to keep in mind is that questions for a questionnaire are designing a measure, not a conversational inquiry (Fowler, 2009). Good questions maximize the relationship between the answers recorded and what the researcher is trying to measure.

A good questionnaire requires the selection of questions that are needed to meet the research objectives, testing the objectives and make sure they can be asked and answered as planned and then put them into a form to maximize the ease in which respondents can answer the questions (Fowler, 2009). To meet the research objectives, a Delphi method seems to be the best suitable method.

3.4.2.1. Delphi Method
The Delphi method enables awareness for the factors that can degrade group decision-making connected to the idea that group judgement can improve decision-making which led to ‘structured’ methods to enhance group decision making by removing or restricting interpersonal interaction and controlling information flow (Goodwin & Wright, 2005). A method to enhance group decision-making is the Delphi method. The Delphi Method consists of an iterative process for making a quantitative judgement. Delphi consists of three phases (Goodwin & Wright, 2005):

1. Panellists provide opinions about the likelihood of future events, or when the events will occur, or what the impact of such events will be. Then, opinions are often given as responses to questionnaires that are completed individually by members of the panel (experts).
2. The results of this polling of people in the panel are then recorded and statistical feedback of the whole panel’s opinions (e.g. range or medians) are provided to the individual panellists before a repolling takes place. At this stage, anonymous discussion (often in written form) may occur so that dissenting opinion is exposed to the panellists.
3. The output of the Delphi technique will be measured as group ‘consensus’, which is normally expressed as the median response of the group of panellists.

Without any repolling, only using the median of the group’s opinions, for example the amount of overconfidence, will provide more accuracy than that due to at least 50% of the
individual panellists. When panellists are involved in repolling and feedback, it is assumed that the median response of the group will shift towards the true value of the outcome that will be predicted. The improvement will take place because the change of opinions of ‘swingers’, those who change their less firmly grounded opinions, and the opinions stability of ‘holdouts’, who are assumed to be more accurate than ‘swingers’ (Goodwin & Wright, 2005).

There are many variations of the Delphi method, from individuals weighting their own expertise to big groups that are steering towards ‘consensus.’ Therefore, many procedures for assessing the opinions in an anonymous way and thereby providing feedback to a panel of participants have been termed Delphi.

In this research a panel of 12 experts in three different companies (cases) will be used to form the anonymous opinions in order to try to create ‘consensus’ amongst the experts about the subject of strategic decision-making in times of information overload. The questionnaire will be sent to the experts in two rounds. The exact execution of this Delphi method will be discussed in the next paragraph.

3.4.3. Data-analysis

This paragraph will describe the data analysis methods that will be used. It will describe how the formulated propositions and the defined central constructs are translated into the questionnaire. It also describes how the patterns of relationships were captured and how data from questionnaires were connected with the propositions. This approach is in line with the Yin (1994) approach as already discussed in the previous paragraphs, which states that the data analysis method has to be determined early on when the propositions are formulated. In this way, the research is in line with the theoretical background and the way the theory is framed.

The first step in the data-analysis process is the formulation of the propositions. The propositions are already formulated in the second chapter. While studying information overload and strategic decision-making in the context of organizations three propositions were formulated. All three propositions aim to estimate the relationship between the variables of information overload, heuristics (and associated biases) and strategic decision-making. All the propositions refer widely to the existence of phenomena that are not possible to directly observe or easily recognizable. For example, differences in decision-making styles, task
complexity, organizational culture, social interactions or organizational information processing. One cannot prove the propositions directly, however all propositions are observable. Accordingly, the expectation is that we can conclude whether or not the propositions are valid.

The propositions are focused on how much information overload increases the use of the representativeness heuristic and occurrence of the overconfidence bias which leads to sub-optimal decision-making. The propositions lead to better understanding the main constructs and connection between them. So, the propositions will be used to eventually create an answer on the main question. As described in paragraph 3.1 the representativeness will be measured via the Fong and Nisbett (1991) and Fong, Krantz, and Nisbett (1986) approach where real-life scenarios will be developed in order to measure the use of the representativeness heuristic. The overconfidence bias will be measured via the Fischoff et al. (1977) and Lichtenstein and Fischoff (1977) approach. The bias can be measured in the questionnaire by creating two responses to each item and after that asking them to guess their level of confidence.

3.4.4. Linking data to the propositions

In order to have a high-quality research result, the links between the data and the propositions are critical for the validity of the research. Therefore, it is important to be cautious with linking the data to the propositions. In this part, the conceptual variables will be operationalized and the instruments for assessing and evaluating the concepts will be defined.

3.4.4.1. Information Overload

Information overload is operationalized based on the organizational perspective Bazerman & Moore (2008) describe. Three information overload related questions will be asked about how many times the panellists experience information overload, how much effort they have to exert to stay up to date and how many times they keep consuming information after reaching ‘information overload.’ The answers will be given on a 5-point Likert scale, which is a common scale in survey research. This provides an idea of how much information overload a person experiences before the first proposition with regard to information overload and the use of the representativeness heuristic is presented to them.
3.4.4.2 Overconfidence

The operationalization of the overconfidence bias will be based on the Fischoff et al. (1977) and Lichtenstein & Fischoff (1977). Twelve questions based on the general information will be asked. Of course, only one of the three answers is correct. But respondents do not only choose the answer, they also have to decide their level of confidence with regard to the answer they gave. So, they have to indicate on a scale ranging from 33-100% their level of confidence in the answers. Before the questions were asked, they are instructed that 33% means a total guess, 70% means a 7/10 chance that they were right and a 100% answer would indicate that they were totally confident in the answer they gave.

The levels of confidence will be grouped into one of the probability categories. 0.30-0.39, 0.40-0.49, 0.50-0.59, 0.60-0.69, 0.70-0.79, 0.80-0.89, 0.90-0.99, and 1.00. 0.30-0.39 will be coded as 0.30, 0.40-0.49 will be coded as 0.40 etc.

The measure, also based on the Fischoff et al. (1977) article, is based on finding the mean response of the experts of each item and the amount of replies that are right. The measure now becomes a measure for the amount of overconfidence or under confidence in the sample (a score that is positive will indicate overconfidence and a negative score will indicate under confidence). A respondent who for example answered 0.50, 0.60, 0.70, 0.70, and 0.90 and only answered correctly three times (out of five) would receive an overconfidence score of 0.08 (0.68 (=mean) – 0.60).

3.4.4.3 Representativeness

To operationalize the Representativeness heuristic the Fong and Nisbett (1986) and Fong, Krantz, and Nisbett (1986) approach will be used. The subjects use of statistical reasoning will be tested. Fong and colleagues used 18 Problems to test if people were prone to using the representativeness heuristic. In this research a compact version of the Fong, Krantz and Nisbett research will be used based on the Busenitz (1999) article, which used a compact version of the initial research.

The developed scenarios are based on real-to-life decision-making situations which normally tend to be prone to the use of the representativeness heuristic. The problem involves the
possibility to build a new headquarters (see Appendix for the problem). After reading the problem, participants have to decide between the two given alternative for the problems and after that they have to describe their line of reasoning with regard to the decision.

When the questionnaires are finished. The responses will be collected and analyzed to determine if heuristic-type reasoning was the case within the answers of the participants.

The coding schema that will be used to analyze the responses with regard to the representativeness heuristic will be replicated from the Fong et al. (1986) and Fong and Nisbett (1991) research. A code of 1 will be given to responses that do not mention any statistical reasoning but relied on just subjective opinions or ‘rules of thumb.’ Think about simple decision rules like personal experience. A code of 0 will be given to responses that contain any form of statistical reasoning, think about variability of sample size for example. If there are any responses that are not categorizable because of a lack of information, they will be excluded from the research. After analyzing a score of 0 will lead to statistical reasoning and with a score of 1 it is clear that the responses rely on the use of heuristics.

3.4.4.4. Decision making quality

Decision quality will be measured using the three items developed by Amason (1996) to assess the quality of the strategic decision made within the cases. In line with previous studies, the data will be collected from experts who are involved in the strategic decision-making process.

The outcomes of the decisions are a function of the people who are actually involved in making the decisions (Amason, 1996; Amason & Mooney, 2008). This measurement is used in multiple researches in order to measure the quality of decision-making (Olson et al., 2007, Carmeli et al., 2011; Amason & Mooney, 2008). The respondents will be asked to rate the overall quality of the decision and the effect on the organization. A perceptual measure of decision quality will be used, which also have been used in previous studies (Amason, 1996). Also, Dess and Robinson (1984) proposed that when objective measures are not available, perceptual measures of executives are effective substitutes.

3.4.4.5. Connecting the constructs
All the constructs of the research will be measured separately in order to get an idea of the amount of information overload a panellist experiences, if the panellist is prone to use heuristics, if the panellist is likely to be overconfident and the perspective of the panellist with regard to decision-making quality. This information will be used to get an idea of the perspective of the panellist (expert) in the research in order to better understand the really important questions of this research, namely the perspective and reasoning with regard to the three propositions of this research. The propositions of this research connect all the constructs together in order to be able to answer the research question of this study.

The Delphi method was used in order to collect the opinion and the reasoning of experts with regard to strategic decision-making. The opinion and reasoning with regard to the propositions will be asked in two rounds. The first round will contain the measurement of every construct individually and the opinion and reasoning of experts with regard to the propositions. Then the Delphi method will be activated by creating a second round where only the opinion and reasoning of the experts will be measured, but the group result of the first round will be shown to the experts in order to create more consensus between the experts.

Thus, the connection of the constructs is realised by performing this Delphi method in a pool of experts with regard to strategic decision-making. This in combination with the individual measurements creates a great understanding of the opinion and reasoning of the experts.

3.4.5. Criteria for interpreting the findings

With regard to a case study, there are some validity problems. It is hard to generalize findings (external validity). It therefore can be hard to relate back to the theoretical framework after the research has been conducted. Therefore, a multiple case study can provide more valuable information regarding the use of heuristics and biases for companies in general. But to generalize the findings of this research can be very hard. However, if the framework seems to work fine in this explorative research, the framework can be applied in other case studies in future research. There are four tests that are important to keep in mind when conducting a case study. With a case study, it is much more complex that the standard ‘validity’ and ‘reliability’ notions to which most students have been exposed, and each item deserves explicit attention (Yin, 1994). They will be discussed below.
3.4.5.1 Construct validity

The construct validity is about establishing the correct optimal measures for the concepts being studied. This test can be problematic in case study research. Yin (1994) argues that researchers often fail to develop a sufficiently operational set of measures and ‘subjective’ judgments are often used to collect the data. In order to meet the test of construct validity it is important to cover the following two steps:

1. Selecting the specific types of changers that are to be studied (in relation to the original objectives of the study)
2. Demonstrate that the selected measures of these changes do indeed reflect the specific types of change that have been selected.

In order to establish the first step of construct validity in this study it is important to operationalize the chosen heuristic and the associated biases, so that they can be measured in a viable way. The second step is justifying why using a questionnaire are the right measures that reflect the constructs in a way that the research is viable.

In case studies, according to Yin (1994), there are three available tactics to increase the construct validity.

1. Using multiple sources of evidence in a way that encourages convergent lines of inquiry
2. Establishing a ‘chain of evidence’
3. Have the draft case study report reviewed by key informants

In this research, multiple interviews will be conducted in order to create convergence in the multiple sources of evidence. Also, the selected heuristic and associated biases will be measured with the use of a questionnaire, this will create a ‘chain of evidence’. Before conducting the questionnaires, a draft case study will be reviewed by the supervisor of this Master thesis.

3.4.5.2 Internal validity

The internal validity is especially critical in experimental and quasi-experimental research (Cook & Campbell, 1979). Internal validity is only a concern for causal (or explanatory) case studies, in which an investigator is trying to determine whether event x led to event y (Yin, 1994). This is not the case in this research. However, another main concern with regard to internal validity is the fact that internal validity may be extended to the broader problem of
making inferences. An inference arises when an event cannot be directly observed. The investigator will thus ‘infer’ that a particular event resulted from an earlier occurrence, based on interview and documentary evidence collected as part of the case study (Yin, 1994). This is a very important point to keep in mind in this study. This study tries to ‘infer’ a particular event from the past with conducting a questionnaire. It can be very hard for people to even recognize the use of heuristics and biases at the moment they use them, let alone when questionnaires are conducted about how people experienced certain strategic decisions in their organization. It can be hard to achieve internal validity in this research, so operationalizing the construct has to be executed in a cautious way.

3.4.5.3. External validity

The external validity determines how much the domain to which the study’s findings can be generalized. This test deals with the problem whether the findings of the study are generalizable beyond the case study. ‘The external validity problem has been a major barrier in doing case studies’ (Yin, 1994, p. 36). A case study offers a poor basis for generalizing. Case studies rely on analytical generalization where the investigator strives to generalize the results of the case study to a broader theoretical frame.

Because of this lack of generalizability of the findings it is important to take a look at the analytical generalizability. Yin (2010, in Tsang, 2013) describes the analytical generalizability as follows:

"With both the case study and the laboratory experiment, the objective for generalizing the findings is the same: The findings or results from the case study are to follow a process of analytic generalization. Analytic generalization may be defined as a two-step process. The first involves a conceptual claim whereby investigators show how their case study findings bear upon a particular theory, theoretical construct, or theoretical (not just actual) sequence of events. The second involves applying the same theory to implicate other, similar situations where analogous events also might occur." (Yin, 2010)

So, the analytical generalizability consists of two steps. The first step is showing the case findings with regard to the theoretical part of this research. After that it is important to apply
that theory to other similar situations where comparable events take place. Therefore, this research has an explorative focus, while working in a deductive way.

3.4.5.4. Reliability

A reliable research demonstrates that the study can be repeated and ending with the same results. So, the emphasis is on doing the same case over again and create the same results, it is not about doing another case study and arrive at the same results. ‘The goal of reliability is to minimize the errors and biases in a study’ (Yin, 1994, p. 36). The general way of tackling the reliability problem is to make as many steps in the operationalization as possible in order to achieve the same process when the research is repeated.

In conclusion, the four tests can be considered as relevant in judging the quality of a research design. Some of the tactics are needed when designing the case study, other tactics are occurring during the data collection and analysis. A summary of this analysis is presented in figure 8.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Used approach</th>
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| Construct validity | Establishment of correct operational measures for the concepts            | -Questionnaire check with supervisor with regard to operationalization of the measures for the concepts.  
                          |                                                                           | -Using a panel of experts to gather opinions with regard to the propositions |
| Internal validity  | Establishment of the casual relationships were conditions are projected that lead to other conditions | -In order to increase the internal validity this study relies on the theoretical propositions that are stated in this research.  
                          |                                                                           | -The actual patterns from the data will be compared with the predicted patterns.  
                          |                                                                           | -The conceptual model will provide the possibility to match the empirical data with the theoretically predicted events.  
                          |                                                                           | -The sample consists of experts in the field with regard to SDM |
| External validity | Establishment of the domain to which a study’s findings can be generalized | -Analytical generalization through collecting data via multiple cases.  
- Delphi method with two questionnaire rounds |
|-------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Reliability       | The operations of the study—such as the data collection procedures—can be repeated with the same results | -The questionnaire will be taken online in a Delphi format which makes repetition of the study possible.  
- Through repeating the questionnaire after collecting the first results, the reliability of the results will increase. |

Figure 8: summary of criteria for interpretation (based on Yin, 1994)
3.5 Limitations and Research Ethics

Some limitations with regard to this explorative, quantitative multiple case study design with a Delphi method are already partly discussed in paragraph 3.4. The limitations will be further elaborated on in this paragraph.

3.5.1. Limitations

First the limitations with regard to the exploratory nature of this research will be discussed. After that the limitations with regard to the Delphi method and the use of a questionnaire will be elaborated.

This exploratory research tries to collect data about an issue which has not been clearly defined yet, namely the effect of information overload on strategic decision quality. The main limitation of a study with an exploratory character is the inability to create real final and conclusive results, the interpretation of the findings is usually judgmental (Stebbins, 2001). This means that you have to be careful to base future decisions purely based on this research. An exploratory research like this should be able to steer towards a certain direction to go to for further research. Conclusions from a panel of experts can be unclear or hard to make forecasts from.

The Delphi method has a lot of advantages like anonymity and confidentiality of response, limited time required for respondents to complete surveys, avoiding direct confrontation with other experts (no peer pressure), a structured group communication process, cost effectiveness, flexibility, and it is a fast and versatile research method. However, the Delphi method also has some limitations. There are for example no guidelines to determining consensus, sample size and sampling techniques. In this case the sample size and sampling technique is determined with the help of the supervisor of this research, who is experienced in using the Delphi method as a research method. Thus, the appropriate sample size and sampling technique is determined by an experienced researcher.

Other disadvantages are the requirement of commitment from the participants, requirement of skills in written communication, time delays between rounds of data collection, concerns about the technique reliability and the possibility of drop-outs and with that the drop of
response rates. The main limitation is the speedy response that is required from often very busy experts that are in the panel.

The Delphi method is translated into a questionnaire which also brings some limitations. Still, questionnaires are cost-efficient, practical, scalable, quick, anonymous, confidential and able to cover all aspects of the topics. Thus, using a questionnaire is of course a well-suited method, there are still some disadvantages. The main advantage of a questionnaire is the lack of a conscientious response. This will for example happen when a busy expert is answering questions of the questionnaire before really thinking it through or even fully reading the question. This drawback can be minimised by making the survey short and the questions simple. Another limitation is that a questionnaire makes it hard to capture emotional responses or feelings of the respondents. This limitation can be minimized by using Likert-scales instead of multiple choice questions, thus Likert-scales will be used.

With questionnaires, it can also be hard to quantify open ended questions. They should be minimized in the research. The research contains relatively seen a lot of open-ended questions, which seems to be a limitation. However, this research is not a default questionnaire with a large sample, but a Delphi method with a small sample, so this limitation is not of high importance in this research.

Thus, the main limitation of this research is that the results are probably not conclusive because of the exploratory nature of this research. With regard to the collection of the data it will be hard to create the desired results of the experts, because they are often very busy and have little time to participate in researches like these. In order to create the expected results, the questionnaire will be designed in a compact way in order to create the most reliable and valid answer on the questions that really matter, namely the opinion and reasoning with regard to the propositions of this research.

3.5.2. Research Ethics

In this part of the research, the research ethics will be discussed. There are a number of ethical principles that have to be taken into account when performing a research (Smith, 2003). The main goal of the research ethics stress on the need to do good and to avoid doing any harm. There are five principles for research ethics that are important to keep in mind. It is
important to discuss intellectual property, multiple roles have to be taken into account, informed-consent rules have to be followed, the confidentiality and privacy issues have to be discussed and understanding ethical obligations, for example providing the right to withdraw. It may seem obvious to include all these principles, but there are instances where it is not possible or desirable to obtain them all in the research.

The first principle, minimising the risk of harm, is important because this research should not harm participants. If there is a possibility that the participants could be harmed or put in a position of discomfort, there has to be a strong justification for it. There are a number of types of harm that can happen while conducting the research (Smith, 2003): physical harm, psychological distress and discomfort, social disadvantage, financial harm and privacy and anonymity questions. Minimising the risk of harm can be done by several ethical principles (Smith, 2003): obtaining informed consent from participants, protecting the anonymity and confidentiality of the participants, avoidance of deceptive practices within the research design and the right to withdraw from the research at any time. The principles will be discussed in the next few paragraphs.

Obtaining informed consent means that participants have to be aware that they participate in the research and understand what the goal of the research is. In this quantitative research with a Delphi Method, the participants (experts) were all aware of the purpose of the research, the methods being used, the possible outcomes, the associated demands, and risks that they may face. All participants will also be informed about the results of the study. All this was explained to them beforehand and everyone participated entirely voluntary. The findings of the study may lead to more knowledge for the organizations that participated with regard to information overload, heuristics, biased and strategic decision-making. With regard to the population and society, this research will not deliver any value, because the data will not be published afterwards and the data will be handled with complete anonymity and confidentiality, which will be discussed in the next paragraph.

The third principle, protection of anonymity and confidentiality, is important because normally participants are only willing to volunteer giving information. Therefore, it is really important to handle the information anonymous and confidential. The questionnaire was distributed via an anonymous link; the questions were not related to personal information and the anonymity and confidentiality was clearly stated and read by the participants at the start
of the questionnaire. The participants were also informed about the fact that the research will not be published afterwards.

The fourth principle, the avoidance of deceptive practices, can also be a necessary component of research. Sometimes it is not feasible while collecting the data to let everyone know what the research is about. This is mostly the case for observations. In this research, this principle has little to no impact on the ethics.

The fifth principle, providing the right to withdraw, means that the participants should be able to withdraw from the research at any time. This is also the case in this study. Not a single participant was pushed to participate in this research, everyone participated completely voluntary.
4. Data-analysis

In this chapter, the findings of this study will be summarized and the results will be discussed. After that the data will be related to the propositions. In paragraph 4.1 a short summary of the conceptual model will be presented. After that the findings from this study will be presented.

4.1 Introduction

In this research the effect of information overload with regard to strategic decision-making is investigated. All parts of the study are either directly related or can be logically related to the issue of information overload and strategic decision-making. The main goal of this exploratory focused research is to create a better understanding of how people make decisions and what the effect on the quality of the decision is.

The conceptual model is used as a basis to form the propositions of this study and to serve as an analytical lens through which the study is conducted. It was developed to better understand strategic decision-making under the assumption of information overload and how the overload of information could lead to decision making inefficiencies and thus a lower quality of decision-making. The conceptual model consists of four main constructs; information overload, use of the representativeness heuristic, increase in the overconfidence bias and the quality of decision-making.

First, facing information overload in this study is focused on an organizational context, for example task complexity or time constraints. The problem of information overload is focused on an individual level (i.e. managers) in organizations. Then, the focus is related towards different heuristics and biases that occur on a regular basis in an organizational context. They are explained in order to better understand the use of heuristics and biases in general and to determine the most significant heuristic (the representativeness heuristic) and bias (overconfidence bias) with regard to strategic decision-making.

The last construct of the conceptual model contains the quality of decision-making. The quality of decision-making in this study is based on the measurement of perceptions of
decision-makers. The quality is based on the cognitive capabilities of the panellists and the interaction process through which the team produces its decisions.

Then, the propositions where formulated in order to guide the study towards a valid and reliable answer on the research question. The propositions are measured with the Delphi method. This method tries to create consensus with regard to the use of the representativeness heuristic and the overconfidence bias and the effect it has on the quality of decision-making. Thus, it connects the individual constructs with each other and tries to create a better understanding of the decision-making process.

To guide this research, a conceptual model was designed to better understand all the related variables and to demonstrate the way in which the heuristics and biases influence the strategic decision-making process. The conceptual model is then applied in this research.

4.2 Findings of the study

Three companies participated in this study: Veco, a precision metal company, Diageo, a multinational in the beverage sector and Planon Software, a medium-sized enterprise in the software industry. In total fourteen strategic decision-makers participated in the study.

The Delphi method aims to create a perspective of experts in the field with regard to the constructs of information overload, the representativeness heuristic, overconfidence and the quality of strategic decision-making. The constructs will be elaborated separately in the first four subparagraphs, and will be connected to each other in the paragraph 4.2.5.

4.2.1. Information overload

In this study, information overload was measured with three items. The results of the questionnaire is presented in Appendix B.1. Of the fourteen participants, every participant experienced information overload. Half (50%) of the participants experienced information overload multiple times a day, while 14,28% experienced information overload only a few times a month ($\bar{x} = 2.00$, $\sigma = 1.10$). So, every participant in this study does experience information overload. Also, ten of the fourteen respondents think that the amount of daily effort they have to make to stay up-to-date is heavy, while four think the amount of daily effort to stay up-to-date is just right ($\bar{x} = 3.60$, $\sigma = 0.61$). The third item measured if people
kept consuming information after reaching ‘information overload’. Nine people agreed, while three neither agreed or disagreed, one strongly agreed and one disagreed ($\bar{x} = 3.67, \sigma = 0.70$).

Thus, we can conclude that the participants all experienced information overload, while most of them think that the daily amount of effort they have to exert to stay up-to-date is high and they keep consuming information even after they have reached information overload. This part of the research was necessary to indeed confirm that the panellists experience information overload on a regular basis. After that the first proposition was presented in the study (see Appendix B.2), but that will be explained in paragraph 4.2.5. First, we discuss the results of the representativeness heuristics variable.

### 4.2.2. Representativeness heuristic

The use of the representativeness heuristic was measured according to a real-to-life decision making situation, which normally tends to be prone to the use of the representativeness heuristic. The goal was to determine whether people used statistical reasoning or heuristic reasoning in their answers. A code 1 will be given to responses that do not mention any statistical reasoning, and are relying on just subjective opinions or ‘rules of thumb.’ A code 0 was given to responses that contained any form of statistical reasoning. The problem was related to a big investment decision and the perception of the CEO or the perception of the director were elaborated. Participants then had to choose between the two. Fourteen people answered this question, nine followed the line of reasoning from the director (64.29%), four followed the line of reasoning of the CEO (28.57%) and 1 did answer the question (7.14%), but did not choose between the director and the CEO. Of the fourteen answers, nine answers were categorized as heuristic reasoning, while five were categorized as statistical reasoning. Thus, it seems that most experts in the panel are prone to use heuristic reasoning while making strategic decisions.

### 4.2.3. Overconfidence

After measuring the effect of the representativeness heuristic, the overconfidence was measured. As stated earlier, the respondents have to indicate their level of confidence in the answers between 33% (= zero confidence) and 100% (= total confidence). The mean confidence score is then compared to the amount of correct answers and this results in an overconfidence or under confidence score. From the fourteen participants, eleven panellists
(78.57%) were overconfident in their answers, two panellists were under confident (14.28%) and one respondent was in alignment between his/her confidence and amount of correct answers (see Appendix B.4).

4.2.4. Quality of strategic decision-making

With regard to the quality of strategic decision-making three items where measured. The items were based on previous researches. The complete results are presented in Appendix B.6. With regard to the first item ‘the effect that strategic decisions have on my company’, twelve of the fourteen respondents (85.71%) answered that the effect on the organization was good, whilst two respondents (14.29%) were neutral ($\bar{x} = 3.86, \sigma = 0.35$). The second item was related to the expectation with regard to the strategic decisions within their company, thus on an organizational level. Eight out of twelve respondents (57.14%) say that the results of the strategic decision-making were good, four respondents were neutral (28.57%) and two respondents (14.29%) say that the results are poor with regard to the initial expectation ($\bar{x} = 3.43, \sigma = 0.73$). The third item was related to the strategic decision making on an individual level. Nine out of twelve respondents (64.29%) say that the results of their strategic decision-making were good and five respondents (35.71%) say that the results of their strategic decision-making were neutral ($\bar{x} = 3.64, \sigma = 0.48$).

Thus, we can conclude that, on average, the panellists were slightly positive about the strategic decision-making effect and results of the study on both an organizational and individual level. This is a good starting point to further investigate the constructs and how they are related to each other. The measurement of the relation between the construct is measured via the Delphi method were the propositions were directly asked to experts in the field, in order to better understand the connection between the individual constructs. These opinions and reasoning of experts will be discussed in the following paragraph.

4.2.5. Opinions and reasoning with regard to the propositions

An e-Delphi method is used in this study in order to gather relevant information from experts in the field, who make a lot of strategic decisions. The three propositions were presented to them in twofold. They had to answer these questions two times. The first time as a normal question, the second time they were provided the group results of the first questionnaire. They had to answer the proposition on a 7-point Likert scale on how much they agreed to the
proposition. After that, they had to explain their reasoning with regard to this subject in order to better understand their perspective with regard to the propositions.

**Proposition 1**
The first proposition which stated that information overload leads to an increased use of the representativeness heuristic within companies, resulted in the fact that out of the fourteen respondents, twelve (85.71%) agreed and two respondents strongly agreed (14.29%) that information overload indeed leads to an increased use of the representativeness heuristic within companies (\( \bar{x} = 5.20, \sigma = 0.40 \)). Thus, every expert agreed on the fact that information overload leads to an increase in the use of the representativeness heuristic.

The main reasoning behind the agreement on this proposition is based on the fact that it is hard to understand everything at once while enduring information overload and that the use of the representativeness heuristic is therefore a logical result. Also, the fact that using heuristics costs less mental capacity and less time was mentioned. The experts also thought that using heuristics would make it possible to make strategic decisions based on a default option, skip the details of the options or makes it possible to enable decision-making on a superficial level.

The second questionnaire was send to the experts after the first questionnaire was collected and analyzed (See Appendix C.1). The results of the first study were included in the questionnaire so that the experts were able to adjust their answers if they wanted to. This resulted in the fact that out of twelve respondents (two people were not able to answer the questions, which is a risk of the Delphi method), eight people agreed (66.67%), two people strongly agreed (16.67%), one strongly disagreed (8.33%) and one disagreed (8.33%) (\( \bar{x} = 4.75, \sigma = 1.09 \)). Thus, the experts still agreed on the fact that information overload leads to the use of the representativeness heuristic, although less than the first time.

The main reasoning behind the agreement was that a lot of people stayed with their first response and thereby created consensus in the group. However, two participants were surprised with the results or say no direct impact, that could be the reason for a sudden change in opinion with regard to the subject of information overload and the use of the representativeness heuristic.
Proposition 2
The second proposition was asked in the same way as the first proposition, so first the 7-point Likert scale and after that an explanation of their reasoning. The second proposition stated that the use of the representativeness heuristic leads to an increase in the overconfidence bias. From the fourteen respondents, one respondent (7,14%) disagreed, one respondent (7,14%) neither agreed nor disagreed, eight respondents (57,14%) agreed and four respondents (28,57%) strongly agreed ($\bar{x} = 5.07$, $\sigma = 0.80$).

The main reasoning for the agreement was that people overestimated their knowledge and abilities with regard to certain aspects. The experts also think that that experience creates overconfidence. While one expert disagreed on this and in his/her opinion personal experience does not result in overconfidence. Thus, the main consensus is that the use of the representativeness leads to an increase in the overconfidence bias. However, there is not a 100% (strong) agreement as with the first proposition.

With regard to the second proposition the results were as follows (See Appendix C.2). Also in this case, the results of the first study were included with the goal of creating consensus within the group of experts. This resulted in the fact that out of the twelve respondents, ten respondents (83,33%) agreed on the proposition, one (8,33%) strongly disagreed and one (8,33%) strongly agreed on the proposition ($\bar{x} = 4.83$, $\sigma = 0.90$). Thus, the experts agreed more than as the first time. It seems that one expert strongly disagreed on both the first and the second proposition in the second questionnaire, which was not the case in the first questionnaire.

The main reasons for these opinions is that people stayed with their initial response of agreement, although a small shift towards ‘agree’ instead of ‘strongly agree’ is observable, which is logical because this was the most chosen answer in the first round. This means that although one expert apparently changed its mind, the overall consensus of the group become more aligned around the idea of an increase in the representativeness heuristic that leads to an increase in the overconfidence bias.

Proposition 3
The third proposition focused on the effect of an increase in the overconfidence bias on the quality of strategic decision-making. This proposition was measured in the same way, so first
the opinion and then the reasoning behind the opinion. This resulted in the fact that of the fourteen respondents, two respondents (14,29%) neither agreed nor disagreed, seven respondents (50.00%) agreed on this proposition, while five respondents (35,71%) strongly agreed with regard to this research (\( \bar{x} = 5.21, \sigma = 0.67 \)).

The reasoning with regard to this proposition was related to a lot of different factors. The experts definitely agreed on the fact that the overconfidence bias negatively influenced the quality of decision-making, but their reasoning was not as aligned as with the other propositions. Causes with regard to a lower quality of strategic decision-making really differed, from individual cognitive limitations, to biased thinking, to the environment, to individual optimism, through luck, or through a skewed relationship between the manager and an employee for example. Other factors that influenced the quality of SDM were missing information, previous experience or failure to acknowledge weaknesses.

In the second questionnaire, the third proposition created more consensus in the group (See Appendix C.3). This resulted in the following data: from the twelve participants two neither agreed nor disagreed (16,67%), five agreed (41,67%) and five strongly agreed (41,67%) (\( \bar{x} = 5.25, \sigma = 0.72 \)). Thus, we can conclude that the experts had almost the same consensus with each other that the first time.

The most important reasons for this consensus is the fact that people that already agreed the first time, still agreed the second time and that the people who neither agreed nor disagreed, this kept this opinion the second time. This apparently looks like with the third proposition the second questionnaire failed to create more consensus within the group of experts.
5. Discussion and conclusions

In this chapter the findings of this study will be summarized and the discussion with regard to these findings will be shown. In the discussion, the conceptual framework will be revisited and the data will be measured with regard to the theoretical propositions. First, a summary of the conceptual model will be provided. After that, the analyzed data will be discussed. Then the research results will be compared to the theoretical contribution of this study and the implications for the experts (managers) and organizations.

5.1. Summary of theory and conceptual model

This thesis the concept of information overload is connected to the representativeness heuristic and the overconfidence bias and the effect on the quality of decision-making it has. A wide range of issues that are directly or indirectly related to the effect of information overload in the context of strategic decision-making are explained in the research. The objective of the study was to create a better understanding of the effect of information overload on the use of the representativeness heuristic and an increase in the overconfidence bias and what the effect on the quality of strategic decision-making in the context of organizations was. So, in total, the goal was to create better knowledge about the use of heuristics and biases in organizations under conditions of information overload.

In order to create a reliable and valid answer with regard to this problem. A literature study was performed in the second chapter. In this chapter, the different parts with regard to SDM were discussed. This was done to understand the concept and definition of SDM and the importance between decision-making under certainty, decision-making under risk and decision-making under uncertainty. The concept of information overload was also elaborated on in order to create a better understanding why and how people experience information overload.

The second part of the literature study was about the use of heuristics, the rules of thumb, we use to simplify our decision-making. In line with discussing the heuristics, the most common biases with regard to those heuristics were discussed. Those biases arise when we rely too much on the heuristics without fully rationalizing our decision-making. Heuristics are used to save time and this usually leads to the desired outcomes, but it is hard to understand this process because most of the time people are not aware of the fact that they are biased in their
thinking or that they are using heuristics to make decisions. Especially, with strategic
decision-making it can be very risky to rely on the use of heuristics, because usually large
amounts of money or high risks are involved. Therefore, it is better to make strategic
decisions based on more rational decisions.

Several heuristics and biases are described in order to better understand heuristics and biases
in general and how they relate to information overload and strategic decision-making in an
organizational context. The availability heuristic, the confirmation heuristic and the
representativeness heuristic are discussed. Biases that are related to organizational context
and thus are discussed are the ease of recall, retrievability bias, anchoring or focalism bias,
the hindsight bias, the conjunctive and disjunctive events bias, the confirmation bias, the
misconception of chance bias, the regression fallacy, the insensitivity to sample size, the base
rate fallacy and the conjunction fallacy.

After that the conceptual model provided the main constructs of this research and how they
are connected to each other. The main variables of this study are: information overload, use
of the representativeness heuristic, the overconfidence effect and the quality of decision
making. Based on these variables the propositions of this research were presented which
formed core of this research in order to be able to answer the research question. The
propositions create focus towards important parts of the conceptual model so that within the
scope of this exploratory research we can determine the effect of the different variables
towards each other.

5.2. Discussion and reflection

In this part the results will be discussed based on what we expected to see after analyzing the
theories with regard to all the variables. After that the reflection on the methodology will be
provided.

5.2.1 Reflection and contribution on theory

Information overload
With regard to the thesis some points have to be taken into consideration. The first part of the
discussion will contain the feedback towards the theory. Processing information requires
attention and attention clearly has become the scarce factor when processing information
(e.g. Chetty et al., 2009; Dellavigna and Pollet, 2009; & Abaluck and Gruber, 2011). This creates a lot of scenario’s where it is impossible to take a look at and analyse all the information. This creates information overload. If we look at the theory it is clear that information overload is becoming a serious problem for people within organizations (Bazerman & More, 2008). If we look at the results of the study, most of the panellist’s experience information overload every day (66,67%). In the beginning of this study we noticed increasing amount of information overload that people are experiencing and the results of the study indeed confirms the fact that information overload is present in organizational context.

Representativeness heuristic
If we then take a look at the second variable, the use of the representativeness heuristic, we expected to see that the use of heuristics is common in strategic decision-making and that the multiple heuristics can happen at once. As Bazerman (2008) states that decision makers are willing to generalize about a phenomenon based on only a few attributes of a person or only a few observations of a specified phenomenon. The most used random sample is personal experience (Kahneman et al., 1982). It is also important to keep in mind that the representativeness heuristic was chosen, because it is one of the most determinative heuristics when it comes to decision-making (Curseu & Vermeulen, 2008).

After analysing the results of the study, we see that heuristics often intertwine with each other. For example, the anchoring or conjunction fallacy clearly arised in the results of the study. The results of the study are in line with what we expected, all panellists (100%) either agreed or strongly agreed on the idea that heuristics and in this case specifically, the representativeness heuristic is being used when making strategic decisions within organizations. This confirms the first proposition. The confirmation of the first proposition is backed up with the case question in the research.

Proposition 1
In that case a problem with regard to an investment decision was explained towards the panellists and this resulted in that nine out of the fourteen participants (64,29%) used heuristic reasoning while explaining their decision. Thus, not only agreed the panellists on the theory that the use of the representativeness heuristic is common, they also confirmed it themselves with their line of reasoning within another case question.
The second questionnaire resulted in the fact that we received only twelve responses instead of fourteen responses from the first questionnaire. The fact that people do not respond to a second questionnaire is a risk of the Delphi method. This time, most of the experts still agreed or strongly agreed, however two people tend to have changed their mind and strongly disagreed and disagreed. This lead to less consensus than the first time. Thus, after the second round a consensus with regard to the proposition still exists although the consensus has become smaller instead of bigger. The reason for this is probably the fact that the participant was surprised with the results, which was also stated in their reasoning.

**Overconfidence**

With regard to the theory of overconfidence, we expected to see that the respondents were overconfident in the decisions they made. Thus, that strategic decision-makers would overestimate their own capabilities, knowledge or skills and that they would be very optimistic about their future (Bazerman, 1986; Busenitz, 1999; Camerer and Lovallo, 2000). Decision-makers tend to be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem (Erceg & Galic, 2014). Pikulina, Renneboog & Tobler (2017) also see a positive relationship between overconfidence in one’s financial knowledge and investment choice. The overconfidence effect can be related back to the case question of the investment decision. However, only four out of fourteen (28.57%) choose to make the investment based on very little information, and thus overestimating one’s financial knowledge and investment choice.

The part of the questionnaire with regard to the amount of overconfidence experts in the field, indeed confirmed the idea that strategic-decision makers usually overestimate their own capabilities, knowledge or skills. Eleven out of fourteen (78.57%) of the respondents overestimated themselves in the questionnaire. Thus, the study is in alignment with what we expected based on the theory, namely that confidence is necessary for achievement and can be inspiring, but overconfidence can lead to worse decisions than expected.

**Proposition 2**

After analysing the results of the second proposition with regard to the opinion and reasoning of the panellists, we found that indeed what we expected from theory, namely that the use of the representativeness heuristic leads to an increase in the overconfidence bias. Twelve out of fourteen respondents either ‘agreed’ or ‘strongly agreed’ on this (85.71%). The main
reasoning was that people overestimate their knowledge and abilities with regard to certain aspects when making decisions. The experts also think that experience creates overconfidence. Only one expert disagreed that experience does not result in overconfidence, which is not in line with theory. However, the overall consensus of the panel of experts is in line with the theory of overconfidence.

The second questionnaire resulted in 91.66% of the experts either agreed or strongly agreed. Thus, with regard to the second proposition more consensus was created between the group of experts. The expected results were created with regard to proposition 1 and proposition 2, only one expert apparently changed its mind and suddenly disagreed with the group. This is not the goal of a Delphi method, because you want to create more consensus. However, the overall consensus of the group improved, so that is a good sign with regard to the results.

Quality of decision-making
With the last variable, the quality of decision-making, we expected to see that there are two important factors which influence the quality of the decisions, namely the cognitive capabilities of a top management team and the interaction process through which the team produces its decisions (Amason, 1996). The theory stressed the importance of focusing on the perceptions of strategic decision-makers with regard to the quality of the strategic decisions they make (Amason, 1996; Carmeli et al. 2011; Olson et al., 2007). With regard to the results we see that they are in line with what we expected. The panellists agree almost all (85.71%) on the fact that the strategic decisions both the organizations and they individually made were good. Maybe this also relates back to the overconfidence effect, but that is not what was intended to measure here. The intention was to identify whether the panellists have a positive or negative perspective with regard to the strategic decision-making of their company and themselves. As expected, we found a slightly positive perspective towards strategic decision-making.

Proposition 3
After measuring the perception of the quality of strategic decision-making, the panellists had to give their opinion and reasoning with regard to the third proposition. This proposition is designed based on the theory where we expected to see that an increase in the overconfidence bias would lead to a lower quality of strategic decision-making. This resulted in the fact that twelve out of the fourteen respondents (85.71%) either agreed or strongly agreed with regard
to the fact that an increase in the overconfidence bias would lead to a lower quality of decision-making. However, the causes which the experts gave with regard to the lower quality of decision-making were not all in line with purely the overconfidence bias. For example, some experts reasoned about the skewed relationship between a manager and an employee (agency theory). This of course can have a serious effect on the quality of decision-making, but does not really align with the overconfidence effect. Thus, although the overall consensus within the panel of experts with regard to overconfidence and the quality of decision-making is present, we have to be careful with interpreting this proposition, because not all reasoning is related to the overconfidence bias.

The second questionnaire resulted in almost the same amount of agreement as the first questionnaire. With regard to the third proposition the approximately the same consensus was found in both questionnaires.

So, it looks like both proposition 1 and 3 failed to increase consensus within the group and proposition 2 succeeded to improve the consensus within the group of experts. Of course, due to the relatively small sample size, the opinion of one expert can significantly change the outcomes of the study. That is however a limitation of the Delphi method. The fact that both questionnaires are almost aligned with each other do indeed confirm that experts are aligned with regard to their opinion about the propositions. This increases the reliability of the research.

5.2.2. Reflection on methodology

This part of the chapter will focus on the methodology that is used in order to generate the results of the study. This exploratory focused study used a questionnaire with a Delphi Method to collect the data for this research. All the variables are operationalized in other ways and the propositions are measured by using the Delphi Method. First the operationalization of all the variables will be reflected on, then the operationalization of the Delphi method will be reflected on.

Before starting to reflect on the operationalization of the variables, it is important to mention that all the variables are measured with a relatively small number of items. This is done because otherwise the measurement of the most important part of the questionnaire, namely
the opinion and reasoning of the experts with regard to the proposition, would be prone to a low completion rate according to the Qualtrics Expert review. The Information overload was measured via an organizational perspective based on Bazerman & Moore (2008). Information overload related questions were asked on a 5-point Likert scale and via this indirect method, we could determine that the panellists indeed experienced information overload, almost every day. In agreement with the supervisor a 5-point Likert scale was used to measure the items, because this would generate sufficient answers. The propositions are measured with a 7-point Likert scale, in order to create more validity in the answers. But this will be discussed later on. This information provided sufficient evidence with regard to the fact that the experts indeed experienced information overload a lot.

The representativeness heuristic was measured via a case in which an investment decision was stated and the goal of this was to understand the choices people would make and the reasoning behind their choices. The reasoning was very important because this determined if the respondents used a statistical reasoning or if they used heuristics with their reasoning. It was a compact version of the article of Fong, Krantz and Nissbet (1986) which was replicated from the Busenitz (1999) article. Therefore, we can determine if heuristic-type reasoning was the case within the answers of the experts. Because it was a replication study which is used a lot, we can assume that the measurements are good. The answers of the experts were coded and it seemed that most experts are indeed using heuristic type reasoning.

Also, the method of measurement for the variable of overconfidence was based on earlier research. The 12 questions were asked in order to determine the amount of overconfidence within the group of experts. We can conclude that this methodology indeed helped us determine the amount of overconfidence within the panel of experts. Thus, this method was just as for the measurement of the use of the representativeness heuristic only used as a support for the data created with the Delphi method. It formed an extra confirmation that the panel of experts not only had the opinion of being prone to the representativeness heuristic and being prone to having overconfidence, but that they actually did use heuristic reasoning and that they actually were overconfident in most of their decisions.

So, the methodology until here is used to confirm all the ideas that were have drawn from theory and which formed the conceptual model of this study. It is good to see that all the variables indeed were confirmed via the used methodology. After that, the Delphi method
was used to connect the variables to each other via the propositions and to determine how they actually relate to each other. The Delphi method consisted of three phases.

1. Opinions were provided about the likelihood of events. After that, opinions were collected as responses within the questionnaire that were completely individually answered by the experts.

2. After that, the results of the study were analyzed and provided to the experts and a repolling took place when the experts were aware of the results of the first study.

3. The output of the questionnaire was then used as group ‘consensus’, which is expressed as the median response of the group of panellists.

5.3 Conclusions

The goal of this conclusion is to be able to answer the research question. In order to determine what effect information overload has on the use of the representativeness heuristic and the overconfidence bias in strategic decision-making in organizations, we have to be sure that this study provides enough empirical evidence to indicate that information overload is indeed experienced, that information overload increases the use of the representativeness heuristic in companies, that the use of the representativeness heuristic leads to an increase in the overconfidence bias and that an increase in the overconfidence bias leads to a lower quality of strategic decision-making within companies.

With regard to the individual variables we can conclude that almost all the experts (at least 80% for all variables) experience information overload, make use of the representativeness heuristic, are overconfident in their decisions and their perception towards strategic decision quality is aligned.

With regard to the propositions we can conclude that the consensus of the experts is about agreement of all three propositions. Only once (out of 42) times an expert disagreed on a proposition in the first questionnaire (the second proposition). This means that we can conclude that there is a very strong consensus towards an agreement of the three propositions. Although, the second questionnaire failed to create more consensus in the group of experts with regard to proposition 1 and proposition 3, we can still conclude that the results are reliable and the opinions of the experts are aligned with each other, because the consensus is still very significant.
This means that within this Delphi study we can conclude that information overload does increase the use of the representativeness heuristic in companies, that the use of the representativeness heuristic leads to an increase in the overconfidence bias and that an increase in the overconfidence bias leads to a lower quality of strategic decision-making within companies.

Concluding, this study confirmed with empirical evidence that indeed an increasing amount of information overload ultimately leads to a lower quality of strategic decision-making within organizations.
6. Practical implications and recommendations

This chapter will discuss the practical implications and lessons for strategic decision-makers and organizations and will reflect on the thesis and will provide recommendations for future research.

6.1. Practical (managerial) Implications

The exploratory character of this research creates a lot of opportunity for further research with regard to this subject. Although an exploratory study usually offers a lot of interesting findings for further research, there usually are some practical implications that can be concluded from a research like this.

The first implication is that information overload is indeed a problem and will eventually lead to a lower decision making quality with regard to strategic decisions, so preventing information overload where possible would be a good strategy for companies to pursue. Another implication is that people within organizations usually are not aware of the fact that they use heuristics so often and that they can have a serious influence on the quality of their decisions. Therefore, it is important to be aware of the fact that heuristics are used a lot and that, especially with big strategic decisions, it is important to rely more on statistical reasoning in order to create better quality strategic decisions. For the ‘everyday’ tasks using heuristics is great to use, because this saves a lot of time, which makes people more productive within the organization. The increase in productivity while using heuristics on a daily basis has a much more positive effect than making every decision based on statistical reasoning (which costs a lot more time).

Another implication is the fact that people in organizations, especially managers, experts or entrepreneurs are really prone to the overconfidence bias. Especially when people have experience in a certain field of when they determine their individual capacity, they tend to really overestimate themselves. It is important to keep in mind as a manager that you be aware of the overconfidence bias, because otherwise you will put enormous amounts of pressure on the employees in your team, which then probably leads to worse performance. That is why it is important to align the amount of confidence with the skills and knowledge available when making the (strategic) decision.
Thus, the main managerial implication of this study is to be aware of the effect that information overload has on both an organizational and an individual level and what effect it can cause towards the quality of decision-making within organizations.

6.2. Limitations and future research

This study of course contains some limitations. Although the answers of almost all the experts in the study aligned to each other, toward the theory and towards the expected results, only 12 experts of three different companies (cases) are used, which can make it hard to generalize the findings towards the greater population. Therefore, future research could replicate this study with other experts in order to check if the results stay the same and make the study then more generalizable.

The core of this study is still exploratory, so future research is definitely needed in order to better understand the connection between the different variables, but this study clearly defined a conceptual model with variables that are indeed connected to each other as expected based on the theory. So, although a limitation of the exploratory character is that it is hard to generalize the findings, we can conclude that future research can replicate the study or use the conceptual model as a basis for further research.

In this thesis, the aim was to improve the understanding of the effect of information overload that via heuristics and biases had a negative effect on the quality of strategic decision-making. The study demonstrated that information overload is likely to result in a lower quality of the strategic decisions that are being made. Because the research problem lies at the boundaries of several disciplines (e.g. organizational behaviour, human cognition, management information systems), the study provides future researchers with the possibility to aim more on a single perspective in order to create more focus within the exciting but challenging field of information overload.
References


Hello,

Thank you for agreeing to take part in this questionnaire with regard to decision-making in a time of information overload. Be assured that all answers you provide will be kept in the strictest confidentiality and the data will not be published.

Rules
1. Choose ONE of the alternatives or explain your answer if asked
2. The questionnaire will consist of two rounds. This round, the first round will take approximately ten minutes. After the first round, the answers will be analyzed and adapted to the given answers. Then, the second round will be much shorter and will take up to five minutes.

NOTE: Please answer all questions in the questionnaire before completing it.
Questions Information Overload

1. How many times do you think ‘information overload’ happens to you?
   - Multiple times a day
   - Once a day
   - A few times a week
   - A few times a month
   - Never

2. I feel like the amount of daily effort I must exert to stay up-to-date is:
   - Very little
   - Little
   - Just right
   - Heavy
   - Very Heavy

3. I often continue consuming information despite feeling that I’ve reached ‘information overload’
   - Strongly disagree
   - Disagree
   - Neither agree nor disagree
   - Agree
   - Strongly agree

Proposition 1:

Within the field of decision-making, heuristics are described as "judgmental shortcuts that generally get us where we need to go – and quickly – but at the cost of occasionally sending us off course." The representativeness heuristic occurs when decision makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. Think for example about a bad experience while using a certain product from a brand for the first time. Using the representativeness heuristic would result in never buying a product from that brand again.

What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies

   Information Overload leads to increased use of the Representativeness heuristic within companies

   - Totally disagree
   - disagree
   - neutral
   - agree
   - totally agree

Reasoning proposition 1 - Please explain your reasoning with regard to the question above.
Problem: Headquarters Investment Decision

The CEO of a big corporation is urging the board of directors to accept the investment in a new hyper-modern headquarters (HQ) that would fundamentally change their operations. After describing the capabilities of the new HQ, the CEO cites a recent nationwide study that examined 120 businesses with similar state-of-the-art headquarters. Results showed that at least 85% of the businesses had a sizable increase in productivity. In a parallel a control group of firms not have a modern HQ, about half as many firms (40%) showed a sizeable increase in productivity. Based on this study, the CEO concludes that a new HQ would be a smart investment.

However, one of the directors gives two reasons why a new HQ is not the real reason for the increased productivity. He thinks that companies with a hyper-modern HQ usually have a more energetic and adventurous company culture and it is the company culture that creates the increased productivity, not necessarily a new building. Secondly, any change is likely to lead to superior performance because of increased interest and commitment from the management.

If you were participating in such a decision, whose line of reasoning (CEO or director) would you be more likely to accept? Why?
Questions overconfidence:

You are presented random questions you have to answer and after that you can describe how confident you are with regard to the answer you gave. Because there are three alternative answers, and just one answer is correct, you have a 33% chance of giving a correct answer. Thus, guessing 33% means that you are not confident about the answer you choose and 100% relates to absolute certainty. Any number between 33% and 100% can be used to indicate the confidence in your answer.

1. Which land does the Nobel Prize winner in Economics Daniel Kahneman come from?
   - Germany
   - Israel
   - Austria
   How confident are you that your answer is correct? ….. %

2. How many letters does the Russian alphabet consist of?
   - 40
   - 33
   - 26
   How confident are you that your answer is correct? ….. %

3. “Tosca” is an opera from …?
   - G. Puccini
   - G. Verdi
   - A. Vivaldi
   How confident are you that your answer is correct? ….. %

4. How does one still call an instant camera?
   - Canon camera
   - Polaroid camera
   - Minolta camera
   How confident are you that your answer is correct? ….. %

5. Which is the most abundant metal on Earth?
   - Iron
   - Aluminium
   - Copper
   How confident are you that your answer is correct? ….. %

6. How is the snow shelter of Eskimos called?
   - Wigwam
   - Igloo
   - Tipi
   How confident are you that your answer is correct? ….. %

7. Which enterprise does Steve Jobs belong to?
   - Apple
   - Microsoft
   - Intel
   How confident are you that your answer is correct? ….. %
8. How is the fasting month in Islam called?
   - Sharia
   - Ramadan
   - Imam

   How confident are you that your answer is correct? ..... %

9. Which language does the concept “Fata Morgana” come from?
   - Italian
   - Arabic
   - Swahili

   How confident are you that your answer is correct? ..... %

10. Who flew for the first time across the Canal with a motorised plane?
    - Santos-Dumont
    - Wright
    - Blériot

    How confident are you that your answer is correct? ..... %

11. From which country originates the sparkling Lambrusco wine?
    - Italy
    - Turkey
    - Croatia

    How confident are you that your answer is correct? ..... %

12. Which French monk and cellar master is also called ‘the father of champagne’?
    - Dom DeLouise
    - Dom Pérignon
    - Dom Avignon

    How confident are you that your answer is correct? ..... %

**Proposition 2:**

As explained earlier, the representativeness heuristic occurs when decision-makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. For example, a bad first experience with a brand results in never buying that brand again. Next to that, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem.

What do you think about the following statement: The use of the representativeness heuristics leads to an increase in the overconfidence bias.

*The use of the representativeness heuristics leads to an increase in the overconfidence bias.*

- Totally disagree
- disagree
- neutral
- agree
- totally agree

**Reasoning prop 2** - Please explain your reasoning with regard to the question above.
Questions Decision Making Quality

Decision quality questions:

1. In general, the effect that strategic decisions have on my company are:
   - very poor  
   - poor  
   - neutral  
   - good  
   - very good

2. Relative to what we expected, the results of strategic decisions have been:
   - very poor  
   - poor  
   - neutral  
   - good  
   - very good

3. What was the effect of the strategic decisions in which you were involved:
   - very poor  
   - poor  
   - neutral  
   - good  
   - very good

Proposition 3:

As stated earlier, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem.

What do you think about the following statement: An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies.

   An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies.

   - Totally disagree  
   - disagree  
   - neutral  
   - agree  
   - totally agree

Reasoning prop 3 - Please explain your reasoning with regard to the question above.
Appendix B: Results of the study

Report: *Decision Making in A Time of Information Overload*

**Appendix B.1**

Q45 - How many times do you think ‘information overload’ happens to you?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many times do you think ‘information overload’ happens to you?</td>
<td>1.00</td>
<td>4.00</td>
<td>2.00</td>
<td>1.10</td>
<td>1.20</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple times a day</td>
<td>50.00%</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Once a day</td>
<td>21.42%</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>A few times a week</td>
<td>14.28%</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>A few times a month</td>
<td>14.28%</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Never</td>
<td>0.00%</td>
<td>0</td>
</tr>
</tbody>
</table>

Q46 - I feel like the amount of daily effort I must exert to stay up-to-date is:

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I feel like the amount of daily effort I must exert to stay up-to-date is:</td>
<td>2.00</td>
<td>4.00</td>
<td>3.60</td>
<td>0.61</td>
<td>0.37</td>
<td>14</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very little</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Little</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Just right</td>
<td>28.57%</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Heavy</td>
<td>71.42%</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Very heavy</td>
<td>0.00%</td>
<td>0</td>
</tr>
</tbody>
</table>

Total | 100% | 14
Q48 - I often continue consuming information despite feeling that I’ve reached ‘information overload’

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I often continue consuming information despite feeling that I’ve reached ‘information overload’</td>
<td>2.00</td>
<td>5.00</td>
<td>3.67</td>
<td>0.70</td>
<td>0.49</td>
<td>14</td>
</tr>
</tbody>
</table>

Appendix B.2

Q52 – Within the field of decision-making, heuristics are described as "judgmental shortcuts that generally get us where we need to go – and quickly – but at the cost of occasionally sending us off course."

The representativeness heuristic occurs when decision makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. Think for example about a bad experience while using a certain product from a brand for the first time. Using the representativeness heuristic would result in never buying a product from that brand again. What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Disagree</td>
<td>7.86%</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Neither agree nor disagree</td>
<td>21.43%</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Agree</td>
<td>64.28%</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Strongly agree</td>
<td>7.86%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies?

<table>
<thead>
<tr>
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<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies</td>
<td>5.00</td>
<td>6.00</td>
<td>5.20</td>
<td>0.40</td>
<td>0.16</td>
<td>14</td>
</tr>
</tbody>
</table>
Reasoning proposition 1 - Please explain your reasoning with regard to the question above.

Please explain your reasoning with regard to the question above.

Impossible to understand all the facts
As we tend to become bored or irritated by a certain level of information overload, employees may find it hard to separate each task and think of it the same as the previous one.

Reviewing a few observations takes less time than reviewing anything which contains an Information overload.

With an overload of information not all the possible outcomes will be viewed.
Through information overload, there is less mental capacity to reason decisions carefully and so heuristics are used.

You don't want to dive in the details again, because you have already so much information. Therefore, you make sometimes your decisions on this heuristic.

When you’re dealing with information overload, the brain will automatically make use of the so called heuristics.

It’s easier to choose something you’ve already experienced in case of information overload.

Als je iets zat bent op je tijdlijn en een bedrijf blijft ermee komen krijg je negatieve opvattingen daarover.

one problem with information overload is that people get wide range of information but all on a very superficial level, which makes people vulnerable to Representativeness Heuristic issues, since one cannot always cover everything for every topic.

It's impossible to take all relevant information into account, because there is so many, therefore most of the decisions are made on a best effort basis to my opinion.

Topics of reasoning with regard to proposition 1:

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Neither agree nor disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Agree</td>
<td>85.71%</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Strongly agree</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly agree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>
Appendix B.3

Q20 - The CEO of a big corporation is urging the board of directors to accept the investment in a new hyper-modern headquarters (HQ) that would fundamentally change their operations. After describing the capabilities of the new HQ, the CEO cites a recent nationwide study that examined 120 businesses with similar state-of-the-art headquarters. Results showed that at least 85% of the businesses had a sizable increase in productivity. In a parallel a control group of firms not have a modern HQ, about half as many firms (40%) showed a sizeable increase in productivity. Based on this study, the CEO concludes that a new HQ would be a smart investment. However, one of the directors gives two reasons why a new HQ is not the real reason for the increased productivity. He thinks that companies with a hyper-modern HQ usually have a more energetic and adventurous company culture and it is the company culture that creates the increased productivity, not necessarily a new building. Secondly, any change is likely to lead to superior performance because of increased interest and commitment from the management. If you were participating in such a decision, whose line of reasoning (CEO or director) would you be more likely to accept? Why?

If you were participating in such a decision, whose line of reasoning (CEO or director) would you be more likely to accept? Why?

Looking at the information presented, I would be more likely to agree with the director. There is no additional argumentation as to why there is such a big difference in increased productivity at companies that have a modern HQ. The workplace is too complicated to diminish other factors and take the CEO's line of reasoning for granted. 0

CEO. I believe that a new hyper modern environment is a really good starting point for new stimulus and involvement, resulting in an increase in productivity. 1

Director, because there are probably more factors than only a workspace which decide your operations’ performance. 1

I would agree with the director. Hir/Her line of reasoning includes more reasons for possible outcomes. There is a higher chance that one of his/her possibilities could be accepted. 1

Director, the reasoning that companies with a new HQ are more energetic and adventurous. The energy created by moving is a lot more influential than a corporate decision. 1
The director. There is no firm evidence that the fact that a building is state-of-the-art leads to more productivity. I can imagine that this change does bring about a culture change.

In general it is good to have a modern HQ to serve your existing employees and give them a boost in performance but also to attract new young people who demand much more of a working environment than in the past. In a time that good employees are scarce, it is a good idea to have a good and challenging HQ because that is also important next to salary. It depends a bit of the business. In general I think that culture plays a very important role, but also the workplace itself should be modern.

It’s a difficult decision to make, regarding the fact that both parties got a solid point. The argument of the CEO is backed up by an article, which contains a representative amount of participants. Scientifically seen, such an article is a solid argument to provide. But you have to wonder if such a drastic change gives you the result you’re looking for regarding the fact that ‘improved productivity’ is a

The director, since psychological factors play an important role in the productivity of an organization. Furthermore, no information is given about how the operations would change in a new HQ.

The director. There are many factors leading to one result, and the CEO's reasoning is weak by giving all credit to one factor, not to mention that there's no proof that new building leads to productivity.

I would follow the reasoning of the CEO because there are facts to support the decision, however, it makes sense that culture also can have an impact on productivity. It's just not easy to trust on only one reason.

I think the director would more agree with the reasoning of the director. A new building can be a way for employees to increase productivity, but if the company culture still doesn't motivate people to be more motivated and inspired, eventually a new building will not increase productivity in the long term.

The director, the new environment helps a lot but is do think it is more a state of mind thing in combination with your environment.
Appendix B.4

Q1 - Which land does the Nobel Prize winner in Economics Daniel Kahneman come from?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Which land does the Nobel Prize winner in Economics Daniel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kahneman come from?</td>
<td>1.00</td>
<td>3.00</td>
<td>1.93</td>
<td>0.59</td>
<td>0.35</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
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<td>1</td>
<td>Germany</td>
<td>21.43%</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Israel</td>
<td>64.29%</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Austria</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q2 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

Confidence levels:

| 95  |
| 70  |
| 50  |
| 80  |
| 100 |
| 65  |
| 100 |
| 33  |
| 33  |
| 40  |
| 80  |
| 33  |
Q5 - How many letters does the Russian Alphabet consist of?

<table>
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<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many letters does the Russian Alphabet consist of?</td>
<td>1.00</td>
<td>3.00</td>
<td>2.00</td>
<td>0.85</td>
<td>0.71</td>
<td>14</td>
</tr>
</tbody>
</table>

Q6 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

33  
60  
34  
33  
50  
100 
33  
75  
33  
40  
33  
40  
50  
40
Q7 - "Tosca" is an opera from ...?

<table>
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<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Tosca” is an opera from ...?</td>
<td>1.00</td>
<td>3.00</td>
<td>2.07</td>
<td>0.88</td>
<td>0.78</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G. Puccini</td>
<td>35.71%</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>G. Verdi</td>
<td>21.43%</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>A. Vivaldi</td>
<td>42.86%</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q8 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

33
50
33
33
40
100
80
33
33
33
33
40
40
40
Q9 - How does one still call an instant camera?

<table>
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<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How does one still call an instant camera?</td>
<td>2.00</td>
<td>3.00</td>
<td>2.14</td>
<td>0.35</td>
<td>0.12</td>
<td>14</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canon camera</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Polaroid camera</td>
<td>85.71%</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Minolta camera</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q10 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

<table>
<thead>
<tr>
<th></th>
<th>95</th>
<th>70</th>
<th>90</th>
<th>50</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>40</th>
<th>100</th>
<th>55</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
</table>
Q13 - Which is the most abundant metal on Earth?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Which is the most abundant metal on Earth?</td>
<td>1.00</td>
<td>3.00</td>
<td>1.79</td>
<td>0.77</td>
<td>0.60</td>
<td>14</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Iron</td>
<td>42.86%</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Aluminium</td>
<td>35.71%</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Copper</td>
<td>21.43%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
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</table>

Q14 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

50
70
60
33
75
50
70
100
100
33
100
70
60
80
Q17 - How is the snow shelter of Eskimos called?

<table>
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<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
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<tbody>
<tr>
<td>1</td>
<td>How is the snow shelter of Eskimos called?</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>0.00</td>
<td>0.00</td>
<td>14</td>
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</table>

<table>
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<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Wigwam</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Igloo</td>
<td>100.00%</td>
<td>14</td>
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<tr>
<td>3</td>
<td>Tipi</td>
<td>0.00%</td>
<td>0</td>
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<tr>
<td></td>
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Q18 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)
100
99
100
100
100
100
100
100
33
100
90
100
Q19 - Which enterprise does Paul Allen belong to?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Which enterprise does Paul Allen belong to?</td>
<td>1.00</td>
<td>3.00</td>
<td>2.36</td>
<td>0.61</td>
<td>0.37</td>
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</table>

<table>
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<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apple</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Microsoft</td>
<td>50.00%</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Intel</td>
<td>42.86%</td>
<td>6</td>
</tr>
<tr>
<td></td>
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</table>

Q20 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

40
70
90
33
65
100
100
100
100
33
33
60
80
60
Q21 - How is the fasting month in Islam called?

<table>
<thead>
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<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>How is the fasting month in Islam called?</td>
<td>1.00</td>
<td>2.00</td>
<td>1.93</td>
<td>0.26</td>
<td>0.07</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sharia</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Ramadan</td>
<td>92.86%</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>Imam</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
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</tbody>
</table>

Q22 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

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<th>Answer</th>
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</thead>
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<tr>
<td>1</td>
<td>Sharia</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Ramadan</td>
<td>92.86%</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>Imam</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
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</tbody>
</table>
Q23 - Which language does the concept "Fata Morgana" come from?

<table>
<thead>
<tr>
<th></th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Which language does the concept &quot;Fata Morgana&quot; come from?</td>
<td>1.00</td>
<td>2.00</td>
<td>1.86</td>
<td>0.35</td>
<td>0.12</td>
<td>14</td>
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</tbody>
</table>

<table>
<thead>
<tr>
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<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Italian</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Arabic</td>
<td>85.71%</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Swahili</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q24 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
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<tr>
<td>67</td>
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<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q29 - Who flew for the first time across the Canal with a motorised plane?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Who flew for the first time across the Canal with a motorised plane?</td>
<td>1.00</td>
<td>3.00</td>
<td>2.14</td>
<td>0.64</td>
<td>0.41</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Santos-Dumont</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Wright</td>
<td>57.14%</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Blériot</td>
<td>28.57%</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q30 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

40
80
70
33
65
100
60
100
50
50
33
70
80
90
Q31 - From which country originates the sparkling Lambrusco wine?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From which country originates the sparkling Lambrusco wine?</td>
<td>1.00</td>
<td>3.00</td>
<td>1.14</td>
<td>0.52</td>
<td>0.27</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Italy</td>
<td>92.86%</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Turkey</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Croatia</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q32 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
</tr>
<tr>
<td>50</td>
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<tr>
<td>80</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>
Q33 - Which French monk and cellar master is also called 'the father of champagne'?

<table>
<thead>
<tr>
<th>#</th>
<th>Which French monk and cellar master is also called 'the father of champagne'?</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2.00</td>
<td>3.00</td>
<td>2.14</td>
<td>0.35</td>
<td>0.12</td>
<td>14</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dom DeLouise</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Dom Pérignon</td>
<td>85.71%</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Dom Avignon</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q34 - How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

How confident are you that your answer is correct? choose a number between 33 and 100 (33 = no confidence at all, 100 = totally confident)

| 90 |
| 75 |
| 80 |
| 33 |
| 100 |
| 80 |
| 90 |
| 75 |
| 100 |
| 33 |
| 33 |
| 100 |
| 90 |
| 100 |
## Probability categories overconfidence:

<table>
<thead>
<tr>
<th>Resp.</th>
<th>0.30 – 0.39</th>
<th>0.40 – 0.49</th>
<th>0.50 – 0.59</th>
<th>0.60 – 0.69</th>
<th>0.70 – 0.79</th>
<th>0.80 – 0.89</th>
<th>0.90 – 0.99</th>
<th>1.00</th>
<th>Amount of correct answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp. 1</td>
<td>I</td>
<td>II</td>
<td>I</td>
<td>II</td>
<td>I</td>
<td>III</td>
<td>IIII</td>
<td>III</td>
<td>IIIII I</td>
</tr>
<tr>
<td>Resp. 2</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>IIII</td>
<td>I</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IIIII I</td>
</tr>
<tr>
<td>Resp. 3</td>
<td>III</td>
<td>II</td>
<td>I</td>
<td></td>
<td>III</td>
<td></td>
<td></td>
<td></td>
<td>IIIII III</td>
</tr>
<tr>
<td>Resp. 4</td>
<td>IIII</td>
<td>IIII</td>
<td>I</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td>IIII II</td>
</tr>
<tr>
<td>Resp. 5</td>
<td>IIII</td>
<td>IIII</td>
<td>I</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td>IIII IIII</td>
</tr>
<tr>
<td>Resp. 6</td>
<td>II</td>
<td>I</td>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td>IIII IIII</td>
<td>II</td>
<td>IIIII II</td>
</tr>
<tr>
<td>Resp. 7</td>
<td>I</td>
<td></td>
<td>II</td>
<td></td>
<td>I</td>
<td></td>
<td>IIII IIII</td>
<td>II</td>
<td>IIIII IIII</td>
</tr>
<tr>
<td>Resp. 8</td>
<td>I</td>
<td></td>
<td>I</td>
<td>II</td>
<td>I</td>
<td>I</td>
<td>IIII IIII</td>
<td>II</td>
<td>IIIII IIII</td>
</tr>
<tr>
<td>Resp. 9</td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td>IIII IIII</td>
<td>II</td>
<td>IIIII II</td>
</tr>
<tr>
<td>Resp. 10</td>
<td>I</td>
<td>I</td>
<td>II</td>
<td>I</td>
<td>I</td>
<td></td>
<td>IIII IIII</td>
<td>II</td>
<td>IIIII II</td>
</tr>
<tr>
<td>Resp. 11</td>
<td>IIII</td>
<td>I</td>
<td>III</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td>IIII I</td>
</tr>
<tr>
<td>Resp. 12</td>
<td>II</td>
<td>I</td>
<td>III</td>
<td>I</td>
<td>III</td>
<td></td>
<td>IIII II</td>
<td></td>
<td>IIIII I</td>
</tr>
<tr>
<td>Resp. 13</td>
<td>I</td>
<td>I</td>
<td>IIII</td>
<td>I</td>
<td>II</td>
<td>I</td>
<td></td>
<td></td>
<td>IIII III</td>
</tr>
<tr>
<td>Resp. 14</td>
<td>II</td>
<td>II</td>
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<td></td>
<td>I</td>
<td>III</td>
<td>II</td>
<td></td>
<td>IIII III</td>
</tr>
</tbody>
</table>

**Formula to measure overconfidence:** Mean of confidence score - (Answers correct / total answers (=12))

<table>
<thead>
<tr>
<th>Resp.</th>
<th>Mean of confidence score</th>
<th>Answers correct / total answers</th>
<th>Overconfidence score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp. 1</td>
<td>9.2/12 = 0.766</td>
<td>5/12 = 0.416</td>
<td>0.7667 - 0.4167 = 0.35</td>
</tr>
<tr>
<td>Resp. 2</td>
<td>9.1/12 = 0.758</td>
<td>6/12 = 0.5</td>
<td>0.758 – 0.5 = 0.26</td>
</tr>
<tr>
<td>Resp. 3</td>
<td>7.9/12 = 0.658</td>
<td>5/12 = 0.416</td>
<td>0.658 – 0.416 = 0.24</td>
</tr>
<tr>
<td>Resp. 4</td>
<td>5/12 = 0.416</td>
<td>7/12 = 0.583</td>
<td>0.416 – 0.583 = -0.167</td>
</tr>
<tr>
<td>Resp. 5</td>
<td>5.9/12 = 0.492</td>
<td>3/12 = 0.25</td>
<td>0.492 – 0.25 = 0.242</td>
</tr>
<tr>
<td>Resp. 6</td>
<td>9.9/12 = 0.825</td>
<td>7/12 = 0.583</td>
<td>0.825 – 0.583 = 0.242</td>
</tr>
<tr>
<td>Resp. 7</td>
<td>9.5/12 = 0.792</td>
<td>9/12 = 0.75</td>
<td>0.792 – 0.75 = 0.042</td>
</tr>
<tr>
<td>Resp. 8</td>
<td>9.2/12 = 0.766</td>
<td>10/12 = 0.833</td>
<td>0.776 – 0.833 = -0.067</td>
</tr>
<tr>
<td>Resp. 9</td>
<td>10.9/12 = 0.908</td>
<td>12/12 = 1</td>
<td>0.908 – 1 = 0.092</td>
</tr>
<tr>
<td>Resp. 10</td>
<td>9.2/12 = 0.766</td>
<td>7/12 = 0.583</td>
<td>0.766 – 0.583 = 0.183</td>
</tr>
<tr>
<td>Resp. 11</td>
<td>6.3/12 = 0.525</td>
<td>6/12 = 0.5</td>
<td>0.525 – 0.5 = 0.025</td>
</tr>
<tr>
<td>Resp. 12</td>
<td>8.8/12 = 0.733</td>
<td>6/12 = 0.5</td>
<td>0.733 – 0.5 = 0.233</td>
</tr>
<tr>
<td>Resp. 13</td>
<td>8.9/12 = 0.742</td>
<td>8/12 = 0.667</td>
<td>0.742 – 0.667 = 0.75</td>
</tr>
<tr>
<td>Resp. 14</td>
<td>8/12 = 0.667</td>
<td>8/12 = 0.667</td>
<td>0.667 – 0.667 = 0</td>
</tr>
</tbody>
</table>

**Overconfidence:** Respondent 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13

**Underconfidence:** Respondent 4, 8

**Alignment of confidence and answers:** Respondent 14
Appendix B.5

Q62 - As explained earlier, the representativeness heuristic occurs when decision-makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. For example, a bad first experience with a brand results in never buying that brand again. Next to that, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem. What do you think about the following statement: The use of the representativeness heuristics leads to an increase in the overconfidence bias.

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do you think about the following statement: The use of the representativeness heuristics leads to an increase in the overconfidence bias.</td>
<td>3.00</td>
<td>6.00</td>
<td>5.07</td>
<td>0.80</td>
<td>0.64</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Disagree</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Neither agree nor disagree</td>
<td>7.14%</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Agree</td>
<td>57.14%</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Strongly agree</td>
<td>28.57%</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly agree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Reasoning prop 2 - Please explain your reasoning with regard to the question above.
Please explain your reasoning with regard to the question above.
Because we often feel that we master a specific skill as we have used it successfully before. However, we fail to understand that the environment in which we now deploy that skill could have changed dramatically.
If heuristics are available, you will make decisions quicker and overconfidence plays a big role in quick decisions.
Overconfidence occurs in almost every situation because people don't want to lose face.
I think that ones personal experience do not result in the overconfidence. The representative bias has no effect on it, because both successes and failures are experienced.
No idea sorry.
People usually think that they know a lot more about their craft than they actually do. They overestimate themselves.
When you have more experience or knowledge available, you’re automatically inclined to overestimate your knowledge and capabilities.

Overschatting van jezelf gaat in combinatie met onderschatting van het risico.

It is in human nature to find approval to be more confident about his opinion. Information that happens to be in favor of one’s opinion tend to be exaggerated, while information in the opposite direction will be ignored.

People think they have the knowledge, and therefore think they have the abilities, but in fact that’s not the case.

Topics of reasoning with regard to proposition 2:

<table>
<thead>
<tr>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>quick decisions</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>underestimating risk</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>be humiliated</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>approval of opinion</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>use of heuristic</td>
<td>10.00%</td>
<td>2</td>
</tr>
<tr>
<td>confirmation bias</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>experience</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>personal experience does not result in overconfidence</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>environment changes</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>knowledge</td>
<td>10.00%</td>
<td>2</td>
</tr>
<tr>
<td>abilities</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>overconfidence</td>
<td>25.00%</td>
<td>5</td>
</tr>
<tr>
<td>default option</td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>20</td>
</tr>
</tbody>
</table>
Appendix B.6

Q59 - In general, the effect that strategic decisions have on my company are:

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In general, the effect that strategic decisions have on my company are:</td>
<td>3.00</td>
<td>4.00</td>
<td>3.86</td>
<td>0.35</td>
<td>0.12</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very poor</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Poor</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>85.71%</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Very good</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
</tr>
</tbody>
</table>

Q60 - Relative to what we expected, the results of strategic decisions have been:

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relative to what we expected, the results of strategic decisions have been:</td>
<td>2.00</td>
<td>4.00</td>
<td>3.43</td>
<td>0.73</td>
<td>0.53</td>
<td>14</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very poor</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Poor</td>
<td>14.29%</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>28.57%</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>57.14%</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Very good</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
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</tbody>
</table>
Q61 - What was the effect of the strategic decisions in which you were involved:

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<th>Minimum</th>
<th>Maximum</th>
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<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What was the effect of the strategic decisions in which you were involved:</td>
<td>3.00</td>
<td>4.00</td>
<td>3.64</td>
<td>0.48</td>
<td>0.23</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very poor</td>
<td>0.00%</td>
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<tr>
<td>2</td>
<td>Poor</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>35.71%</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>64.29%</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Very good</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>14</td>
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</table>

Appendix B.7

Q67 - As stated earlier, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem.

What do you think about the following statement: An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies.

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
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<td>An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies</td>
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<td>6.00</td>
<td>5.21</td>
<td>0.67</td>
<td>0.45</td>
<td>14</td>
</tr>
<tr>
<td>#</td>
<td>Answer</td>
<td>%</td>
<td>Count</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td>-------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
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<td>0.00%</td>
<td>0</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Strongly disagree</td>
<td>0.00%</td>
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<td>3</td>
<td>Disagree</td>
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<td></td>
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<td>Agree</td>
<td>50.00%</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>35.71%</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Very strongly agree</td>
<td>0.00%</td>
<td>0</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
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<td>100%</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reasoning prop 3 - Please explain your reasoning with regard to the question above.

I somewhat agree with this as the 'overconfidence' suggests that you fail to acknowledge certain weaknesses of your company that are essential for making the right strategic decision.

Bias will lead to bad decisions, because it is called bias.

It depends on previous experience and the environment the organization is operating.

One should be unsure about their own capacities. Too much confidence leads to Narrowminded thinking and decisions.

Some decisions were really luck that they were successful. It also goes wrong many times whereas the really involved employees would have decided differently from the manager.

Decision-making can be really hard especially with information overload, so people become biased because of the overload.

In making strategic decisions you have to be very realistic instead of too optimistic about your own abilities.

Ja het staat er eigenlijk boven

the reasoning was given prior to the question...

The fact that information is missing, which people do not know because they are biased, will have a big influence on the quality of the Strategic Decisions made.

In our company the overconfidence of the GM leads to unrealistic targets for the rest of the company.
Q68 – Topics Reasoning proposition 3:

<table>
<thead>
<tr>
<th>Answer</th>
<th>%</th>
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</thead>
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<td>narrowminded thinking</td>
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</tr>
<tr>
<td>individual capability</td>
<td>4.55%</td>
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</tr>
<tr>
<td>biased thinking</td>
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<tr>
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</tr>
<tr>
<td>environment</td>
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<td>1</td>
</tr>
<tr>
<td>optimism</td>
<td>4.55%</td>
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</tr>
<tr>
<td>luck</td>
<td>4.55%</td>
<td>1</td>
</tr>
<tr>
<td>agency theory</td>
<td>4.55%</td>
<td>1</td>
</tr>
<tr>
<td>missing information</td>
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</tr>
<tr>
<td>previous experience</td>
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<tr>
<td>realism</td>
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<td>1</td>
</tr>
<tr>
<td>overconfidence</td>
<td>13.64%</td>
<td>3</td>
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<tr>
<td>quality strategic decision-making</td>
<td>22.73%</td>
<td>5</td>
</tr>
<tr>
<td>failure to acknowledge weaknesses</td>
<td>4.55%</td>
<td>1</td>
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<tr>
<td>Total</td>
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</tbody>
</table>
Appendix C:
Decision Making in A Time of Information Overload 2

Appendix C.1
Q3 - Within the field of decision-making, heuristics are described as "judgmental shortcuts that generally get us where we need to go – and quickly – but at the cost of occasionally sending us off course." The representativeness heuristic occurs when decision makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. Think for example about a bad experience while using a certain product from a brand for the first time. Using the representativeness heuristic would result in never buying a product from that brand again. What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies. After reviewing the first questionnaire, the following results were found: 80% agreed and 20% strongly agreed on this proposition. What do you think of this statement after reading the results from the first questionnaire?

<table>
<thead>
<tr>
<th>#</th>
<th>Field</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do you think about the following statement: Information Overload leads to increased use of the Representativeness Heuristic within companies</td>
<td>2.00</td>
<td>6.00</td>
<td>4.75</td>
<td>1.09</td>
<td>1.19</td>
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<table>
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<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Strongly disagree</td>
<td>8.33%</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Disagree</td>
<td>8.33%</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Neither agree nor disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Agree</td>
<td>66.67%</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Strongly agree</td>
<td>16.67%</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly agree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Reasoning prop 1 - Please explain your reasoning with regard to the question above.

Please explain your reasoning with regard to the question above.

I don’t think Heuristic decision making had an direct impact through Information overload

My first impression was to agree to this statement. When seeing the results this confirmed my thoughts.

I still agree with the outcome, the results only confirm my thoughts

It is logical that when you have a bad experience with a brand you will be less likely to buy it another time.

The same reasoning as in the first part
I stick to my answer I gave last time, so I strongly agree.

I still ‘agree’ with the statement like I did before. I am a little surprised though that no one has answered neutral or negatively. My opinion has not changed after seeing these results.

I think information overload DOES lead to increased repr. heuristic.

I think that we should question if information overload leads to use of more heuristics.

Just as the last time I think the same, I still agree, good to see that the other participants also think that way.

Het klinkt logisch dat de hoeveelheid informatie leidt tot meer heuristics dus nog steeds eens.

Just as the first questionnaire is strongly agree with this.

Q5 - Topics

<table>
<thead>
<tr>
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<th>%</th>
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</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>no direct impact</td>
<td>6.67%</td>
<td>1</td>
</tr>
<tr>
<td>consensus</td>
<td>46.67%</td>
<td>7</td>
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<tr>
<td>same opinion</td>
<td>6.67%</td>
<td>1</td>
</tr>
<tr>
<td>information overload</td>
<td>13.33%</td>
<td>2</td>
</tr>
<tr>
<td>surprised</td>
<td>6.67%</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>15</td>
</tr>
</tbody>
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Appendix C.2

Q7 - As explained earlier, the representativeness heuristic occurs when decision-makers are willing to make strategic decisions about a phenomenon based on only a few attributes or only a few observations. For example, a bad first experience with a brand results in never buying that brand again. Next to that, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem. What do you think about the following statement: The use of the representativeness heuristics leads to an increase in the overconfidence bias. After reviewing the first questionnaire, the following results were found: 7.14% disagreed on this proposition, 7.14% neither agreed nor disagreed, 57.14% agreed and 28.57% strongly agreed on this proposition. What do you think of this statement after reading the results from the first questionnaire?

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<th>Minimum</th>
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<th>Mean</th>
<th>Std Deviation</th>
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<tr>
<td>1</td>
<td>2.00</td>
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</tr>
</thead>
<tbody>
<tr>
<td>Very strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>8.33%</td>
<td>1</td>
</tr>
<tr>
<td>Disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Agree</td>
<td>83.33%</td>
<td>10</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>8.33%</td>
<td>1</td>
</tr>
<tr>
<td>Very strongly agree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>12</td>
</tr>
</tbody>
</table>

Reasoning prop. 2 - Please explain your reasoning with regard to the question above.

Please explain your reasoning with regard to the question above.

In the most of the organizations the representativeness heuristics leads to increase in the overconfidence bias.

The more a manager thinks from is heuristic perspective, the more overconfidence bias leads to poor decision making.

I agree because of having experience with this phenomenon in working situations. Managers tend to be overconfident in my opinion even when they lack experience.
I still believe that the use of the representativeness heuristics lead to an increase in the overconfidence bias.

People do not use only their positive/negative experiences: they use both to make a decision.

When you rely on what you already know or experienced, you’re inclined to overestimate the value of this when making a decision.

I stick to my answer I gave last time, so I agree.

As the questions initially also asked for a personal comment, I think it is hard to judge the results just looking at the numbers. As the initial statement is very complex, I would need to see people’s argumentation to maybe change my answer as well.

I agree On this just as the first time.

Als een manager meer denkt vanuit het perspectief van heuristics dan krijg je natuurlijk meer overconfidence.

I think this happens in most organizations, so it does not surprise me that almost everyone agreed.

### Q9 - Topics

<table>
<thead>
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<th>Answer</th>
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<td>lower quality decision-making</td>
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</tr>
<tr>
<td>use of heuristic</td>
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</tr>
<tr>
<td>complexity</td>
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<td>consensus</td>
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<tr>
<td>experience</td>
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</tr>
<tr>
<td>groupthink</td>
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<tr>
<td>overconfidence</td>
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</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>18</td>
</tr>
</tbody>
</table>
Appendix C.3

Q11 - As stated earlier, the overconfidence bias is about the individual’s tendency to overestimate one’s capabilities, knowledge, skills and being very optimistic about one’s future. The overconfidence bias shows how decision-makers (managers for example) can be too optimistic about their abilities, especially when they do not have any expertise in the field or when serious uncertainty is related to the problem. What do you think about the following statement: An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies. After reviewing the first questionnaire, the following results were found: 14.29% neither agreed nor disagreed, 50% agreed and 35.71% strongly agreed on this proposition. What do you think of this statement after reading the results from the first questionnaire?

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<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Variance</th>
<th>Count</th>
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<tbody>
<tr>
<td>1</td>
<td>What do you think about the following statement: An increase in the overconfidence bias leads to lower quality Strategic Decision-making within companies.</td>
<td>4.00</td>
<td>6.00</td>
<td>5.25</td>
<td>0.72</td>
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<th>Count</th>
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<td>1</td>
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<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Strongly disagree</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Disagree</td>
<td>0.00%</td>
<td>0</td>
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<tr>
<td>4</td>
<td>Neither agree nor disagree</td>
<td>16.67%</td>
<td>2</td>
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<td>Agree</td>
<td>41.67%</td>
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<td>6</td>
<td>Strongly agree</td>
<td>41.67%</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly agree</td>
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</tr>
</tbody>
</table>

Total 100% 12
Reasoning prop. 3 - Please explain your reasoning with regard to the question above.

Please explain your reasoning with regard to the question above.

Same as the last question

Sometimes this "gut feeling" is spot on in my opinion but I'd rather make decisions on a rational basis.

I still think that the most important information should be taken into consideration instead of using overconfidence.

Being more confident with your own choice prevents the decision maker to weigh all factors and look at an alternative possibility. Because of this, choices that are made will be worse.

Often it is better to be realistic and more critically reflect on your own capabilities in order to make good decisions.

Same answer as last time, I do not change my reasoning after reviewing the results.

Like I mentioned before, I still think that overconfidence leads to poor decision making sometimes.

Apparently more people agree with this but I am curious as to why they give the same answer.

If you are more confident in your decision making you will be more likely to use heuristics, which can lead to a lower quality of decision making, so I agree.

I think it is good to be aware that time is a huge factor and experience can create enough confidence to make decisions without checking the facts.

Most of my decisions are based on my gut feeling because it saves me a lot of time and if sometimes that means that I did not make the right decision that is bad, but it saved a lot of time for other things.

Meer zelfvertrouwen leidt natuurlijk tot meer fouten omdat je keuzes niet meer onderbouwd met feiten.

After reading I still strongly agree.

Q13 - Topics

- Statistical decision making
- Overconfidence
- Good decisions
- Poor decision making
- Heuristics
- Self-confidence
- Time
- Experience
- Critical thinking
- Quality
- Strategic decision making
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<td>capabilities</td>
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</tr>
<tr>
<td>small minded thinking</td>
<td>5.56%</td>
<td>1</td>
</tr>
<tr>
<td>poor decision making</td>
<td>5.56%</td>
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</tr>
<tr>
<td>consensus</td>
<td>33.33%</td>
<td>6</td>
</tr>
<tr>
<td>luck</td>
<td>5.56%</td>
<td>1</td>
</tr>
<tr>
<td>curiosity</td>
<td>5.56%</td>
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<td>critically reflect</td>
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</tr>
<tr>
<td>quality strategic-decision making</td>
<td>5.56%</td>
<td>1</td>
</tr>
<tr>
<td>overconfidence</td>
<td>16.67%</td>
<td>3</td>
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<tr>
<td>good decisions</td>
<td>5.56%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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