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Rationalité et intuition : intégration des outils décisionnels fondés sur l'intelligence artificielle dans les pratiques managériales

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Résumé :

Parmi les tâches essentielles des managers, la formulation de choix qu'ils espèrent optimaux parmi un éventail de possibilités, lors d'une décision stratégique ou opérationnelle, est particulièrement ardue. Au moyen d'une analyse multiméthode, notre recherche vise à mieux comprendre la contribution des outils numériques fondés sur l'intelligence artificielle à la performance des décisions managériales au sein des organisations et à la création de valeur grâce à : 1) une meilleure compréhension de la façon dont ils sont utilisés et appropriés par les managers, 2) l'évaluation de leur contribution à la performance décisionnelle du manager et 3) la formulation de recommandations visant à mieux intégrer l'humain (intuition, improvisation) à la technologie dans les outils décisionnels.

Mots clés :

Prise de décision, intuition, heuristique de jugement, intelligence artificielle, appropriation.

Rationality and intuition: integration of decision-making tools based on artificial intelligence in managerial practices

1. Introduction

“I do not deny that most managers lack a good deal of information that they should have... It seems to me that they suffer more from an overabundance of irrelevant information” (Ackoff, 1967, p. B-147). This statement by Russel Ackoff in his seminal paper on management information systems (MIS) seems prophetic, even to this day! One of the main tasks of the decision-maker, up until now, is ultimately to separate the wheat from the chaff, and select hopefully optimal choices from a range of possibilities, in both strategic and operational decisions. As mentioned by Kane and colleagues, *“Historically, the capabilities of technology limited what society could do. Now, as rapidly developing technologies erode prior limits, questions shift from ‘what can we do?’ to ‘what should we do?’”* (Kane et al., forthcoming, p. 50). Today, making effective decisions is more than ever before vital to ensure the competitiveness and sustainability of companies around the world. Prior research suggested that information technology (IT) would support managers by automating *structured* decisions, letting the full role of the managers regarding *unstructured* decisions. In fact, managers make use of their intuition, among others, which is considered as unique to human beings. Interestingly, however, artificial intelligence (AI) is in some ways expected to automate unstructured decisions, which increasingly questions the evolutions of the work and role of managers. Overall, while organisations attempt to leverage the potential of AI, it is still unclear how managers make sense of those tools in their work, specifically when they must make decisions. Accordingly, this paper examines how managers integrate business intelligence tools (BI tools) in their work and practices and the role it has in their decision process.

Cognitive technologies, presented as the new AI, will, according to Davenport and Ronanki (2018), revolutionise the business world. According to the Davenport and Ronanki study, 35% of interviewed managers believe AI will empower them to make better decisions. A *“systematic redesign of workflows is necessary to ensure that humans and machines augment each other’s strengths and compensate for weaknesses”* (Davenport & Ronanki, 2018, p. 9). The authors, however, are silent in how all this would realize, how the managers would integrate the tools into their work. In fact, many researchers and managers acknowledge the benefits technologies bring to the quality of the decision-making processes in organisations, and the support provided by information and communication technologies (ICT), thanks in particular to the progresses made on AI in recent years. Some even expect to see AI soon make decisions for the managers themselves (Davenport & Ronanki, 2018; Duan et al., 2019). In view of some of the elements introduced by Ackoff, one might expect that the manager’s decisions being more and more supported, s/he may even one day be “replaced” by AI for decision-making tasks in organisations. In contrast, other authors suggest that we should rather seek to articulate the manager's unique capabilities, such as their intuition, with BI tools based on AI. For them, this would allow bringing back the human thinking, its cognitive biases and heuristics (Gigerenzer & Gaissmaier, 2011), potentially in the decision algorithm itself, or at least by the means of complementary decision-making processes (Gilboa et al., 2018).

Researchers and practitioners therefore have many expectations regarding the use of AI by managers and organisations in the field of information systems (IS). This is an even more

critical important issue given the important investments made by public and private organisations in AI. All those allow understanding the interest for these technologies among organisational leaders. What form should this articulation between human thinking and decision algorithms take?

Overall, the literature in IS is rather silent on the contribution of AI-based decision-making tools to manager's work, and how they integrate those tools in their work when they make decisions. To answer this research problem, and fill the gap in the literature regarding how-AI-based BI tools support managers, help them refine their decision making, and are integrated into work practices, this paper tackles the research questions below:

- How do BI tools support managers' decision process, especially AI-based BI tools?
- How do managers integrate those tools into their work practices? How are their rationality and intuition exercised in this process?

Decision support tools are particularly receptive to technological advances, such as machine learning and analytical processing of an ever-increasing amount of data. These tools are acclaimed by many managers in decision-making, as people expect improvements in the rational processing of data during the strategic choice. Other authors mention, on the other hand, that the conditions for optimal decision-making arise quite rarely and that the bounded rationality of decision-makers (Herbert A. Simon, 1993), as well as heuristics, based on experience of individuals, can lead to better decisions in a shorter time (Gigerenzer & Gaissmaier, 2015). Reconciling the rationality of the tools, the managers, and their intuition, in a context where AI and its extraordinary possibilities are more and more salient, becomes an essential objective for most managers who use BI tools to support decisions. Therefore, it is increasingly important to understand how managers seize and appropriate those tools in their daily practices to make decisions.

To answer the research questions, we provide an overview of managerial decision-making processes using decision support tools. It will make it possible to bring out the conceptual and/or organisational limitations. We then review the relevant literature to help understand the kind of support managers expect from BI tools, and how they appropriate the features and potential of those tools and interact with them. Following this, we provide an overview of the expected research design and methods. The expected contributions are then discussed. We conclude with the perspectives of the work for research and companies. This work aims to help decision support technologies designers and developers improve their knowledge on how managers respond to the contributions of the tools to decision making.

2. Review of the literature

2.1 IT and Managers' Decision Making

As Russel Ackoff (1967, p. B-147) mentioned it years ago, the enthusiasm for management information systems is understandable for the constant novelties and innovations brought by the computers. Even today, the expectations are higher than ever, counting on the untapped potential of quasi unlimited computing power of 21st century computers and AI-based BI tools. Yet, Ackoff (1967) explored the main reasons given for the "inefficient" design and

configuration of decision support systems at this time. He then offered a meta view of business decision making and emphasised the flexibility that the IS should have to best meet the needs of managers. He for example mentioned that in most management problems there are far too many possibilities to expect that experience, judgment, or intuition can provide a good decision, even with access to perfect information. While this may lead to frustration of the computational power limit, it leads to foresee the expectations for a more mature technology-

Following the insights from Ackoff, Mintzberg and colleagues (1976) studied 25 strategic decision processes. They highlighted a structured process in what appeared to be unstructured, given the complexity encountered in situations at the strategic level of organisations. It emerged from this work that what is structured could be programmed, and therefore integrated into the IS. It could also be noted that some decisions are possibly nonrational, without being irrational, i.e., not at all oriented towards a goal, as then explained by Simon (1993). Interestingly, today, authors suggest that AI would allow bringing responses to what was believed to be unstructured and non-programmable work, through algorithms, Big Data and Analytics techniques.

Simon (1956; 1979, 1993) then put greater emphasis on cognitive styles and defined two distinct profiles: Maximizers and Satisficers. The Maximizers try to arrive at an optimal rational decision, while the Satisficers recognise the limits of their rationality and settle for a satisfactory solution.

After those prior insights, Pomerol (1997) supported the idea that AI is especially useful in the diagnostic phase, but ultimately poorly performing in predictions. He found it difficult to deal with uncertainty and decision-making, and the decisions made, if at all, have already been programmed by the designer of the system (Pomerol, 1997, p. 3). He nevertheless predicted the development of these BI tools, suggesting: “*There is no doubt that diagnosis plus look-ahead machines have a brilliant future, if not to mimic human reasoning, at least to support human decision.*” (1997, p. 22). Later on, Cabantous et al. (2010) described the emergence of the field of decision analysis and explored the construction of rationality in business. The authors identify professional practices supporting the performativity of rational choice theories in organisations. Rationality becomes something that organisations can put in place if they give themselves the means to do so. Chugh and Grandhi (2013) however insist on the need to adapt a governance procedure that would serve as a benchmark in organisations. The more decision support tools become essential, the more they become a management concern. Accordingly, it can be noticed the eagerness to develop and rely on the tools’ rationality, and the aspiration of a perfect rational choice.

Heuristics, Intuitions, and the Decision Process

On his side, Gerd Gigerenzer, a German psychologist specialising in bounded rationality and heuristics, argues that the cognitive shortcuts to solve problems can lead to better decisions than optimal theoretical rational decisions, because the ideal situations to apply these are rarely met (Gigerenzer & Gaissmaier, 2015). Artinger and colleagues (2015) further analysed the definition of heuristics in management science and the two different views: the heuristics and biases view, led by Tversky and Kahneman (1974), and the fast and frugal heuristics, with regard to their ecological rationality, led first by Simon (1955; 1956) and more recently by

Gigerenzer et al. (1999), Todd and Gigerenzer (2000, 2007) and Gaissmaier and Gigerenzer (2011, 2015).

Regarding the “Heuristics and biases view”, in the 1970s, Kahneman and Tversky developed the behavioural decision theory, analysing and exploring the heuristics and biases, accruing from intuitive errors (Tversky & Kahneman, 1974). Tversky and Kahneman globally approach heuristics and intuition as the second best option, as opposed to optimal solution which can be determined by rational choice (Artinger et al., 2015, p. S34), and their experimental results were typically interpreted as indicating human computational deficiencies (Akinci & Sadler-Smith, 2012, p. 108). As stated by Tversky and Kahneman “*people rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations. In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors.*” (1974, p. 1125).

The 2000s onwards saw the renewal of heuristics and biases, introducing the role of affect in intuitive judgment (Slovic et al., cited in Gilovich et al., 2002). Researchers built as well on the shoulders of their predecessors in the field of empirical studies, examining the relationship between intuition, behaviour, and performance (Khatri & Ng, 2000; Sadler-Smith, 2004).

Regarding the “fast and frugal heuristics” view, for Gigerenzer and his colleagues, among the leaders on recent heuristics research, “*heuristics are efficient cognitive processes, conscious or unconscious, that ignore part of the information.*” (Gigerenzer & Gaissmaier, 2011, p. 451), or “*a heuristic is a specific instantiation of a strategy that ignores part of the information available in the problem space. It is fast and frugal as it relies on ‘a minimum of time, knowledge, and computation to make adaptive choices’*” (Gigerenzer et al., cited in Artinger et al., 2015). Gigerenzer and his colleagues highlighted the fast and frugal view which gained value these past three decades with scholar works and researches assessing the efficiency of heuristics in decision-making processes, in particular if they are domain-specific, that is to say adapted to the environment of the issue managers are trying to solve. They reviewed five classes of heuristics and showed how they are applied and can lead to better and faster decisions, especially in uncertain environments.

The works from Gigerenzer and Gaissmaier (2011) implied that heuristics can lead to better outcomes than rational decision theory and classify which heuristics to use in which situation. They developed the concept of ecological rationality, that is a heuristic adapted to the structure of its environment. They claimed that the ecological rationality of the domain-specific heuristics enables quick and efficient decisions. Intuition is also quite often associated with nonrational decisions. Simon stated that the term nonrational is applied to decision making that is intuitive and judgmental (1987, p. 57). He explains that intuition is not a “magical” process but instead, a multi-step process, sometimes unconscious, that is more like recognising patterns and helping the seasoned manager to make an hopefully appropriate decision (Herbert A. Simon, 1987).

Dane and Pratt defined intuitions “*as affectively charged judgments that arise through rapid, nonconscious, and holistic associations.*” (2007, p. 33), and for Issack, intuition “*is that psychological function which transmits perceptions in an unconscious way*” (Carl Jung, cited in Issack, 1978, p. 919). Hensman and Sadler-Smith (2011) later stated that the reliance of intuition depends also on organisational contextual factors. As so, intuitive judgments will be more or less effective, that is producing more or less relevant and fruitful decisions, depending

on the nature of the task (structured on non-structured), the domain expertise of the decision maker and the “kindness” of her/his environment (Dane & Pratt, 2007).

Following those insights, many publications have insisted on Human-Machine complementarity (Davenport & Ronanki, 2018; Duan et al., 2019; Gilboa et al., 2018; Jarrahi, 2018; Watson, 2017). Decision theories related with rational strategic choices are ultimately scarcely leveraged in organisations, according to Itzhak Gilboa, Maria Rouziou and Olivier Sibony. This except for the research departments of financial institutions and heavy capital industries. It is often considered that the data is quite often too fluctuating, too insufficient, and too random to make valid predictions. The decision-maker therefore feels ultimately uncomfortable using inherently subjective probabilities that s/he ultimately considers unreliable to provide a so-called rational analysis (Gilboa et al., 2018, p. 242). The authors propose to reconcile intuition with the rationality of decision theory to challenge the manager’s intuition, avoid cognitive traps, and arrive at the best possible decision; they suggest a process they call a dialogue between the decision theorist and the decision maker, “*in which decision theory does not replace intuition, but supports and refines it*”.

2.2 The Integration of AI IT into Work Practices

Notwithstanding all those contributions, a conceptual framework is however necessary for building a more systematic and integrated understanding of AI in decision-making (Duan et al., 2019) and the way managers integrate those tools in their practice.

How people use IT and integrate it into their work practices has been the interest of numerous prior research. This is for example the case of DeSanctis and Poole’s structuration approach for whom “*Appropriations are not automatically determined by technology designs. Rather, people actively select how technology structures are used, and adoption practices vary*” (DeSanctis & Poole, 1994, p. 129). In fact, as recalled by Schmitz and colleagues “*Technologies are not simply physically constructed by their designer and implementers but are also socially constructed by the interpretive action of users who give meaning to the technology every time they appropriate it*” (Schmitz et al., 2016, p. 665). The work of Anthony Giddens has been instrumental in information systems research, allowing to develop the structuration theory and leveraging the concept of appropriation, in the adaptive structuration theory (AST) by DeSanctis and Poole in 1994. On the methodological approach, it is interesting to note that Jones and Karsten (2008) stated that AST is heavily oriented toward deterministic and functional research (2008, p. 146), the latter being commonly associated with quantitative methods. Poole (2009) and said that structuration theory and AST are organised around a set of concepts that can be studied via qualitative and interpretive methods. “*AST in particular, and structuration theory in general, can be illuminated by multiple methods*” (Poole, 2009, p. 584). Poole added that functional and constitutive analysis are complementary, in the way that constitutive analysis deals with how the systems, variables, and relationships are socially constructed, and explores the structuring processes that create and sustain the patterns identified in functional analysis.

Starting from the works of DeSanctis and Poole and following a multi-method approach, our research will explore extent models and develop a model of integration of AI tools in work practices, also allowing to further understand the role intuitions play in that process.

3. Research design

To answer the research questions, a multi-method approach is considered (Venkatesh et al., 2013) in two steps. First, a qualitative study with managers using AI-based decision-making tools will be performed. It will be about understanding how these managers use those technologies, exercise their intuition, and integrate them into their work practices. This approach will also allow us to identify the most relevant conceptual frameworks for responding our research questions. Individual interviews will be conducted with at least 30 managers. The coding and the analyses will be carried out according to the standards of research in management and organisation (Miles & Huberman, 2003; Yin, 2011). This first step will contribute to a better understanding of managers' representations and expectations regarding the appropriation and use of the latest generation decision-making tools and, at the managerial level, to determine the best ways to support them in initiatives relating to the digital transition.

Second, we plan to conceptualise a model to examine the contribution of AI-based decision tools believes and features (Straub & Burton-Jones, 2007) to the quality of decision-making. This will include studying how and to what extent AI and managerial intuition are combined and contribute to decision-making quality. The information will be collected via a survey questionnaire (Pinsonneault & Kraemer, 1993), which may be adapted according to the results of the qualitative study. This quantitative study is expected to be carried out with managers belonging to professional associations of managers or users of AI-based decision-making tools. Analyses will be performed using structural equation modelling software (e.g., SmartPLS). In addition to its contributions to a better conceptualisation of the use of latest-generation decision-making tools based on AI and their success, this work will allow us to observe the uses of decision-making tools, to identify the factors on which organisations can act to foster and support them and understand the role of intuition in decision-making.

4. Expected contributions

This research work will significantly contribute to an emerging field of information systems, which questions the articulation between technology and humans, the integration of technology into the work practices of managers, the contribution of technologies for decision-making performance (Grace et al., 2018; Jarrahi, 2018). First, while prior research did attempt to examine how technologies supports unstructured decision making, it rarely did so with technologies that are either expected to *make* complex decisions and learn, and it treats the role of manager's intuition – believed to be the unique assets of managers that could not be replaced by technologies – as black boxes that are unproblematised and undertheorised.

Second, this work will also contribute to renewing the theoretical frameworks capable of bringing novel perspectives to the renewal of knowledge about managers' decision-making in information systems.

Third, this work will present significant practical contributions. Indeed, it is fully in line with supporting the digital transition of organisations, with the aim of improving their decision-making processes, and therefore the rise in business competitiveness.

5. Conclusion

This research work proposes to arrive at a better understanding of the contribution of the new-generation BI tools to the creation of value by 1) a better understanding of the way in which decision-making tools based on AI are used and integrated in the work practices of managers, 2) the evaluation of the contribution of these tools to the decision-making performance of the manager, from the point of view of the manager and the organisation and, 3) the development of knowledge, which we expect will allow better integrating the human thinking (intuition, improvisation, mindfulness) to the technology of decision-making tools, making it possible to highlight new opportunities linked to ICT for organisations.

While not focusing specifically on it, our work will take into consideration the risks and ethical concerns associated with this class of technologies, which are emphasised by some authors, for example with errors that can be introduced into the decision-making process (Barocas & Selbst, 2016; Martin, 2019). Barocas and Selbst (2016) for example describe five ways an AI decision could result in discrimination. Problems arise mainly from unintentional errors in parameters (variable definitions and labelling, etc.), but also AI can be deliberately used for discriminatory purposes. Martin (2019) alerts on how algorithmic decisions produce biases answers and who should be responsible for managing the mistakes. Finally, in their 2019 article, Duan, Edwards and Dwivedi identify the challenges associated with AI-revitalised decision support tools and offer 12 paths for researchers to think about. The examination of how managers integrate AI tools in their work and practice will also be sensitive to those potential ethical issues.

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