

Improving the use of analytics and big data by changing the decision-making culture

A design approach

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Abstract

Purpose – Evolving digital technologies continue to enable new ways to collect and analyze data and this has led some researchers to claim that skillful use of data analytics and big data can radically improve a company's performance, but that in order to achieve such improvements managers need to change their decision-making culture and to increase the degree of collaboration in the decision-making process. The purpose of this paper is to create an increased understanding of how a decision-making culture can be changed by using a design approach.

Design/methodology/approach – The paper presents an action research project in which the authors use a design approach.

Findings – By adopting a design approach organizations can change their decision-making culture, increase the degree of collaboration and also reduce the influence of power and politics on their decision-making.

Research limitations/implications – This paper proposes a new approach to changing a decision-making culture.

Practical implications – Using data analytics and big data, a design approach can support organizations change their decision-making culture resulting in better and more effective decisions.

Originality/value – This paper bridges design and decision-making theory in a novel approach to an old problem.

Keywords Big data, Decision-making, Business analytics, Business intelligence, Decision-making culture, Design approach

Paper type Case study

1. Introduction and background

Business Intelligence (BI), data analytics and big data are three closely related developments that have emerged as a result of advances in information and communications technology (ICT) (Chen *et al.*, 2012). It has been claimed that, collectively, data analytics and big data are creating a revolution in both organizational management and decision-making. McAfee and Brynjolfsson (2012) claim that skillful use of data analytics and big data can radically improve a company's performance. In a related observation Davenport and Patil (2012, p. 73) state that it is also important to: "[...] understand how to fish out answers to important business questions from today's tsunami of unstructured information."

A growing number of tools for "fishing out" or extracting information from these data now exist. Broadly these fall into two categories: those designed to help users find information that they "know" is there ("the known unknowns" to use Donald Rumsfeld's famous phrase) and those designed to unearth information that users do not know is there, the so-called unknown

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unknowns. Searching for a priori unknown information is a recent development. The 1990s saw the emergence of concepts such as knowledge discovery in databases and data mining (Piatetski and Frawley, 1991). Initial concepts such as On-Line Analytical Process and data mining evolved into the concept of big data analytics which harnessed ever more sophisticated statistical, machine learning and visualization techniques (Chen *et al.*, 2012). Such tools are discovery driven and can support much more fluid searches for information. They can be guided, semi-guided, unguided and/or self-learning. Unlike older tools, they can, in theory at least, mine any form of data from numbers to websites to video.

However, in order to learn how to “fish out answers” and improve performance companies may also need to change their decision-making culture. In particular, say McAfee and Brynjolfsson, organizations may need to increase the degree of collaboration between different actors in decision-making processes. McAfee and Brynjolfsson go on to suggest that the time has come for BI research to examine more closely BI’s social and organizational context. To this might be added the criticism of Shollo and Kautz (2010) that BI research focuses too much on the technology and not enough on how it is used or on the decision-makers who use it.

It is worth noting that, to some extent, this type of individual decision-making is a “western” problem. In far eastern organizations, for example in Japan, China or Korea, decision-making tends to be collective and consensual. In western organizations the individual manager is often seen as the locus of decision-making (Lok and Crawford, 2004; Weber and Hsee, 2000; Martinsons and Davison, 2007). In the cases discussed in this research, a further complication was a culture that favored rapid decision-making. This phenomenon reflected the role and function of the organizations, i.e. the provision of fire and rescue services. Collaborative decision-making is relatively slow. In his book, *Organizational Culture and Leadership*, Schein (2010) observes that cultures that serve organizations well at certain stages in their development or in dealing with certain classes of problem can themselves become an obstacle when circumstances change. They can also be an obstacle when a problem is different from those the organization has faced in the past. Organizations often fall back on what has worked before (or worked elsewhere in the organization), failing to recognize that the new situation needs a different approach (Harvey-Jones and Tibballs, 1999). Schein (1996) also argues that organizational culture plays a critical role when organizations attempt to improve their operations in response to new data.

For a number of reasons, changing a decision-making culture from the individual to the collaborative is not an easy task to accomplish. One reason is that perceptions of reality will differ between groups and individuals (Schein, 2010). Another is that such changes often result in changes in the power structure and in individual roles, both of which may be resisted (Krovi, 1993; Lapointe and Rivard, 2005). Furthermore, what constitutes truth and information depends on a shared knowledge of formal language, context and consensus. Schein notes that: “For a group to be able to make realistic decisions, there must be a degree of consensus on which information items are relevant to the task at hand” (p. 122). The presence of several different subcultures within a given organization (Trice, 1993) implies that communication and dialogue are of critical importance in order to arrive at a shared understanding of different views and ultimately at an agreement on how best to proceed.

The use of design thinking to address this problem is a promising recent development. In recent years number of scholars including Boland and Collopy (2004), Boland *et al.* (2008), Wastell (2010) and Mintzberg (2009) have turned their attention to design as a way to improve decision-making (see Section 2.2). Boland and Collopy (2004) claim that taking a design attitude means starting from a meta level and asking the question “What do we want to do?” Rather than using a default method/model, a formal strategic decision-making process (SDMP) is designed at a meta level and tailored to the specific decision and its context. This is done by considering both the know-how of relevant literature and

stakeholders with different roles and at different levels. This encourages a culture of collaboration that: “[...] helps put better ideas and alternatives on the table for analytic consideration and quantitative assessment” (Boland and Collopy, 2004, p. 16).

The purpose of this paper is to demonstrate, using a multiple case study, how adopting a design attitude can enable managers to change the established decision-making culture in their organizations toward a more collaborative endeavor. The research questions are as follows:

RQ1. How can a design approach be used to change a decision-making culture?

RQ2. Does such an approach improve the quality of decision-making and thus organizational effectiveness?

This study demonstrates one way in which such increased collaboration can be accomplished.

2. Theoretical background

2.1 Culture and its impact on decision-making

SDMPs are shaped within organization by the interplay between decision-specific characteristics, management, organizational and environmental factors (Papadakis *et al.*, 1998). In order to comprehend why groups and organizations behave in the way that they do, including how they make decisions, it is necessary to understand their culture (Schein, 2010).

According to Schein culture is: “[...] the set of shared taken-for granted implicit assumptions that a group holds and that determines how it perceives, thinks about, and reacts to its various environments” (Schein, 1996, p. 236). Schein suggests that management is affected by three different cultures, those of the operators, the engineers and the executives. The operators are the line managers, who while they may be affected by the executives’ culture (see below), tend to be focused on getting the job in hand done. The engineering culture is generally associated with hard system thinking; it seeks solutions that often ignore human and social realities as irrelevant and expensive. As a result its decision-making typically focuses on “hard” and narrow criteria. The executive culture is mostly driven by a financial focus and it too often discounts or downplays the human factor.

In particular, the CEO and the top management team surrounding the CEO have significant impact on the SDMP. Elbanna (2006), reviewing the SDMP literature, found two widely reported negative factors in decision-making. First, those who manage the SDMP are in a strong position to over-influence the outcome of the process. Second detrimental effects from political maneuvering are often found in such processes. A well-designed SDMP should seek to minimize the impact of both of these factors. As a way of tackling this problem, Schein argues that there is a need to reflect upon both how executives learn and on how to get them to understand the importance of collaboration and of integrating subcultures.

Detert *et al.* (2000), in an extensive overview of the literature, identify what they call eight general dimensions of organizational culture of which two are of particular relevance in this research, namely, the nature of time and the time horizon and most importantly isolation vs collaboration/participation. The nature of time and the time horizon reflects, *inter alia*, whether members of an organizational take a long-term view or focus mainly on the here and now. Isolation vs collaboration/cooperation reflects organizational beliefs about whether tasks are more efficiently and effectively accomplished by individual efforts or collaboratively. Subcultures too can be a source of problems for decision-making, particularly between Information and Communications Technology/Information Technology (ICT/IT – both terms will be used interchangeably in this paper) and general business management (Grindley, 1992; Ward and Peppard, 1996; Taylor-Cummings, 1998). In this research, however, differences in approach not only existed between ICT and general

management, but also between front line, tactical (middle) and senior management. On the other hand, the time horizon, the culture of fast response and rapid decision-making, permeated all three organizations at all levels. To make decision-making more effective, both of these problems needed to be addressed.

Finally, it is worth noting that the trigger for this project was the recognition that there was a gap between their current norms and behaviors and desired norms and behaviors – what Kilmann and Saxton (1991) describe as a culture gap – and that this was leading to bad decisions. Kilman and Saxton identify four types of culture gaps: social relationships; personal freedom; task support and task innovation. In this research culture gaps can be identified at least three of these (see Section 5). Kilman and Saxton emphasize the importance of closing culture gaps in order to improve organizational performance.

2.2 Traditional decision-making

One of the early and major contributors to the field of decision-making in organizations was Hebert Simon. Simon argued that the decision-making process involves three phases: intelligence, design and choice. Intelligence is meant in the sense of gathering decision-relevant data and information. The second stage, Design, is about analyzing the alternatives to determine likely outcomes and looking at how those outcomes will meet the goals. The third phase is about making a Choice between possible alternatives (Shim *et al.*, 2002). According to Simon neglecting either of the first two phases makes good choices more difficult to make. The third phase has received most attention in both academia and practice particularly in recent years with the work of Kahneman and Tversky (Tversky and Kahneman, 1986; Tversky *et al.*, 1990; Kahneman, 2011). Simon (1969, 1982) criticized managers for thinking of decision-making processes as being purely logical and coined the term “bounded rationality” to describe the limits of human reason in complex situations. Notwithstanding the growing influence of behavioral economics (Mullainathan and Thaler, 2000) and the psychology of decision-making in the past two decades, the tradition of the rational decision-maker remains influential in decision theory and especially in practice. Books on decision-making, especially books aimed at the business reader, often assume a rational decision maker with good information, a clear decision to make and clear criteria with which to make it.

While such idealized decision-making situations do occur in real life, they are more the exception than the rule. In practice, there are many problems with the rational model (Tversky and Kahneman, 1986; Tversky *et al.*, 1990). Apart from issues with bias (cognitive and otherwise), problems with information include that the information required for the decision is unclear, is not fully available and/or is incomplete, inaccurate, unreliable, unstructured or even overwhelming. The last of these is of particular relevance to this discussion. Humans have limited cognitive capacity (Hahn and Aragón-Correa, 2015) and a long-recognized problem in decision-making is information overload (Edmunds and Morris, 2000). Boland and Collopy (2004, pp. 8-9) summarize Simon’s views on this thus:

[...] humans have a limited cognitive capacity for reasoning when searching for a solution within a problem space. Given the relatively small size of our brains’ working memory, we can only consider a few aspects of any situation and can only analyse them in a few ways. [...] The problem space that a manager deals with in her mind or in her computer is dependent on the way she represents the situation she faces.

Simon’s comment about the constraints on computers is decreasingly true, but human evolution moves at a more leisurely pace. Today’s managers suffer from the same cognitive limitations as their predecessors. Any design approach to improve decision-making must start from this fact.

2.3 Design as a component of decision-making

Addressing this problem, Boland and Collopy differentiate between what they describe as a decision attitude and a design attitude. A traditional decision attitude to making decisions is where the approach is based on the presumption of rational choice(s) involving different (and usually familiar) techniques, methods and algorithms and assuming that the best alternatives are already to hand. They describe this as a passive way of making decisions as it assumes that a good process design is already in place. They argue that if managers on a meta level adopted a design attitude by asking the question "Why are we doing this?" and incorporating collaboration between different stakeholders that consider human satisfaction and commitment, the world of business would change for the better.

Mintzberg (2009) also argues that decision-making is not only a process of thinking going on inside the head of the decider, but a collaborative process involving design as a way to define the issue(s), develop courses of action and decide upon outcomes. Wastell (2010) stresses the importance of incorporating design into the mind-set of managers. He argues that a shift is needed from monitoring and control toward design of the workplace and of the system of work. Boland *et al.* (2008) emphasize that design is both a powerful tool for innovation and a cognitive mode that should be nurtured in management practice and education.

Design thinking is also receiving increasing attention in other areas, for example as a way to drive corporate strategy, to help simplify and humanize complex systems, to help deliver sustainability and to act as a strategic enabler that can both improve business as well as humanize organizations (Ignatius, 2015). Kolko (2015, p. 66) summarizes it thus "Design thinking comes of age, the approach, once used primarily in product design, is now infusing corporate culture."

To date these remain minority voices. Despite the fact that design has been discussed as important to management, the focus in much of the literature, and certainly in the business press, remains on making the choice. This is unfortunate because Simon's second component – design – is worthy of more attention than it has received so far. Boland and Collopy (2004, p. 6) note that a design attitude to decision-making involves "finding the best answer possible, given the skills, time and resources of the team, and takes for granted that it will require the invention of new alternatives." In a subsequent contribution, Boland *et al.* (2008, p. 3) observe that "The design attitude seeks a functionality that is never fully realized, and is always possible to expand by including new realms of human experience. Functionality begins with a desire to achieve efficiency and effectiveness in a traditional sense, and expands to include an enlarging circle of concern for emotions, customer experiences, ethical behavior, environment, cultural norms, and aesthetic appeal."

A design attitude implies involving all of the different stakeholders that are affected by the decisions. It therefore means developing a formal decision process at meta level and balancing analytic tools with domain expertise. Drawing on Boland and Collopy (2004) and Simon (1982) the following five phases related to the decision process are proposed as the core components of a design attitude.

Representing. The purpose of this stage is to obtain a better understanding of how decisions are currently made, to identify existing issues or possibilities and how those issues and possibilities can best be framed.

Designing. This has three sub stages:

- (1) Knowing: existing knowledge that might be used to support the development of a formal SDMP is investigated. This includes knowledge that may help deepen the understanding of the issues and possibilities identified in the first phase.

- (2) Sensing: in this stage the decision criteria and how the decision-making process(s) will be carried out are determined. Responsibilities at each stage of the process are defined. This process should, in the words of Boland and Collopy, be “liquid and open.”
- (3) Applying: the preliminary solution from the design phase is then applied and/or implemented.

Evaluating. In this phase a post evaluation review is undertaken in which stakeholders are invited to reflect upon the outcome of the use and design of the new SDMP. The objective is to support organizational learning that will lead to improvements in subsequent decision-making.

A design attitude can thus be seen as a way of combining analytical tools with sense-making. Weick (1995) describes sense-making as creating an understanding of what we have done. Sense-making and analytical decision-making come from different philosophical traditions; design, Weick argues, enables us to bring both traditions together. Thus, a design attitude opens up the possibility of combining the views on what we have done in the past with planning for how to change the way we do things and improve performance in the future. The design attitude process is summarized in Figure 1.

3. Research approach

This research was carried out using collaborative practice research (CPR) (Mathiassen, 2002) in three public organizations in Sweden. CPR is a type of action research (AR), a form of research that is used when the objective of the research is to create improvements in organizations. AR seeks to accomplish change by developing new artefacts and by linking theory and practice (Susman, 1983). A key feature of AR is the use of collaboration between researcher and practitioner to improve practice (Lindgren *et al.*, 2004). One variant of AR is CPR, an approach developed by Mathiassen that is comprised of a problem-solving cycle and a research cycle. The problem-solving cycle aims to give practitioners an increased understanding of the problem they are trying to solve and how to solve it. The research cycle aims to contribute to the body of scientific knowledge. This project set out to achieve both of these aims, i.e. to develop a theoretically grounded form of best practice for IT investment decision-making.

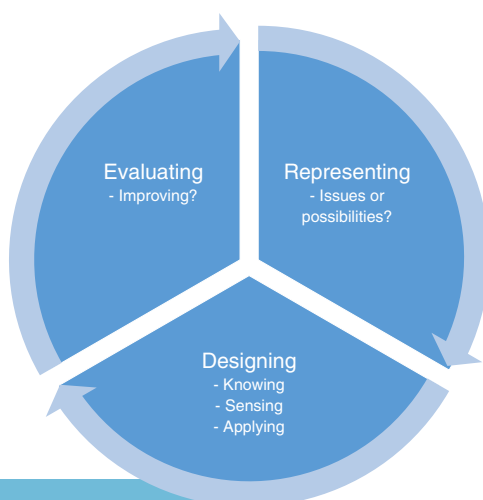


Figure 1.
A design attitude

3.1 The project setting

The multiple case study was undertaken in three public fire and rescue service organizations in Sweden situated in different geographic areas and differing in size. These organizations will be labeled A, B and C. Briefly:

- Organization A has 1,000 employees: in this study two operational managers, two strategic managers, five managers from tactical level, two operational managers and 22 employees from the operational level participated.
- Organization B has 650 employees: in this study two strategic managers, two managers from tactical level, and three operational managers participated.
- Organization C has 100 employees: in this study, one strategic manager, two managers from tactical level and two operational managers participated.

All of the managers in the three organizations were dissatisfied with their organization's history of ICT acquisition. Many ICT systems had not delivered expected value. They knew that their evaluation processes were not working well; they used a cost and technical focus that all three organizations realized was an inadequate basis for decision-making. If value was discussed at all, it was mainly from the perspective of individuals rather than the organizational. The only costs considered were the cost of hardware and software; numerous other direct and indirect costs were ignored. Decision-making about ICT investments took place at department level or at strategic level depending on the size of the investment.

3.2 The research process

In order to improve the decision-making culture of ICT investments at strategic level the CPR process followed the five step model described above. The same steps were undertaken in all three organizations. The following is a summary of how this was done.

Representing (2005). This research process started with an investigation of why the respondents perceive that decision-making culture at strategic level of ICT investments was problematic and how they believed that it could be improved. Data gathering used in this phase included 23 interviews in Gothenburg, Stockholm and Lund as well as two observational studies in Gothenburg (during which field notes were taken), three project meetings, two workshops and a review of a number of internal strategy documents.

Designing.

- *Knowing (2005-2006):* the objective of this stage was to identify existing knowledge related to issues identified in the Representing stage. To do this an extensive review of the ICT evaluation literature was conducted and potential evaluation tools were cataloged.
- *Sensing (2006-2007):* in this stage three workshops were held in each organization (i.e. a total of nine workshops). In these workshops participants discussed what needed to be decided upon, who should be responsible for each decision and how the decision should be made (i.e. what should the decision process be). In the final workshop, a presentation of the findings was given to each organization and the participating managers agreed and signed up to the new process.
- *Applying (2007):* the decision process design that emerged from the preceding two stages was then empirically tested in organization A. In organization B the outcome was put on hold because the organization was going through a number of structural changes at the time. In organization C the solution was implemented without testing.

Evaluating (2009, 2012). The purpose of this phase was to assess the effectiveness of the new decision-making process. The new process represented a significant culture change;

a new culture of decision-making, one based on a design attitude, had been introduced into the two of the three organizations. Evaluation of how well this process had worked was undertaken at two points: shortly after completion (in 2009) and three years later (in 2012). In 2009 interviews were conducted in organizations A and C (as noted, the project had had to be suspended in organization B). Due to structural subsequent changes in organization C, follow-up interviews in 2012 were held in organization A only.

A brief note on data collection and analysis. During the study, data were gathered from a variety of sources using a variety of methods: interviews, participant observation, published data, workshops, project meetings, work meetings and documents. The interviews were semi-structured, lasted for one to two hours and were recorded, transcribed and analyzed using open coding (Strauss, 1987). The responses were clustered into similar themes and then reflected upon (Berg, 2009). The responses from the respondents in the three organizations were surprisingly similar. The findings from the interviews were then reported back to the managers involved in order to resolve any discrepancies, but no discrepancies were found. Later follow-up meetings were held in which the findings of the interviews were further discussed.

4. Findings

Many findings emerged from this study. The following is a summary of the most salient.

4.1 Representing

At the outset of the project managers' perception of the existing SDMP was that it was based more on the requirements of individual rather than on organizational value. Decisions were taken in silos, had a strong technology focus, little or no involvement of users and no follow-up. According to one CIO:

Unfortunately, we often miss the total picture because we tend to focus way too much on individual desires. For example, when it comes to digital calendars [...] we've failed to agree on a single brand for the entire organization. This has led to a costly ad-hoc approach to IT investments.

Another structural problem faced by organization A was the way in which decisions were driven. As one of the project managers put it:

One of the greatest shortcomings is that we have not realized that IT is a strategic resource and there should be a forum where such issues are discussed. Today, initiatives come from different parts of the organization and there is no clear structure for how to purchase IT and [so] it is done in an isolated way in each department.

The same project manager noted that:

When deciding upon IT investments there is too much focus on the technology, technical platform and the system. The focus should instead be on the business and how we need to develop our business, what we want to achieve and how to go about it. Based on this, it can be clarified how ICT can assist in achieving this.

A positive aspect of this stage was the openness of managers to new ideas. They recognized and acknowledged that old ways were not working. In some cases software and even hardware had been purchased, but had never even been used (including one quite expensive hardware acquisition). Other recently acquired systems were underused. The project manager summed it up:

We rarely follow up ICT investments. For instance, we bought access to a GIS [Geographical Information System], but we have not yet used any of it. Likewise, a Task Manager has been developed, but where is the idea of how to use it? We have many technical solutions and good ideas, but what do we do with them?

At the operational level, many users were critical of ICT and how ICT has been introduced into the organization. One group leader expressed this frustration graphically:

I need to input the same amount of information to the system whether the accident concerned is putting out a trash can fire in school toilet or a major chemical spillage. It makes you feel demotivated when you have to fill in all the information for minor incidents. What's more, I have no idea what they do with all the information they receive.

As if to illustrate these problems, it was noticed during the field study in one fire station that a large screen on the wall was permanently black. When asked why this was so, the staff replies that this is because the new technology used by the screen was incompatible with the current system.

4.2 Designing

Knowing. The Knowing phase involved a search for explicit data in prior research that can guide how to improve decision-making in this specific decision-making environment. This stage does not involve the users much as it is largely done by the researcher(s), but can also be conducted by anybody who knows what existing knowledge to look for. The approach used in this case was an extensive review of the ICT evaluation literature. This resulted in a lengthy list of different factors and evaluation techniques suggested by prior research that should be considered when evaluating ICT investments in order to achieve organizational value. This list was summarized by the researchers for presentation in phase 3.

Sensing. Three workshops were held in each organization. The first workshops were opened by presenting the findings from the Representing phase. Next, the list of evaluation factors was presented and a discussion held on how to change the existing decision-making culture and involve more employees in the process. To do this, participants were invited to reflect upon what data were required, i.e. what factors needed to be considered, how the process should be performed and who should be responsible for decision-making. In the second set of workshops participants discussed the results from the first workshop and whether any changes to the process determined in the earlier workshops should be made. In the third set of workshops participants undertook a final review of and signed off on the new process.

The new list of factors that should be taken into account at a strategic level when deciding upon a new investment was labeled the value case rather than the business case in order to differentiate it from the previous decision-making approach. The main differences between the two approaches are that the value case takes an organizational rather than an individual perspective and a stakeholder rather than a technical perspective. The fact that the value case template mandates an organizational perspective limits the ability of individual units or functions to use their power to their particular advantage. On completion, participants commented that by considering how the investment affects the strategy, structure, processes, people, existing IT, stakeholders, etc. It was much easier to make realistic benefit and cost estimates/projections for large ICT project.

Applying. In organization A the value case approach was tested on two ICT investments. The IT department then started to use the value case both as an evaluation tool and as a supportive tool in conversations with business managers in a variety of other contexts. Organization B was hit by a financial cutback and the manager responsible for ICT investment decisions chose to leave the organization after a turbulent internal restructuring so the project was put on hold. In organization C the new SDMP was implemented without any testing as the CEO and CIO declared themselves satisfied with the results.

4.3 Evaluating

In this phase, the outcome of applying a design approach to change the decision-making culture was formally assessed using in-depth interviews. The evaluation showed that the

interventions had been successful in transforming the SDMP for the better. Managers reported that they now better understood the shortcomings of relying solely on one-dimensional “hard” data such as financial projections about (say) the costs of hardware and software or on technical features of the equipment. In particular, the value of unstructured data/information including those related to intangibles was much better understood as was its use as an effective means of establishing a more evidence based form of decision-making.

The managers interviewed were uniformly positive about the new information outputs (facts) created by the new SDMP. They reported that it enabled them to rethink what had heretofore been a solely financially and technically oriented agenda in more holistic and balanced ways. One business manager in organization A articulated the advantages of the design approach thus:

Serving as an enabling platform for evaluation activities, this design approach has leveraged the creation of a professional language that helped bridge conversations between managers occupying different roles at various levels. As a result, my understanding of the usefulness of stakeholder involvement and its potential contribution was based on a more complete and robust approach to value assessment of IT investments.

Another manager remarked:

It's evident that the approach fills the gap we've experienced. [...] It has also made people more aware of the reasons why decision-making went wrong in the past [...] and it seems like we nowadays reach agreements on cost calculations somewhat more effectively.

From the participants' perspective, the value case had worked well.

4.4 Follow-up study

While the initial feedback was positive, it was important to assess whether the new approach would persist over time. A follow-up study was therefore undertaken 2012.

The results of this were again encouraging; the new structures and processes had become embedded and reinforced rather than weakened and a number of investments decisions had been made using the new process. It also had other, unanticipated, positive outcomes including use by managers of the value case at strategic level when informing trade unions about how new investments were likely to affect their members' work environment. The IT manager at the functional level of the organization A said:

I believe that IT can make the utilization of the value case more effective because some of its parts are pretty time consuming to deal with. For example, there's an agreement between the employer and the unions that regulates the impact of IT investments on work conditions [...] if we're updating an existing system or replacing an old system with a new one, I need to inform union representatives as well as department managers about the project plan. Then they analyze it and discuss its potential impact with the employees. Sometimes a more careful risk analysis led by a HR manager with the adequate expertise must be performed to identify consequences. In any case, I've clearly underestimated the time needed and the amount of work required.

Furthermore, some of the factors identified and included in the value case were now incorporated into their project plan. Finally, the value case was used as a supportive tool in the dialogue with the auditors when the projects were audited. The organization also was very pleased with the stakeholder analysis included in the SDMP, the IT manager commenting:

Yes, we use the stakeholder perspective in our analysis, but we take into account not only those directly affected by the investment, but also those indirectly affected. For example, we will inform the police force about what we are doing even if the investment does not directly affect them.

5. Discussion and conclusion

This paper opened with the claim that effective exploitation of data analytics and big data could radically improve organizational performance, but that in order to achieve these organizations would need to change their decision-making culture and make it a more collaborative endeavor combining domain expertise and multiple perspectives. While these claims have come from the Information Systems literature, similar ideas have been put forward by Schein (1996) who suggests that different management cultures within an organization need to meet and discuss what information is needed for decision-making in a specific situation.

In the preliminary investigation and fact finding, the three types of culture discussed by Schein were visible in all three organizations, though in a form that reflected the mission of the organizations. The executive culture was visible in top and middle management, and was reflected in a concern with budgets and cost metrics. A change in the financial environment had contributed to this. Over the preceding few years the organizations had moved from a situation where funding had been generous to one where money was less plentiful. The operators' culture was short term and event driven. For them response time, response effectiveness and the information and systems needed to deal with emergencies dominated. They were impatient with processes and information demands that were deemed necessary by senior management, but which to them were a distraction (for more on this, see below). When it came to IT acquisition their approach was to seek "quick fixes" to whatever the immediate problem was. The engineering culture was, as expected, spread throughout the organization as many of the staff were engineers by profession. Interestingly, in one of the cases, the engineering culture was not a problem in the IT department, though it was a problem elsewhere in the organization. Unsurprisingly, this culture focused on the technology and its affordances and consequently often lost sight of the broader organizational needs. In extreme cases, it became the acquisition of technology for technology's sake. Breaking down these cultural and communications barriers was critical to the success of the project.

As noted in Section 2.1, Kilmann and Saxton (1991) define a culture gap as a difference between desired norms and actual norms or behavior in organizations. While no formal evaluation of the culture gap was undertaken in this research, the problems described by the organizations during the preliminary interviews and meetings suggested that there was a cultural gap in Task Support and that there were possibly gaps in Social Relationships and in Personal Freedom. In all of the organizations, the Task Support gap centered around IT and what it should be doing as opposed to how it operated in practice. Despite large investments, IT was both failing both to provide the type of information that users needed and to support the organizations' processes adequately. Evidence of potential Social Relationship and Personal Freedom gaps could be seen in the fact that managers often made acquisition decisions without considering organizational value. While this was true in all three organizations, in organization A the situation bordered on anarchy. Not only did individual managers frequently make ICT purchases without any consideration being given to organizational value, they did so without adequately involving the IT department. In organization C on the other hand the IT manager was the main initiator on IT investments and his focus was primarily technical. Critically, none of the three organizations had put in place a benefits management process, a core component of task support in IT.

As noted above, Kilmann and Saxton (1991) stress the importance of closing culture gaps in order to improve organizational performance. Although not designed with Kilman and Saxton's specific culture gaps in mind, in practice the design approach addresses problem of culture gaps and in the follow up meetings, all informants felt that there was now much better internal communication and understanding suggesting that this gap at least had been significantly reduced. Comments from users and IT managers also indicated a higher level of satisfaction with task support.

In order to improve the decision-making process several researchers have proposed adopting the concept of design thinking. The findings from this research suggest that adopting a design approach can enable organizations to change their decision-making culture and increase the degree of collaboration between different actors in a SDMP. Different areas of expertise were combined as managers, who came from different levels and had different roles and types of expertise, worked together and participated in the process of developing a design attitude. In this way, the contextual needs of the entire organization were taken into and multiple perspectives (Symons, 1994; Myers, 1997) were integrated into a value case. This contrasts with many traditional forms of organizational decision-making process. Instead of implementing a default decision-making model or process, a design approach was used that considered the context in which the desired changes will occur. In this study, the project resulted in several changes in the case organizations' decision-making culture including:

- moving from an individual perspective to a collaborative perspective;
- moving from a culture of fast decision-making (something essential at the front line, but not useful for ICT investments) to a considered and systematic form of decision-making;
- the development of a common language that facilitated the future collaboration and understanding between managers with different roles, in different functional areas and at different levels;
- change from a dominant technical perspective to a pluralistic value perspectives across levels in the organization and the transformation in modes of communication that accompanied this;
- a change from an individual value perspective to an organizational value perspective; and
- the achievement of organizational learning by considering business problems in order to improve the decision-making.

A good example of the change in decision-making culture is illustrated by a comment made by the IT manager at organization C who characterized IT investment decision-making as a socio-technical analysis:

Now I think differently and have new reference points. Previously, I used to restrict value from ICT investments to direct benefits and costs. The former concerned what an ICT application could potentially accomplish given its technical features, while the latter dealt primarily with hardware and software. My current understanding, in contrast, is more socially informed in that it centers around intended and unintended consequences for users and citizens alike, and much less on the technology *per se*.

5.1 Limitations and future research

The present study has several limitations. The research was carried out in a group of organizations that provide a highly specialized service and it was confined to investments in ICT. Nonetheless the project demonstrates that in this context a design approach was useful and effective. We surmise that such an approach is widely applicable. It would be useful to examine this approach in a variety of other contexts and we hope that this paper will provide an incentive to do so.

More research is needed to develop a better understanding how a design attitude can support deriving data from BI and data analytics in other types of organization in order to achieve better organizational value. One interesting possibility would be to explore the effectiveness of using a design approach to the use of visualization to support

decision-making. Future research might also examine whether this approach could be used to make other types of cultural change within organizations – in particular a change from individual to collaborative working. There is no reason why this type of design led cultural change should be restricted to IT.

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Further reading

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