

BI-based Organizations: A Sensemaking Perspective

Completed Research Paper

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Abstract

Business intelligence (BI) offers opportunities for managers to master vast data resources for operational and strategic gains, and allows BI-based organizations to generate significant business value. While several researchers emphasized the importance of BI to assist making quality decisions, no study explored the use of BI for improved understanding of business before such decisions are made and assessing the impact of the actions derived from these decisions. To fill this gap we use the theory of organizational sensemaking. The presented research uses hermeneutic phenomenology to study the experiences of decision-makers in using BI-generated insights to guide their actions while altering business processes, structures and information. The study emphasizes the necessity of using BI in the creation and maintenance of individual and organizational identity, as well as, enactment of this identity on the business and its environment, which need to be molded in response to changing circumstances.

Keywords: Business intelligence, sensemaking, decision making, phenomenology

Introduction

Today organizations are facing rapid changes – many initiated from their business environment. These changes can act as a two-edge sword. On the one hand they can add to the complexities within organizations, hindering decision-makers from taking the right decisions, while on the other hand organizations can learn to master these changes and turn them into competitive advantage. Many organizations understand the importance of engaging in the process of collecting environmental data, then analyzing and reporting them to assist management decisions that either initiate some changes or deal with their consequences. The process is commonly referred to as business intelligence (BI). BI is also considered to be the collection of methods, tools and systems that combine data gathering and knowledge management with analytics tools to present complex data for decision-makers and planners (Negash 2004).

In spite of the growing importance of BI for understanding an organization, in the majority of cases BI is used only for day-to-day decision-making (LaValle et al. 2011) and, currently, BI capabilities are not being used to their fullest by organizations (Chen et al. 2012). To better appreciate the extent of this problem, Namvar et al. (2014) used theories of sensemaking to explore how BI could be used to achieve competitive advantage. In this context, BI is capable of assisting organizational management not only in decision-making but also in making sense of business structures, events and processes. In fact, BI addresses the majority of requirements for making sense of business environments (mentioned in Weick et al. 2005) including the need for ongoing retrospection on past business circumstances, (Strenger 2008), extraction of meaningful cues from the business environment (e.g. in the form of reports, dashboards, scorecards and KPIs) (Amburgey and Yi 2011; Elbashir et al. 2008), as well as getting clarity on the plausible outcomes of actions (Olinsky and Schumacher 2010), all of which can assist organizations on moving toward being BI-based firms.

To make sense of business, individuals as well as organizations need to leverage their unique capacity to act on and influence the organization, also known as their identity (Weick 2012), so as to enact their vision of change in their immediate business environment. Namvar et al. (2014) added to this view by highlighting the importance of identity creation, at both individual and organizational levels, in order to use BI to enable data-driven organizational change. However, as many organizations are still in their infancy with regard to their analytical capabilities, many decision-makers are not able to rely on the collected and reported data to understand their organization (Shanks and Bekmamedova 2012). Furthermore, such organizations often lack the necessary processes to adequately prepare business data to support quality analysis and reporting (Hallikainen et al. 2012). Yeoh et al. (2010) also observed that without management goodwill and significant organizational effort, BI technology in its current form is not able to effectively create, maintain and leverage BI-based data and processes – both vital for the development of BI identity – for business benefit. To this end Eckerson (2004) defines a set of organizational characteristics that are known to support BI use in business, such as a well-defined BI scope (Glancy and Yadav 2011), mature analytic structure (Sammon and Finnegan 2000), positive executive perceptions (Yeoh and Koronios 2010), access to analytics (Abai 2006), strong stewardship (Hawking and Sellitto 2010), availability of funding (Sammon and Finnegan 2000), good technology infrastructure (Shanks and Bekmamedova 2012), as well as, the adoption of quality change management and administration practices (Marjanovic 2010a).

However, the notions of decision-making and understanding organizations are not central to the exploration of these organizational characteristics'. The objective of this paper is therefore to investigate the requirements of BI-based organizations (Wixom, Ariyachandra, Douglas, Goul, Gupta, Iyer, Kulkarni, J. Mooney, et al. 2014) and indeed the need for organizations to migrate toward a BI-based model of operation (Wixom and Watson 2010), in which BI is used not only for operational decisions but also for making sense of the business environment (with support for BI identity creation and enactment). In this study, therefore, we adopted one of the well-known theories of understanding the organization and decision-making – the sensemaking theory (Weick 1995). By applying hermeneutic phenomenology (Van Manen 1998; Moustakas 1994) to the “war stories” collected from various BI stakeholders, we were able to reflect on their experiences in designing, deploying and using BI technology in business settings.

In the next section we will review the literature on BI-based organizations. Then sensemaking as the theoretical framework for this study will be presented. Hermeneutic phenomenology will be discussed as the research methodology of this study. The results of the hermeneutic study, involving a broad range of business participants, are further elaborated, with the focus on requirements for the creation of BI-based organizations from a sensemaking perspective. The paper discussion reveals the emerging insights into BI identity creation and its enactment, followed by a summary of findings and an outline of further research.

BI-based organizations

BI is often referred to as the techniques, technologies, systems, practices, methodologies and applications that analyze business data to assist organizations to better understand business, markets and making business decisions (Chen et al. 2012). Due to changes in the competitive landscape, for many firms BI has evolved from being a contributor to organizational success to being a prerequisite for competing in the marketplace (Davenport 2006; Wixom and Watson 2010). In such firms BI also has changed from being a tool in the hands of a few specialists to one that is widely used across the organization. It has changed from just focusing on the analysis of historical data, to real-time data analysis (Glancy and Yadav 2011). Such firms are BI-based organizations because of the critical role that BI plays in their operations and overall business success (Watson 2009). According to Abai (2006), in a BI-based organization – or as Abai calls it, a data-centric organization – data is considered an organizational asset, IT and business work in unison, data quality is priority one and data is disseminated uniformly throughout the organization.

To better understand the nature of BI-based organizations, Davenport (2006) proposed a layered view of BI architecture, which includes a variety of tools for data management, presentation and use. Davenport asserts that organizations can use BI to increase their competitiveness providing that a number of critical organizational dimensions are satisfied, namely business processes, executive support, fact-based decision-making and development of user skills. There are also a number of maturity models for BI that offer another useful lens for understanding BI-based organizations. For example, Eckerson (2004) uses a

metaphor of the human life-cycle, which includes six stages of BI growth and improvement, starting with prenatal (or non-existent), through infant, child and teenage (growing), to adult and sage (mature). The stages are characterized and defined by a set of organizational characteristics, including BI scope, analytic structure, executive perceptions, types of analytics, stewardship, funding, technology platforms, and change management and administration. Wixom and Watson (2010) also discuss three specific targets for BI development – the simplest being a single BI application, then a suite of applications, through to BI infrastructure – to facilitate transformation of the entire organization. They further add that in BI-based organizations, BI is well-established, organization-wide and mission critical. In such a view, BI-based organizations are fully transformed (Wixom and Watson 2010) and in their adult of sage stage of maturity (Eckerson 2004). LaValle et al. (2011) classify BI-based organizations by the level of their analytical capabilities, representing three stages of analytical adoption: aspirational, experienced and transformed. Based on a worldwide survey of more than 3000 participants from more than 30 industries, LaValle's team concludes that BI-based organizations are at the transformed level when they demonstrate the highest level of analytical capability, especially in relation to strategy and operations. LaValle's team further mentioned that the main impediments to organizations becoming BI-based are lack of individual BI skills and the organizational culture for using BI.

Moreover, Bertram (2010) argues that for BI to succeed within an organization it needs to deliver value in the following business quadrants: (1) performance, as measured via enterprise-wide performance metrics; (2) people with core business skills and competencies; (3) process, which is reliant on the effective use of information; and (4) platform, which provides technological support for core BI capabilities. Marjanovic (2010a) further added BI strategy to the above BI capabilities. Marjanovic states that BI strategy needs to be fully aligned with the overall business strategy, defining goals and objectives that in turn will be used to define the performance component of the above framework. The importance of organizational aspects for BI success has previously been highlighted by various work to define BI critical success factors, which include aspects of change management (Hawking and Sellitto 2010; Shanks and Bekmamedova 2012; Yeoh and Koronios 2010), management support (Yeoh and Koronios 2010), individual capability (Marjanovic 2010a), characteristics of BI tools, such as data quality and their integration (Abai 2006), and organizational culture (Chen et al. 2012).

In contrast to early research into BI, which focused on how an understanding of the business (and a range of associated factors) could determine requirements for BI technology (e.g. Wixom and Watson 2001), more recent work explores the degrees of alignment and integration between business practices and BI technology (Eckerson 2004; LaValle et al. 2011; Wixom and Watson 2010). In other words, the focus is on the development of fully transformed and mature BI-based organizations, where business and its structure, processes, and strategic and operational objectives walk hand-in-hand with information-driven business decision-making and execution (Davenport 2010). In view of this, we need to address not only the requirements for effective BI, but also to discover how an understanding of the organization and, consequently, decision-making happens (inspired by Davenport 2010). This will result in determining requirements for BI-based organizations, which not only use BI for everyday operational tasks but also for understanding and making sense of their business environment. To this aim we adopted Weick's sensemaking theory (Weick 1995; Weick et al. 2005) as the theoretical framework for this study, to which we turn next.

Theoretical framework

The sequence of events from understanding an organization to making decisions and finally taking action is at the heart of organizational sensemaking (Weick 2012). Sensemaking is quite distinct from decision-making as it is about giving meaning to what has happened in the past whereas decision-making is about comparing alternative courses of actions and choosing one of them (Boland 2008). However, every decision is made only after sense has been made of some past events (Dervin and Foreman-Wernet 2012), therefore every decision-maker can also be considered a sensemaker. And yet, not every case of sensemaking necessarily results in an immediate decision (Choo 2005).

Weick (Weick 1995; Weick et al. 2005) defines sensemaking as a structured process of removing ambiguity and uncertainty from executive decision-making. He discusses sensemaking at organizational and individual levels and considers the process to be characterized by seven unique properties, which include the sensemaker's capacity for retrospection (or giving meaning to past events), cue extraction (or

detection of important events), dealing with plausibility (or inexactness and fuzziness of observations), the social and ongoing nature of the sensemaking process, as well as the willingness to create and enact one's identity (the capacity for sensemaking). Several other authors agree with the elements of Weick's sensemaking. For instance, Snowden (2002) refers to the notion of retrospection as "creation of known and knowable spaces" and Klein and colleagues (2006) even call the notion of retrospection simply "data". According to Weick, people give meaning to past events by extracting cues from the environment. Again, cue extraction is at the core of many other sensemaking models. For example, Russell et al. (1993) refer to extracted cues as mismatch, omission and misuse of data and its representation; Dervin (1998) named cues as gaps, questions, confusions, muddles, riddles and angst. Weick believes that sensemaking is about detection of plausible situations and consequently is involved with fuzziness and uncertainty. Pirolli and Card (2005) also added to this view by noting that sensemaking is about trading between accuracy and cost. Weick (1995) highlighted the social aspects of sensemaking by stating that sensemaking is never a solitary action – others influence sensemakers and sensemakers influence others by every sense made. While Weick's model (1995) of sensemaking is unique amongst others with regard to its power to address group aspects of sensemaking, Russell (1993) also considers individuals within a team while making sense of the environment. In Weick's model (1995), sensemaking is ongoing and includes notions of continuity and repetition, which is similar to what Russell (1993) refers to as "generation and representational shift loop" or Pirolli and Card (2005) refer to as a "sensemaking and foraging loop". Weick (2005) also states that sensemaking never starts, just as it never stops. However, in contrast to some efforts to show sensemaking as a simple and rigid process of transforming information into action (e.g. Russell et al. 1993), in Weick et al.'s later writing (2005) sensemaking is considered an evolutionary process in which retrospective interpretations are built during interdependent activities, with feedback loops and optional processing. In Weick's model (1995), sensemaking starts with enactment, which means that individuals take action in an environment and, with every step, create a new environment around them. This enacted environment, therefore, will influence every sense made and every consequent decision. In Dervin's model (1998) enactment happens for the purpose of bridging the gaps or problems encountered in the sensemaking process, and this is like the process in Klein's model (2006), which postulates the framing and reframing of sensemaking conditions. Finally, Weick (1995) emphasized the role of identity creation in sensemaking as he believed that sensemaking deals with perceived reality, which depends on how sensemakers describe themselves.

Weick's (1995; 2005) model of sensemaking provides the most comprehensive framework for studying and understanding sensemaking in equivocal situations. Alternative models of sensemaking, as reported by other authors (e.g. Dervin 1998; Snowden 2002), provide additional insights into the spectrum of sensemaking knowledge, yet they lack the level of sophistication and completeness of Weick's conceptualization. Weick's framework addresses individual and organizational sensemaking, and has a solid foundation in cognitive science. The framework largely subsumes the features of other models; consequently, this study adopted Weick's (1995; 2005) concepts to investigate how an understanding of the business with the aid of BI can develop, a process which can then assist in identifying the requirements of BI-based organizations.

Research method

While several researchers emphasized the importance of organizational factors for the success of BI implementation, no study explored the underlying factors for understanding business and decision-making to determine the requirements of BI-based organizations (Davenport 2010). In this study, therefore, we investigated through the lens of sensemaking theories how organizations as well as individuals can create BI-based identities. Given that there is insufficient prior understanding of this problem, we gathered and investigated experiences of BI users, consultants, analysts and developers, with a view to gain further insight into BI-based organizations. This was achieved by conducting an empirical exploratory study (Crotty 1998), which relied on interpretative research methods to guide our analysis of the collected data (Crotty 1998). We chose hermeneutic phenomenology as an overarching theoretical perspective and the method of inquiry (Van Manen 1998) to focus on decision-makers' lived experience and practice. In general, phenomenology investigates phenomena of interest as they are experienced and reflected upon, to seek reinterpretation and renewal of meaning (Husserl 1931). Highly subjective and complex personal accounts of events and circumstances can be studied by the process of phenomenological inquiry with a view to gain awareness, understanding and knowledge of the

investigated phenomena (Moustakas 1994). In this study, the phenomena of interest included the investigation of individual and organizational capacity for using BI tools for the purpose of gaining understanding of business with a view to aid decision-making. Development of such capacities would ultimately assist in moving the organization toward being a BI-based firm. By adopting a phenomenological approach we isolated the meanings and experiences that were shared by the study participants. In interpretive research, such participants are often referred to as co-researchers (Given 2008; Moreno Jr 1999); we used this term in our research and thus in the following discussion.

Among different phenomenological traditions, such as transcendental, existential and hermeneutical (Van Manen 1998), we adopted hermeneutic phenomenology to guide this study. Hermeneutic phenomenology was first proposed by Gadamer (1969, see Gadamer 2008) and refined, formulated and publicized as a research methodology by Moustakas (1994). As a theory of interpretation, hermeneutics was originally used to provide in-depth analysis of historical texts, and in our case to provide a methodological analytic framework for understanding subjective views and opinions in situations where there was a gap in understanding, such as the researcher's distance in time, place and culture from the subject matter. Hermeneutics achieves such understanding through a cyclical dialectic process that is collectively referred to as the hermeneutic circle (Ricoeur 1975). By adopting hermeneutic analysis to BI stakeholders' experiences of using BI in organizations, we explored these phenomena from a variety of personal, organizational and social perspectives, and in the process we arrived at the essence of these phenomena (Merleau-Ponty 2004), which represents the common core of shared experiences.

We conducted 23 in-depth interviews with 27 co-researchers from 17 separate organizations. Most of them were one-on-one interviews, however in some cases (on co-researchers' requests) interviews were conducted in small groups. Our co-researchers included the primary organizational users of BI technology, such as consultants, decision-makers, developers and analysts, who were all relying on a set of common BI practices within their work portfolios.

As the focus of the study was on both individual and organizational identity creation and enactment, the co-researchers were chosen mainly from large enterprises (including multinationals), each with over 1000 employees, where rich organizational settings could support the creation and evolution of such identity. Only five organizations were small BI consulting companies of less than 100 employees. The chosen companies were from variety of different industries including IT, finance and banking, government, healthcare, education and retail. All study participants used BI tools in their daily life. The most common tools used by the study participants were Microsoft SQL Server, IBM Cognos and TM1. Depending on the company and the level of analytical skills other tools were used from vendors such as SAS, Microsoft (e.g. Excel with BI add-ins), IBM (e.g. SPSS and SPSS Modeler), R, Tableau, Omniscio and Procuretrak, Oracle, Lavastorm, Allesco, MapInfo, Siebel, Manugistics, Maximo and Unica.

We used the four methodological steps of data analysis interwoven into the cycles of the hermeneutic circle, as adapted from Van Kaam (1959) and Moustakas (1994): epoche, phenomenological reduction, imaginative variation and synthesis. In epoche, for each hermeneutic cycle, we aimed at identifying and setting aside our personal biases and pre-judgments. In the second step, phenomenological reduction, we obtained rich and complete textural descriptions of lived experiences of the participants consisting of 2193 individual statements. We applied open coding (Glaser and Strauss 1967) to derive meaning conveyed by individual textural descriptions. Using this approach we identified unique viewpoints or horizons, with their characteristics clustered into 28 broad thematic categories of concepts (Moustakas 1994). In the process we discovered 19 distinct categories of BI concepts that help with understanding organizations and decision-making. In the third phase, imaginative variation, we determined the essential structure of the phenomena. In this process we varied frames of reference, looked for conflicting views among the co-researchers, and reversals, and arrived at the invariants and the structure of their shared experience (Moustakas 1994). We explored a large thematic structure from the collected data and published research, and explained the lived experience of our co-researchers in dealing with BI technology within their organizations from the perspective of Weick's model of sensemaking (1995; 2005). Finally, in synthesis, the final step in the analysis, we aimed at the fusion of textural and structural descriptions of the investigated phenomena to develop the invariant essence of the co-researchers' experience. We further compared and contrasted such personal views with the extant literature on BI-based organizations and sensemaking.

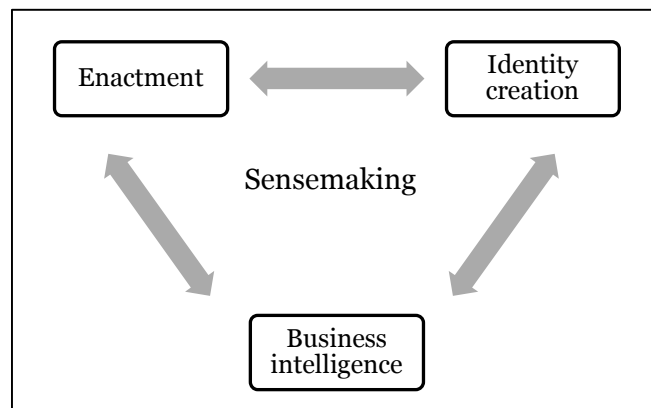
Results

BI is capable of supporting sensemaking in five areas of Weick’s model of sensemaking (Weick 1995, 2012; Weick et al. 2005); namely retrospection (Strenger 2008), social environment (Imhoff and White 2010), cue extraction (Amburgey and Yi 2011; Elbashir et al. 2008), plausibility (Olinsky and Schumacher 2010) and the ongoing nature of the sensemaking process (Foody 2009). In particular, our co-researchers elaborated on the role of BI in creating a retrospective view of the organization by capturing data into enterprise systems and data warehouses. Prediction models are a major part of BI, used to provide decision-makers with advice on plausible outcomes of business activities – information which can then be used as input into decision-making processes and action planning. Environmental cues were being continuously monitored via dashboards, scorecards and alerts to highlight changes in the business and its environment. Finally, some of the more recent BI tools are integrated with collaborative systems to facilitate communication and cooperation between analysts and decision-makers.

To gain the full benefit of BI and move toward BI-based firms an organization as a whole needs to change its culture (Marjanovic 2010a), and more importantly, its individual members need to alter the way they behave and think, which largely represent identity creation and its enactments. BI identity creation at a personal level results in more effective use of BI by those individuals, while creating organizational BI identity evolves the capacity to use data and analytics for BI operation and strategy development. In the current research the importance of BI identity emerges strongly in our interviews with co-researchers. Figure 1 illustrates a high-level view of BI-based organizations with the emphasis on identity creation at individual and organizational levels and its enactment.

In the following sections, we will elaborate on this figure by presenting the views of the study participants on the impact of organizational and individual identity on the effectiveness of BI in an organization and moving toward BI-based organizations. We subsequently discuss how BI can be used by decision-makers and data analysts in order to address the existing barriers and challenges for creating BI identity. We present the discussion of organizational and individual levels separately. Note that in the ensuing discussion, references to co-researchers’ views and opinions have been enclosed in square brackets, identifying the co-researcher’s pseudonym and the paragraph in the interview transcript.

Figure 1: BI-based organizations



Organizational level

To make sense of the organization through the use of BI, organizations need to change their structure to create capacity for sustained use of analytical tools to support management decisions (Yeoh and Koronios 2010). Many organizations, however, use analytics only when facing particular issues or problems. One of our co-researchers, Madison, an enterprise intelligence director, expressed his concerns about using BI analytics for resolving individual issues rather than using the technology as a sustainable approach to managing an organization [Madison, ID18]. Nathan, a director of sales and marketing, further considered BI as a core competency for modern organizations, which should not be outsourced; therefore, in his organization, instead of undertaking analytic work on behalf of his internal clients, he created an

environment where clients could carry out the majority of analytic tasks on their own [Nathan, ID19]. Robert, a channel technical manager, added to this view by stating that organizational capacity for using BI effectively includes every aspect of his organization, from its structure to the way people think and make decisions [Robert, ID32]. This confirms Wixom and Watson's view (2010) of organizational readiness for BI, which requires analytics as a core and sustainable competency – a very firm view of BI-based organizational identity.

Our co-researchers identified five principal requirements for the creation and empowerment of organizational identity, namely scope definition, process alignment, integrity, customization and turning reports into action. In the following sub-sections we explain each of these, and their role for creating BI identity within organizations.

Scope definition (shared understanding)

Defining the scope for BI in achieving a shared understanding of the types of required reports is one of the first steps in BI identity creation at the organizational level – this commonly stems from the fact that business information is valued and analyzed differently across different functional contexts (Davenport 2010). Several co-researchers understood this very issue and described several situations where clear communication between BI stakeholders was needed to define expectations as to BI functionality. Rachel, a research and analytics director, for instance, asserted that clear statement of business problems was needed to assure the expectations of BI decision-makers as to the use of BI analytics [Rachel, ID15]. Shaun, an executive director, further added to Rachel's statement on the importance of clarifying BI scope and spending significant amounts of time analyzing business requirements [Shaun, ID16]. The complexity of scope definition for BI gets even more complicated when none of the stakeholders has a clear and holistic view of the organization, which may contribute to conflicts of interest [Scott, a general manager, developer and platform evangelist, ID26]. To add to this view, Shaun gave his recent experience by explaining that the large number of meetings of BI stakeholders involved in such a process might complicate effective communication and consensus building. In fact, Daniel, Shaun's colleague and a data analyst in the same organization, remarked that due to narrow view of BI capabilities and self-interests, facilitation of communication between different BI users within the organization is often needed to achieve a shared understanding of BI scope and requirements [Shaun, ID20; Daniel, ID32].

Considering the difficulties in defining the scope for BI within the organization, also in line with Eckerson (2004), several study participants suggested an evolutionary approach for achieving a shared understanding of BI requirements. In particular, Alfred, a data integration and management director, drew our attention to the evolutionary nature of BI by contrasting BI development and application development. He mentioned that BI development is more complex than application development as it is not a structured process and BI users cannot decide on the requirements until they see the outcomes [Alfred, ID18]. Daniel further elaborated on how the demands of BI users, or what their company is looking for, is constantly evolving or changing; however, he cautioned that the change in BI needs should be considered as a positive sign as it indicates that "BI users are getting more mature or the way that they are looking at BI is a bit more developed" [Daniel, ID28]. Clark, an operations director, also talked about his experience in using an iterative approach for preparing and using the BI reports needed for decision-makers within his organization [Clark, ID28]. He then elaborated on the evolutionary nature of defining the scope of BI and achieving a shared understanding of BI requirements. He also admitted that after several years of using BI in his organization, still the reports are not what end users of BI need.

Process alignment (sources of data)

There are many studies that examine how competitive advantages could be achieved through ceasing the constant pursuit of business opportunities and aligning of strategic business goals with operationalized business processes (Marjanovic 2010b). For many organizations, processes are a valuable source of organizational capital (Namvar et al. 2010) because they could act as a competitive advantage in a highly competitive business environment (Davenport 2006). In spite of the time and cost involved in changing business processes, upon the introduction of BI, organizations need to modify their business processes to move to being a BI-based organization that uses appropriate data for analytics (Shanks and Bekmamedova 2012). Our co-researchers underscored this issue and discussed the implication of process alignment with BI systems. Scott, for instance, cautioned on mapping business processes with BI as a new technology in the organization.

“Technology, in my mind, isn’t particularly good unless you have a reason for using it and a way of using it, and in that case [BI] organisational process is the most important part. The enabler is the second one. So you need to have your process mapped out and correct first. Then you need someone to automate and enable it to make sure you get a level of rigidity around what the process is supposed to do.” [Scott, ID37]

Jeffrey, a national manager for financial reporting and analysis, described a typical scenario of creating dashboards for managers to provide them with the ability to track their own spreadsheets. In his experience he found that there was no connectivity between business units in order to get a holistic view. He therefore decided to look at the process in isolation through its various stages and explain to BI users their responsibility in the process and what it impacted for the next stages [Jeffrey, ID60]. Interestingly, he faced massive resistance from BI users (Hallikainen et al. 2012). He then mentioned that neither BI users nor BI systems were wrong, still the process feeding data into BI was incorrect, which made him spend excessive time and effort to educate end users.

“But what we had to try and educate was, it is not the numbers that are wrong, it is the process of updating the numbers that was wrong so we need to go back and look at the process and ensure that everything’s been mapped through timely and efficiently and accurately in the source. And then fix the source and the resolution will come.” [Jeffrey, ID60]

Apart from the need for modifying business processes, some co-researchers cautioned that data used in BI systems is collected from reporting systems, which are not designed specifically for BI. Nathan added to this view by noting “data was captured for a particular purpose, now we want to do something else with it” [Nathan, ID30]. Along these lines, Robert gave the essence of his experience facing a company in which BI implementation happened after data warehousing, resulting in the familiar story of “garbage in, garbage out” [Robert, ID4]. Jeffrey further mentioned the above issue as one of the biggest roadblocks and challenges for BI solutions that he was facing every day [Jeffrey, ID61]:

“Everything comes back to the root of the raw data. The processes are mapped in terms of how the data is pushed out to a BI platform and the business rules are written, and it will only pull what’s in the source system. And I find that, for people who aren’t engaged in analytics or financial reporting, that they kind of sometimes just don’t get it. So that’s, I think that’s with anywhere with reporting, whether it’s BI or not. I think that’s the challenge”.

Integrity

Some study participants elaborated on the need for organizations to integrate business rules and data rules to achieve a single version of truth within the organization. Our co-researchers referred to situations where a lack of such integration resulted in skepticism from decision-makers [Daniel, ID36]. Daniel, for example, captured the experience of organizations reading from the same source while having different business rules, resulting in different calculations and results [Daniel, ID36]. Clark underscored this problem in a particular project and tried to resolve it by holding several meetings between different BI stakeholders to achieve a single version of truth of business rules:

“One side of it was this issue of, ‘How do I deal with – how do I do the analytics so I can identify them?’ Another part was, ‘Well how do I integrate the systems?’ But the other part was the business processes. And you had to try and make sure that those three things came together. So the way we did that was that right from the start I had people from each of those areas in a small working party so I got represented all their views so that if, you know, the analytics person says, ‘I’m going to pass you back a score’, the business person would go, ‘Well I have no idea of what a score of 2.5 means? What do I do with it?’ It’s very important that you do take an integrated approach to deploying business intelligence otherwise you end up producing stuff that can be very smart but no-one knows how to use it.’ [Clark, ID8]

Customization

One of the requirements for creating BI identity at the organizational level is customizing BI tools based on the needs, culture and structure of the organization (Wixom and Watson 2010). However, as Hill, a managing director, noted, due to the cost and time involved in BI implementation some organizations prefer to copy BI solutions. Hill observed that very few organizations initiate BI solutions from scratch, which results in copying failures and risks as well [Hill, ID 30]. Roy, a software sales manager, further highlighted the importance of BI customization by drawing our attention to the need for going into certain levels of detail with the customer to understand the underlying business problem. He mentioned the

impossibility of selling BI products over the phone as it requires a very long sale cycle to support underlying business needs. Robert also noted that even businesses with the same functionality and requirements for identifying needs and then customizing BI solutions are different [Robert, ID36]. Finally, in line with what Nemati et al. (2010) identified as the need for BI customization, Clark captured the essence of his experience of customizing BI solutions within his company:

“Really and truly what you find is that it’s not often that you’ll get something out of a package that will just exactly meet your needs unless there’s a package out there that’s specific to your industry.” [Clark, ID16]

Turning into action

Companies need to take action based on BI reports to improve current business processes and strengthen BI systems in an iterative and evolutionary manner (Nemati et al. 2010). Hill mentioned that the success of BI depends to the extent on which organizations get involved in this process, as the more organizations can turn reports into action, the more likely they are to achieve success. Roy further added to this view by noting business process flow is triggered by analytics:

“You know it is governed by business rules and businesses are obviously making – have an insight into what the business process flow is. But influencing that business process flow is analytics in terms of what we know about the customer and what step to take next. So it is a business process. But it’s a business process that is informed through the use of advanced analytics.” [Roy, ID34]

Robert understood this issue and suggested that a solution is often required to fix some current process, and as a result companies refer to him to fix inefficient processes. In this line, and based on what Marjanovic (2010b) mentioned about enacting on business processes, Jeffrey stated that if the process exists it is certainly necessary to get involved in its enactment in order to understand it, and sometimes there is a need to reshape the process in order to ensure it’s reflective of what people want to see. However, in line with the observation of Eisenhardt and Brown (1997), and Davenport (2010), about acting quickly based on reports, the age of reports was identified to be one of the impediments for turning reports into action. Shaun mentioned that he often gets calls from clients who are looking at a report from 12 months ago, and she is surprised why decision-makers are using those old reports [Shaun, ID50]. Ruofan, a senior business analyst responsible for organizational data infrastructure, also cautioned on the importance of using actionable reports in appropriate time:

“The users have to respond to the real world really quick, as soon as possible basically every day. We have this issue, it is like the information technology team have their standards, have their process, their red tapes, and you have to follow and it has to be reviewed by so many people. This process – if you’re lucky it will be six months. The business is not going to wait for a new piece of alert data that some vendor data supplier can now provide in order to say I can give you this data if you sign the contract with me, and there’s – by the way technology, and how long would it take for you to bring this data in that I can then include it into my – whatever – analytic tools. That is the issue, I’m not sure am I the only one or we’re the only organisation facing this because the business want to basically respond within the week.” [Ruofan, ID18]

Individual level

Organizations need to educate individuals to develop core business competencies within the business (Bertram 2010), and enable decision-makers to think and behave in ways that make sense of their organization with BI. Nathan elaborated on the role of BI identity at the individual level by contrasting BI and other IT systems and highlighting the need for the culture of discovery:

“If you put in a CRM system that’s new and it requires some business process change, there’s going to be some resistance so you need to convince people about the new business process but once you’ve embedded the process, it’s there. Whereas, you know, BI and analytics is probably a more open business process. There are some tied up processes that exist in BI but then, you know, there’s a culture of discovery and justifying your position based on evidence which is probably a bit harder than just teaching someone how to generate an invoice differently.” [Nathan, ID51]

Sahil, a manager of IT strategy and architecture, added to this view by noting that decision-makers can develop multiple identities. According to him, executives face multiple data sources in the current

business environment and, as a result, in each particular situation one of their identities could be the dominant one that influences decisions [Sahil, ID49]. In the following sections, we will discuss the situations that hinder different individual identities from using BI to understand their organization, namely imposition of time constraints, need to justify actions, skepticism towards BI and involvement of unskilled users. Possible approaches to dealing with these challenges are offered by the study participants.

Time constraint

Decision-makers who often face a severe lack of time are unwilling to labor through tables and charts of data or perform complicated data manipulation (MacKrell and van den Boogaard 2012; Stoodley 2012). During his career, Jeffrey has realized that there are two types of decision-makers, “those who are numerically savvy and want tables and data to be able to manipulate information whereas the other group is not interested in diving into the data and they would rather to see the options” [Jeffrey, ID37]. Nathan further explained that even if executives have the numerical know-how they would delegate some of the lower level substantiation of a good decision to their direct reports, and he “would be quite suspicious of a CEO that spends all of his time in spreadsheets” as this is not a good way of using their time [Nathan, ID21]. Shaun added to the issue of time constraints for chief-level managers:

“My experience of the top level is they're not necessarily going to be interested in the detail that sits behind that recommendation or that information that allows the action. They are relying on it (a) to be 100 per cent correct and (b) for somebody to explain it to them if they need to be. They're not going to be wasting time sitting there trying to understand why the graph is going down when they think it should be going up. I think that in some cases when you're dealing with the top level, the C level, you are not going to have the time to explain that” [Shaun, ID38].

Our study participants suggested “clarity” and “cue extraction” in reports to resolve the time-constraint issue. Rachel drew our attention to very succinct and targeted reports in order to provide decision-makers with the necessary information [Rachel, ID37]. Shaun also highlighted the importance of simplicity and trends in reports [Shaun, ID39], and further explained that while executives recognize that a business environment is unsettled and there is always change going on, which is often confounded by the external factors, they would like to see items above or below the line [Shaun, ID55]. Roy also elaborated on succinct and pointy reports containing best options for decision-makers at board level; he even expanded this view to operational level decision-makers [Roy, ID32].

In spite of the call for specific options in BI reports for decision-makers, in complex situations it is possible that illustrating options would be challenging. Instead, preliminary visualizations could assist decision-makers in extracting options in such situations. BI reports, then, could be generated based on what decision-makers have extracted from the visuals. Ross, the founder of a data visualization company, contrasts BI and visualization to note how visualization could be used by decision-makers to explore various options for choosing the right start for generating reports [Ross, ID33]. In his view, visualization is about how BI can give insights as clearly as possible to someone, knowing that this is the information they are looking for. Therefore, data visualisation is about a way of exploring data and finding some insights or points that decision-makers want to feed into a more regular BI systems [Ross, ID34].

Justification

Justifying action is one of the reasons why some decision-makers use BI reports (LaValle et al. 2011). In such situations, extensive reports are not effective, as decision-makers are looking for specific numbers or patterns that they already have in mind [Chandler, ID43], and BI systems simply provide decision-makers with tools to support what they already know are the possible options. Our co-researchers emphasized keeping a balance between providing such options vs offering whole answers or solutions. Chandler, a financial governance and planning director, noted that since in reality the CEO and senior management are only looking at a couple of numbers and specific drivers, data analysts should focus on those lower level and operational drivers. Chandler further gave a typical experience of executives facing extensive prediction models, which did not meet their expectations and where the anticipated targets were not highlighted in the report:

“There's normally a number in somebody's head. That's person sitting at the top of the food chain. So a lot of the planning and budgeting exercise is actually getting to that number, then feeding that down through the operational plans. So we have built some models that do statistical analysis of historical data and give

you the best modelling outcome and the likely modelling outcome. But we actually found that not many people were actually typically that interested in those because it wasn't actually flexible enough for them to get to that number. It gave them a number, but it was not necessarily the number that the senior management had in their head. That's the number that you have to get to, at the end of the day. I understand that using statistical modelling will give you a predictable outcome, but even using those sorts of predictive models, you have to treat it with a hell of a lot of caution in business environments." [Chandler, ID43]

Rachel, in response to Chandler's concern for using prediction models, rather suggested that using prediction models as validation tools for decision-makers who would like to justify their actions or understanding is warranted:

"The predictive models are not necessarily used just to predict what's going to happen in the future. The predictive models are often used also to predict what a [customer's] behavior should be. So it's not predicting – and that might be for current year. So knowing what we know about that [customer], or the environment, or what's going on, that models what a [customer] should be doing in the current year. So it's not so much looking into the future, it's just trying to validate what they're currently reporting against what we expect they should be reporting. So it's not future, it's just kind of a validation tool." [Rachel, ID29]

Skepticism

The identity of decision-makers could be depicted through their management style of either trusting data for making fact-based decisions or relying on their intuition for making gut-based decisions (MacKrell and van den Boogaard 2012; Stoodley 2012). Skepticism toward BI reports hinders intuitive decision-makers from using BI. In the view of the co-researchers, skeptical decision-makers either feel they will lose their power or they could simply not trust the reports. Madison stated that this issue is even more likely to happen for recommendations models:

"You wouldn't make a recommendation without running it past the client first because every client, even if they have the standard implementation, they are going to do their own things to it and they've got their own quirks about why they do things. So they'll always be a point of validation." [Madison, ID76]

He noted that unless decision-makers see the benefits of BI reports they will not trust the BI. Andrew further cautioned on presenting strategic reports differently, in terms of details, to skeptical decision-makers; he also contrasted operational reports with strategic reports and noted that in terms of operation it is a straightforward comparison about what the organization is aiming for or what the organization has done. However, for strategic reports more effort is required to show the details [Andrew, ID33]. Rachel further elaborated on the resistance of skeptical decision-makers in established organizations and then suggested presenting reports in a plausible and easy-to-understand manner for decision-makers:

"It's a very, very long-term organisation, so you've got a lot of people with a lot of experience, so use of analytics and the presentation of analytics has to either, rightly or wrongly, it needs to be aware of people who have got some very strong opinions and beliefs about what is actually going on. And if you're going to be developing a model which is contrary to these positions, or long-held standing positions, you have to present your results in a very plausible and easy-to-understand [way]". [Rachel, ID32]

Providing skeptical decision-makers with the opportunity to interact with and validate reports increases trust, and this is why Roy recognized self-service that is usable, intuitive and user-friendly as "a big push in a big area" [Roy, ID18]. Daniel added to this view by noting his willingness to anticipate decision-makers' needs and provide them with the opportunity to customize and tailor their reports. Jeffrey further suggested interaction as a solution to resolve this issue, since decision-makers are tied to tangibles that make them lose confidence in BI platforms and would rather control and investigate what is behind BI reports [Jeffrey, ID13]. He suggested personalization along with self-service BI as a solution to skepticism:

"They do require a bit of handholding and they want to – as much as they want control in terms of changing things, they also want to feel the confidence that when they open things, it looks how they want it to look and know how they want it to look. So they want it setup like that. So we sometimes have to handhold them and say let's login under your credentials, let's set it up, hit the save button and take you through it, and know that it will open up like that every time." [Jeffrey, ID10]

Unskilled users

The analytical skills of individuals influence their interactions with BI systems and subsequently impact the effectiveness of BI systems in helping decision-makers understand their organization (Glancy and Yadav 2011; Shanks and Bekmamedova 2012). Shane, for example, strongly encouraged development of skills sufficient to manipulate BI reports [Shane, ID22]. Ian, an operations manager, described situations where lack of skill impeded decision-makers even from articulating the right questions [Ian, ID54]. Dale, an enterprise intelligence data analyst, also cautioned on the use of self-service analytics by unskilled managers acting on BI reports without the presence of an analyst capable of explaining the results and their meanings, as well as, how such results should be used in action [Dale, ID49]. Daniel added to this view by noting that the main issue for understanding an organization through BI is clarifying what decision-makers want to see in business terms, rather than in terms of BI functionality. He said “we have to sit down with them and take them through that process” [Daniel, ID67]. To resolve this issue, Clark gave an account of a typical project in which he had two teams working together at the same time, one for developing the BI model and the other one for communicating with decision-makers:

“In terms of developing the model, which I suppose is much more of the business intelligence side, we took two approaches. One was that we just did the straight data crunching like cluster analysis, etc., all those ranges of different approaches you can take, but then what we had is the business person sitting there trying to work out whether they knew what it meant.” [Clark, ID17]

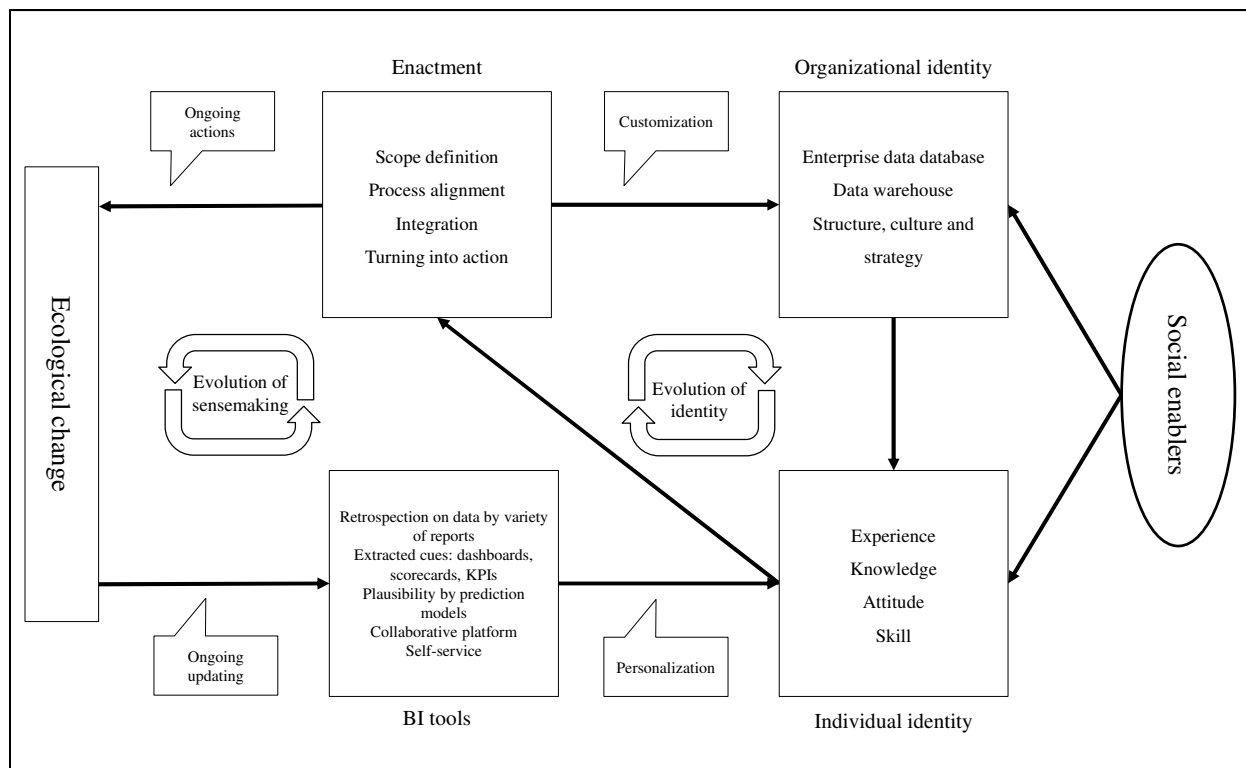
Clark then identified the lack of proper interaction between data analysts and decision-makers as the main barrier to unskilled decision-makers using BI reports, as “these people do not talk the same language”. He then gave his experience of resolving this issue, by facilitating communication between the groups [Clark, ID41]. Rachel further added to this view by highlighting the role of communication for data analysts, and the extent to which proper presentation of their work could assist decision-makers to understand underlying concepts and influence the efficacy of BI reports [Rachel, ID31]. Rachel then captured the essence of analysts facing decision-makers who could not understand the reports they were presenting, as she told us of failing to explain her work in spite of the strong model she had developed:

“My lowest moments in the organization was [when] I developed, I think it was like a 27 dimensions cluster analysis of work-related expense compliance and then me trying to explain to the auditors why they should be using this model of non-compliance on why one individual was more non-compliant than another individual. I lost them within two minutes and that model was actually quite good but it was never, ever going to go anywhere because the way that I presented it was just so far out of my audience [understanding] that it just wasn't going to get up.” [Rachel, ID33]

Discussion and Synthesis

The results of our study extend Weick's sensemaking theory (1995) in the context of BI-based organizations, with a particular emphasis placed on the creation of individual and organizational identity, which can assist decision-makers in making sense of the ongoing changes in the business environment. Thanks to BI and its ability to extract environmental cues and analyze plausible outcomes, it is possible for decision-makers to develop a retrospective view of the organization. Our study participants further highlighted the necessity for BI to play an important role in the creation of identity at individual and organizational levels, thus, developing a prospective view of the organization. They also provided advice on some possible approaches to achieving this objective. This included a clear definition of scope for BI within the enterprise, as well as, increasing the level of integration between business rules and data rules across the organizational functions. Moreover, they highlighted the need for decision makers to gain sufficient skills to utilize BI tools and incorporate BI-generated insights in their decision and actions. Self-service analytics are of special importance when defining and enacting organizational identity on business structures, processes and data. Communication between decision makers and data analysts was deemed indispensable in developing shared understanding of business and data insights, and dissemination of such insights with an organization. To this end, personalization of BI reports to match the identity of BI users was found to be of great value. We will further synthesize and elaborate on these insights.

Individual and organizational identities should be created and utilized with regards to sensemaking needs and BI capabilities. Here we, therefore, identify the links between these two types of BI identity, as well as their interaction with other properties of sensemaking in BI context (see Figure 2).

Figure 2: BI identity creation

BI as technology has limited power for changing the identity of decision-makers (Foody 2009); however, BI systems and tools can provide decision-makers with a variety of services and outcomes based on different identities. BI systems that incorporate data for ongoing ecological change allow their users to review and reflect on past data, and filter data influx to extract cues via summary reports, KPI charts and alerts for busy decision-makers or for those willing to justify their actions (LaValle et al. 2011). Prediction models and self-service BI motivate skeptical decision-makers to interact with the presented information, and form and articulate insights that should eventually yield better decisions [Madison, ID76]. Finally, a collaborative BI platform assists decision-makers to share insights from reports and learn from each other (see "BI tools" in Figure 2).

Personalized interaction with BI provides opportunities to gain experience, knowledge, attitudes and skills (Foody 2009) that will eventually leverage individual identity (see "Individual identity" in Figure 2). Decision-makers, however, need to establish clear communication in their groups and with data analysts (Imhoff and White 2010), who may have better understanding of data and its underlying concepts (e.g. its statistical and mathematical grounding). These conversations not only leverage decision-makers' BI identity, but also educate data analysts about business rules and lead gradually to a shared understanding of business needs and expectations of BI, and help to define the scope of BI within an organization [Clark, ID41]. The interaction and conversation between data analysts and decision-makers is indicated by "Social enablers" in Figure 2.

Individuals are able to enact in the business environment by participating in the process of defining the scope for BI [Shaun, ID16], aligning business processes with BI requirements (Marjanovic 2010b), customizing BI tools based on the needs and expectations of the organization (Nemati et al. 2010), integrating data definition with business rules and turning decisions into action [Daniel, ID36]. Every action based on BI reports also influences the business environment itself, which consequently creates new inputs for BI systems (the link between "Enactment" and "Ecological change" in Figure 2). Upon turning fact-based decisions into action, organizations are able to collect more data and provide their BI systems with higher quality data, and eventually close the loop of sensemaking within and outside the organization.

In addition to influencing the external business environment, BI-based enactment improves organizational identity by refining business processes and updating data sources, which assist in preparing appropriate data for analytics and improve data quality (the link between “Enactment” and “Organizational identity”). Integrating BI and business rules creates a “single version of truth” within the organization, which leverages decision-makers’ trust toward BI outcomes [Daniel, ID36]. Customizing BI solutions according to the requirements of organization’s structure, culture and strategies is also considered a major component of identity enactment within the organization [Robert, ID36], as it will result in an organization with suitable enterprise databases, data warehouses and other enterprise tools.

Figure 2 suggests two different feedback loops. The first, “Evolution of identity creation”, affects individual identity and enactment, which also aims to improve organizational identity. All data-driven choice made by individuals result in enacting BI in the business environment. In the long-term, such decisions ultimately shape the organizational identity as well. The second cycle, “Evolution of sensemaking”, refers to turning decisions into actions, influencing the business environment and consequently receiving new inputs. These two cycles work side-by-side. The sensemaking cycle can happen without the identity creation cycle; however, once the identity cycle is complete, individuals and organizations can achieve an understanding of BI and its functionality, which then assists them in making thorough sense of a BI-driven business, leading to appropriate and quality decisions and actions. What can be concluded from the above figure is that in BI-based organizations both cycles can potentially work together, thus resulting in using BI for understanding the business environment as an integral part of everyday operational decisions.

Conclusion

In a competitive business landscape, organizations need to monitor changes in the business environment and turn them to their advantage. BI, with its analytical power, uses vast amounts of data to create one type of competitive advantage. With the growing amount of data around us, BI has changed from being a useful tool to a necessity for survival in the rapidly fluctuating business environment. Previous studies on the business value of BI confirmed that in order to master environmental change and take advantage of big data, organizations need to alter the way they operate and move toward being BI-based organizations (Hsinchun Chen et al. 2012; Wixom, Ariyachandra, Douglas, Goul, Gupta, Iyer, Kulkarni, B. J. G. Mooney, et al. 2014).

To identify the requirements for BI-based organizations, many studies have been conducted on critical factors needed for implementing and adopting BI. These studies include creating maturity models for BI enterprise (Eckerson 2004; Wixom and Watson 2010) and they demonstrate how organizations should leverage themselves through levels of maturity to yield significant BI gains. A second group of studies identify the critical success factors for implanting BI requirements, including IT/business alignment, management support, and data quality and integration. However, in spite of efforts to use BI at strategic levels, most of its use is limited to day-to-day operational decisions (LaValle et al. 2011). There was a need to use decision-making theories to explore the underlying factors in how firms move toward information-based decision-making (Davenport 2010), and how firms go about understanding themselves (Hsinchun Chen et al. 2012). In a similar fashion, we relied on the theory of sensemaking (Weick 1995) to investigate how BI could be used to better understand the organization, with a view to assist business decision-making, and eventually turn the organization into a BI-based one.

All insights presented in this paper come from practitioners and the synthesis of approaches recommended by these practitioners could be of value to the BI community. The results indicate that for organizations to succeed in migrating toward being BI-based firms, they need to support the creation and consistent utilization of BI identity at organizational and individual levels. At the organizational level there is a need to define the scope for BI within the enterprise, as well as to integrate business rules with data rules. Decision-makers need to be able to independently interact with BI tools and use the BI-generated insights to enact their own identity in the process of refining business structures, processes and data. The communication between decision-makers and data analysts who have a good grasp of data and visualization techniques was found to be of crucial importance for sharing business insights by both parties, which would ultimately result in high integrity between business and data rules. Data analysts need to personalize their reports by considering the BI identity of different users and user groups while addressing their distinct needs, skills, constraints and reactions.

The research reported in this paper brings two distinct theoretical fields together – sensemaking and enterprise decision-making – and demonstrates how the two approaches can be put into practice with applications for BI and analytics. The analysis of insights collected from BI practitioners provides benefits to organizations planning to implement BI systems to support their business decision-makers. Finally, the consideration of BI identity creation and its enactment are of singular importance to decision-makers and their effectiveness in BI-based organizations. And yet, future work in this area still needs to be undertaken to further investigate how collaboration between data analysts and decision-makers should be conducted to enhance their joint efforts and to determine when and how decision-makers need to interact with BI tools in a highly personalized way. As our study was conducted broadly across different industry sectors and functional areas, more work is still needed to investigate the work patterns and best practice that may emerge for specific industries.

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