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The impact of individual, collective and structural Sensemaking on the usefulness of business intelligence data

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The impact of Sensemaking on Business Intelligence: A work in progress case study

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Abstract

The aim of this paper is to discuss how individual, collective and structural sensemaking influences the use of Business Intelligence in decision-making. Building on previous research we explore three patterns of sensemaking, individual, collective and structural. From this examine the impact these patterns have on Business Intelligence. Specifically we found that existing patterns of sensemaking hindered the data quality of the BI system because of how key people made sense of their work. We argue that because there was divergence in sensemaking patterns in the social systems, the data collected may not represent a true picture of 'business intelligence'. We discuss the outcomes of a work in progress case study.

Keywords: Business Intelligence, Sense Making, Data Analysis, Case Study.

1.   INTRODUCTION

Business intelligence (henceforth BI) has emerged as a field of interest for research in recent years (Watson 2009). It is often defined as an extension of organisational analytical techniques (Cody, Kruelen, Krishna and Spangler 2002) that specifically use computers in areas such as: data mining, predictive analysis, historical analysis, performance benchmarking, simulation modelling, knowledge management and a variety of other decision support priorities (Burstein, Holsapple, Negash and Gray 2008). The growth of BI has paved the way for improved reporting and an improved strategic view of data use that in turn helps corporations sustain competitive advantage.

A recent review of the BI literature (Jourdan, Rainer and Marshall 2008) found that the majority of research done to date has been largely technical. The dominant mode of research in BI has been to focus on building better systems (Hou and Papamichail 2010) at the expense of studying complex organisation issues such as strategy making or capability development. Chasalow (2009) argued that the organisational environment plays a role, both from a capability and user environment perspective. That is, the way an organisation facilitates the use of BI and its environment relate to the kind of capabilities that one can expect from BI. Sholo's (2011) study extended these key ideas by demonstrating that manager's often use BI data as factual gathering to help structure messy issues. As Sholo suggests this data is used for sensemaking and structuring complex strategic decisions.

However, the adoption and use of BI has been hampered by a few problems. For instance, the Gartner group (Gartner 2009) points out that because of a lack of understanding of the relationship between BI and the organisation there is a growing problem for decision-makers on how to actually use BI. Specifically they argue that because of a lack of meaningful data, organisations may find themselves unable to manage their business intelligence properly. If decision-makers are unable to clearly see the benefit in data coming from BI, as Gartner suggests, then they are unable to solve difficult management problems (Vercellis 2009). The theory underpinning how BI researchers perceive managerial decision-making is very thin in the IS literature in comparison with that of organisational literature. The question is: Why can't managers make sense of BI data?

These recent projects highlight the role sensemaking plays in data gathering. What's missing is the relationship between the use of BI as part of problem structuring and the day-to-day activities conducted by people who provide the data used for sensemaking from Business Intelligence. Specifically what is the relationship between the way work is organised and hence how data is collected and the use of that data for decision-making. To begin to explore this we propose using a sensemaking framework to analyse the organisation of work and collection of data and then analyse these patterns to see how they influence BI based decision-making. We summarise this as the following research question:

RQ: How does sensemaking influence BI based decision-making?

By studying this we believe that the problem of the lack of managerial understanding stated by the Gartner report and emerging research (Sholo 2011, Jourdan et al 2008) can begin to be explored. To explore this we use a sensemaking theoretical framework. To analyse this we draw on a framework from knowledge management research and apply it to an inductive case study. The following section summarises the sensemaking approach, introduces the framework and then we conclude with analysis and discussion for future research.

2. BACKGROUND

According to Weick (1995), "The concept of sensemaking is well named because, literally, it means the making of sense. Active agents construct sensible ... events" (p.4). Sensemaking seeks to explain how actors formulate logic (causal maps) to explain events that do not have an existing explanation or where current explanations do not provide enough 'sense'. Weick uses the term sensemaking to define how we comprehend situations that fail to make sense and how we use that process of comprehension to create action or 'enactment' (Kurtz and Snowden 2003; Weick 2007). Sensemaking is retrospective, this means finding an interpretation that is an adequate representation of the situation at hand.

Sensemaking is a term that has grown into common use in management and organisational literature in the past decade (Weick 2007) but less so in the information systems literature. In organisational literatures, the term sensemaking is used to explain the retrospective nature of implying causality to a complex situation through cognitive framing and judgement (Kaplan 2008). Weick (1993) highlights how sense making is often used to form routines, establish patterns of thinking and is often applied to situations where explanations are not readily available. Sense making is argued to be a process of judgement where an actor will create a perception and believe in it because the situation at hand needs meaning attached to it.

Rosa (2001) and Cohen, March and Olsen (1972) suggest that managers often have concepts in mind that they use or favour for complex problem solving. These concepts are often submerged mental images hidden within the reasoning process to surface during complex interactions. Kaplan's (2008) analysis of a strategic decision making process in which board members argued with one and other about how to solve a complex problem and wrestled through different 'contests' also shows how concepts play a pivotal role in organisational sensemaking. That is, the ideas we form or have buried deep within our consciousness create a platform that we later access and use for sense making. The personal patterns we form and then act on, argues Weick (2001), become organisational patterns which later surface and solidify in enacted 'environments'. To make sense of a complex situation is the act of putting a frame around a problem so we can live with the 'at hand' interpretation we have formed of it.

The person using BI is argued in the literature to be supporting and guiding the decision-making process (Vercellis 2009). To expand on the notion of decision-making, Shollo and Kautz (2010) explain BI as data, information, and knowledge as well as the supporting products, processes and technologies for making decisions based on intelligence. Part of acquiring of intelligence includes confronting difficult situations and learning how to create ways of interpreting data by the extraction of cues. Weick (1995, p.50) defines this as "… simple, familiar structures that are the seeds from which people develop a larger sense of what may be occurring…" BI literature presents the idea that decision-making involves an intelligence collection process (Christen, Boulding and Staelin 2009). Decision-making theory has a dominant model of interpretation (i.e. March 1993) that

suggests that decisions are bounded to the kind of rationality and information that's available. Weick (1995) calls sensemaking the activity of infusing an interpretive map over situations where no explanation is readily available. In a similar way, managers using BI extract meaning from the data to make sense of benchmarks, KPI and other analytical concerns.

Orlikowski (1992) and Orliksowski and Gash (1994) talk about the way in which actors frame and make sense of technology as being a process of subjective interaction with the material nature of information systems. Technology is argued to provide an interpretation of capability that frames and organises experiences for actors. A frame is the basis through which actors organise their experiences in order to effectively explain them (Goffman, 1974, p.30). These interpretative schemas (Giddens 1984) create a sense of on-going intersubjectivity, materiality and the essential characteristics of the influence of technology on how people interact with their work environments. BI falls into this category because its extension of the decision support tradition and subsequent development since (Sholo and Kautz 2010), places it's centrally into the area of decision-making. Secondly, BI is often used to help strategic managers make sense of performance through the extraction of KPI data. This data is central to the way in which BI literature represents managerial decision-making. Data is also often referred to in BI as 'unstructured' and researchers refer to BI as helping structure messy problems. As well being the recipient of data as an outcome of sensemaking, BI also forms the basis for managerial sensemaking. The diagram below demonstrates the dual patterns of sensemaking involved in BI:
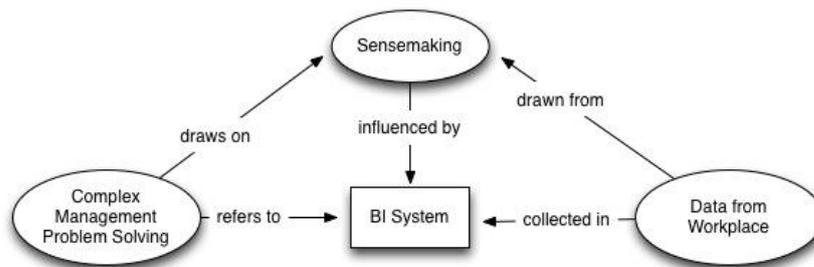

Figure 1 - Interactive relationship between layers of sensemaking and BI

The BI literature frames decision-making in much the same way as the decision-support literature does (Arnott and Pervan 2005) by suggesting that, as decision-support tool, BI is squarely focused on providing data for unstructured problems (Jourdan et al. 2008). This places BI as reference point for sensemaking and problem solving. Secondly, as data gets generated through work and computing use this also is collected into the BI systems for sensemaking. In order to analyse this further, we propose a sensemaking framework explained in the following section.

2.1   Framework for this analysis.

The earlier work of authors such as Orlikowski (1993) has been extended in a recently developed framework by Cecez-Kecmanovic (2004). This framework sought to extend understandings about knowledge management by adopt Weick's (1995) and Wiley's (1988) ideas of sensemaking. According to this view, sensemaking patterns can be: (see also Cecez-Kecmanovic and Jeram 2002):

1. Individual/Intrasubjective: through the ideas of the individual level of thoughts, ideas, intentionality and beliefs

2. Collective/Intersubjective: the web of meanings created through intentional social interaction

3. Structural/Generic subjectivity: the structure implied by a constructed social reality

4.   Culture/Extra subjective: the cultural environment of the organisation.

Cecez-Kecmanovic (2004) uses this framework to analyse knowledge management and there hasn't been much development of core topics since this model was first developed. As there is a clear need to develop social perspectives for BI as previous authors (Jourdan et al 2008) have demonstrated and given that the sensemaking literature is highly developed we propose that it would be a useful framework for analysis in this case. Also, given that BI has extended out of the decision support systems literature, that is based on concepts of rational choice theory (see March 1993, Little 1990), it provides a rich environment to study the interaction of human decision-making and intelligence gathering activities.

The aim of using this framework is to begin to develop the social context of BI and start the conversation about how complex social processes, such as sensemaking, influence BI use and development. To assist in this process we use this framework to analyse our data in order to structure our findings. In the following section we outline our method, the research setting, and process for data coding. This is followed by a discussion on our results.

3.   PROPOSED METHOD

The case study approach was followed because it was believed to be the most relevant for the research (Yin 1994, Stake 1995) because it helps to create theoretical insights into the problem at hand. In this research we can see that very little theoretical work has been done in social environments and BI, so we don't really know what kind of theory would be useful. Combine that with the current focus on technical concerns outlined early and an approach were insights can be gained for later studies, the case approach is an appropriate method in this instance. The literature argues the main aim of case study research is to generate insights that can be later used for theoretical testing (Eisenhardt and Graebner 2007). According to Yin (1994), case studies are not easy to generalise from and as such generate directions and potential for future research. The usual limitations for inductive case study work outlined in Eisenhardt (1989) and Yin (1994) apply.

3.1   *Organisational Setting*

Educo is a large mid-tier tertiary education institution that has about 45,000 students enrolled at any given time. The organisation is a large education provider operating in Queensland, an Australian state. It employs ten thousand staff (approximately) and turns over $430m (AUD) yearly. It was believed to be an appropriate organisation to study because of its technology strategy which includes a recent step to use business analytics and intelligence to complement strategies around continuous quality improvement.

The organisation is involved in three distinct areas of revenue generation: student tuition, research income and services. Because of the complexity of these activities it has to have effective systems that keep track of related issues such as expenditure, income, staffing and so on. The problem for Educo is that the organisation is structured according to a command and control type hierarchy. This generates silos of data collection that saw a proliferation of rogue (unsanctioned or feral) systems (author de-identified) across the organisation. This creates all kinds of headaches for management who are constantly trying to assess performance, keep track of expenditure and maintain a stable organisation. To combat these disparate systems, a move towards BI was sanctioned at the strategic level to create integration across the organisation for the purposes of strategic analysis and planning.

Key people involved with the BI process at Educo were selected and interviewed. Responses were used as the basis for interpretive data analysis and qualitative methodology that follows on from this section. At the time the interviews were conducted the organisation was rolling out a BI platform that was trying to integrate single data units from multiple sources. The purpose of this was to find areas of integration across the organisation to effectively mine the data and perform business analysis. However, as noted in the interview transcripts, it proved difficult to build these data units because of poor data structures. In spite of carefully planned governance, there was not effective management of data. Most units created their own data that never fed back

into the corporate system. In order to explain this we began interviewing people across the organisation to see if Weick's ideas about sense making and organisational routines could be found useful.

3.2   *On-going Data Collection*

In order to create validity of the data we employed triangulation of context. That is, we looked at three distinct organisational levels in our analysis. We began by interviewing the director of BI and then progressed to middle managers down to administrative staff levels. Eleven key staff were interviewed from a variety of technical and non-technical backgrounds and some were BI managers. Interview data was collected from a series of semi-structured interviews for formal recorded interviews and several unrecorded follow up interviews with members of the host organisation. Due to the requests of managers in the organisation the names and titles of staff have been changed. The organisation will hence be referred to as Educo.

Name	Role	Level
Rob	Software Engineer	Operational – lower levels
Maria	Adminstrative assistant	Operational – lower levels
Dean	Former Staff member	Senior – Upper levels
Mary	Personal Assistant (Executive	Operational – lower levels
David	BI Manager	Operational – Middle levels
Eric	Technology Manager	Operational – Middle levels
Clive	Technology Manager	Senior – Upper levels
Mark	2nd IT Manager (different division)	Operational – Middle levels
Helen	Enterprise Architect	Higher levels – Consultant
Cythnia and Michael	Former Employees	Operational – Administrative levels

Table 1 - Interviewees that were approached during the project

Data Analysis

Data was taken in the form of a series of semi-structured interviews conducted over a three-month period. Participants were asked a series of questions about their work and how they used data. Other that the semi-structured interviews, we took field notes, spent time in meetings, made use of archival data and followed up with key participants. We then employed a three-step coding process as outline in Miles and Huberman (1994) to come up with our findings.

4. Example Early Findings[1]

After analysing the transcripts work patterns that were established around cultural norms of behaviour that included computer use. We reached two broad conclusions. Firstly, individual sensemaking can provide barriers to collecting BI data and secondly, collective sensemaking around organisational routines can hinder BI data collection. To reach our conclusions we employed a three-phase coding process where we analysed qualitative data in accordance with the framework. Initially we found three consistent patterns from the Cecez-Kemanovic (2004) framework that emerged from the data.

1. Individual/Intersubjective patterns influenced the outcome of BI.

At this level we noticed that sensemaking about work either facilitated BI development or hindered it greatly. Several of the respondents indicated that they didn't actually understand the way in which work was undertaken. So in the absence of clear roles they made sense of their work by taking actions they deemed necessary to get the job done (see Weick 2010). In the background, the BI system was collecting data that was inaccurate because a lot of the time actors were creating informal patterns to workaround the system. In the following example the senior BI manager indicates that the system set for people to use is not trusted. We found the administrative staff often find ways to circumvent the system because they perceive it to be untrustworthy. The manager acknowledges that individuals do not trust the very data needed to make BI effective:

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[1] These are exemplars only. As this is a work in progress these cant be considered as valid.

"There's a lot of people who mistrust the human resources data … in the PeopleSoft [and] in the small system and the operational system. So I guess it's not so much an access issue … but getting the most correct or … getting clean data is sometimes a challenge." David, Senior BI Manager

An interesting challenge for this manager is knowing what BI data to collect, where to collect it and from whom to collect it. Note how individuals making sense of their own work create their own systems. They develop the sense and create the systems. In essence this data actually disappears because in this organisation, any data outside of the corporate framework is not actually collected:

"… we're meant to be the only BI area. Whether we are or not depends on those rogue elements who want to do it themselves… and in any organization you will probably going to get that. People who will set up their own reporting systems or their own spreadsheets... It happens everywhere. …there are probably some other people out there probably running their own systems." David, Senior BI Manager

People on the other end of the process, namely those involved in administration, expressed similar concerns as the manager above. In this way we can see that a brief example of how individual sensemaking dictates what kind of data is even available for collection. That is, if data used for intelligence gathering is collected by people who routinely use their own systems, then the BI effort will be hindered. An interesting finding here is that actors aren't even aware that their day to day problem solving routines and creation of systems, creates data that stops BI from being as effective as it could be.

2. Collective/Intersubjective and structural patterns influenced the outcome of BI

Our analysis revealed a pattern where sensemaking took place between the elements of the structure (discussed further in point 3). At the next layer we noticed, at least in our relatively small sample, that people it wasn't just individuals using informal systems to work around established processes. While the informal social network we noticed had more to do with pragmatic concerns than BI, it still played a role in the effectiveness of data collection. The governance structure of the organisation creates routine patterns for decision-making. A command and control type hierarchy means those who collect data down the bottom end of the hierarchy are more likely to do as they are instructed instead of wanting to interact with initiative with a newer more flexible organisational BI framework.

This raises an interesting problem with the framework we used for our analysis. Given the hierarchical nature of organisations, it would be easy to separate out and distinctly pattern sensemaking patterns as individual, collective and structural. But, as we went through the transcripts we noticed a couple of interesting things about collective and structural sensemaking. If an individual organises their 'sense' in a certain way because collective routines are ambiguous, then that sense *might* be a pervasive condition in the organisation. That is, more than one person could be doing it, it's now an informal sensemaking practice. It's individual and collective. We found it too hard to separate out elements into units of analysis in this way, and instead found layers of intersubjective sensemaking.

As noted in Klein and Hirschheim (1987), the interpretive perspective of information systems is about perceptions of what we think data is, creating the template for what we think we want our systems to be and the making of meaning. Another way of saying this is through the lens of sensemaking. We create the template for data collection from our individual and collective sensemaking experiences in the organisation. It would be easy to say that an individual can be separated out and their patterns analysed. Then what of the collective experiences of others? Are they following the same routines? If so, how many of them are interacting to reify the informal constructs of sensemaking in a collective fashion?

We noticed that the collective patterns of sensemaking appeared to be the result of a complicated set of elements. Firstly, that individual patterns shown above in point 1, were common amongst the people we interviewed. Secondly, that these patterns shuffled up to a broader sensemaking process, whether actors were cognisant or not, of ideas that formed informal collective intersubjective actions. Thirdly, the structural elements of the

organisation, its design and hierarchy, were inadvertently enforcing these patterns through controls, procedures and ambiguous role definitions. Moreover, the data the used to create BI projections and benchmarking for example, were based on formal data structures. This final point, shows how the interlocking patterns are difficult to study and isolate.

In the following quote, notice how both the systems, routines and patterns influence how this administrative assistant perceives the flow of data:

> "So we're always working with a batches work order and sometimes you've got one module that isn't talking to the other module successfully. [Data] has reciprocal effects somewhere else where you don't expect. So [for] example the students enrol, it gets fed through to the [learning management system] so all their course material shows up. If something doesn't work successfully in PeopleSoft it's not going to move through to the end. So provided it is working fine. It's perfect." Sally, Administrative Assistant.

The last sentence is an example of the kind of sense making that relate to the BI manager's thoughts about how hard it is to collect data. It's the interlocking patterns of sensemaking and structural complexity that make it so difficult. This administrative assistant finds the system changeable and cannot always access the data she needs to work successfully. This was a common response amongst those involved with the on-going activities. In the organisation, we noticed a great deal of workarounds or feral systems (Author de-identified) being used to meld different data streams together. When faced with data issues, instead of relying of intelligence, people were often creating their own by using spreadsheets or other types of systems. Part of this can be explained by the structural, collective and individual sensemaking patterns in the organisation. As confided to us, off the record by a BI manager, people are afraid to interact with new systems because it may get them in trouble. Even though our data didn't reveal many cultural patterns, it's clear that further analysis would reveal deeper patterns of cultural sensemaking that in turn create a complete relationship between the user and the aim of BI.

Note in the following quote the focus on the local purpose of the actor and the generation of new intelligence sources:

> "The main issue … is the fact that we all have these separate systems. I've got a Lotus Notes, CRM that I got built. So I need a database to know when I have spoken to a company. I … contact different people, where they got referred from so it's really, that's CRM. So I built that in Lotus Notes as a contact database." Marcie, Promotions Manager

When we took these concerns back to the Senior BI Manager his response was interesting, demonstrating conflicting processes of sensemaking in organisational routines and norms. To summarise, we asked him if external customer relationships were part of the data being collected. He first responded by indicating that BI and Educo were only focused on operational aspects. The interviewers felt this was strange given that external customer [i.e. students at Educo] relationships are form part of at least 50% of strategic initiatives at Educo.

When we asked for clarification he stated the following:

> "We are actually covering the entire structure. We're focused at this point in time on the key performance indicators as I say and they are primarily learning and teaching related and research related. So we have a number of key performance indicators that aren't in the strategic plan so our emphasis is across the university… We are reporting basically across the board. We're… meant to be the only BI area whether we are or not depends on those rogue elements who want to do it… People who will set up their own reporting systems or their own spreadsheets."

Patterns of interlocking sensemaking here are represented by the above statement. The manager refers to these 'rogue elements' as people reporting outside the system. As mentioned earlier, this is *necessary data* for effective BI design and use. Without it, the organisation is getting a misrepresentation of it's data against it's

projected KPI's (Key Performance Indicators). This means that decision-making is impacted and data quality is questionable.

In summary we noticed three layers of interlocking sensemaking: the individual making sense of their role and data use, the collective informal systems and finally the structural sensemaking implied by the hierarchy and organisational routine patterns across the organisation. While a great deal of this pointed towards organisational design problems at Educo, the close relationship between BI and organisational design here is worth mentioning. Why does the majority of BI literature focus on technical matters when it's so clearly interwined with social processes such as sensemaking and organisational rountines? It is impossible to divide technical and social matters in an organisation that has decided to use BI to measure its performance. At what point does the social end and the technical begin? The transcripts indicated that these patterns created problems for data gathering for BI because a great deal of the needed data was being maintained by 'rogue elements'. The only problem is that rogue elements are systemic and pervasive. Our research question is:

RQ: How does sensemaking influence BI based decision-making?

The short answer to that question is that interlocking patterns of sensemaking influence the efficacy of BI across two main areas. Firstly, that these patterns are interconnected and pervasive. This means they are impossible to separate out unless we can see the actor as being a 'rogue' who acts independently of the organisational and technical systems in question. Another answer to this could be that ambiguously defined routines that do not give appropriate access to much needed data present the BI system with a challenge: How can you rely on data you do not or cannot collect? If actors are in a situation where sense is needed, then the data they create that eventually winds up being measured against a strategic KPI will not be accurate. Secondly, if the data collected is not accurate, then strategic decision making stemming from the BI will be made on false assumptions. The result of that could be even more ambiguity for the people at organisations such as Educo. In summary, sensemaking influences BI because in the absence of clarity, people simply can't live without either an interpretation (See Goffman, 1974, p.30-35) or the data they *perceive* they need to accomplished their assigned tasks. This leads to some interesting questions for future research.

5. CONCLUSION

In conclusion, while sensitised notions of sensemaking have been useful in helping to understand and explain the complex BI processes in the Educo context but more research will need to be done to further explore these issues. This paper introduced ideas of sensemaking and found that interlocking patterns of sensemaking influenced the quality of data that came from a BI context. Future research should develop these concerns by extending the sensemaking concepts further and exploring the impact on BI data quality across multiple sites. By further developing ideas around sensemaking and BI richer insights into the problems we have introduced. This would further shed light on how complex social processes influence BI development and use.

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