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THE ARRIVAL OF A NEW ERA IN DATA PROCESSING – CAN 'BIG DATA' REALLY DELIVER VALUE TO ITS USERS: A MANAGERIAL FORECAST (29)

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The arrival of a new era in data processing – can 'big data' really deliver value to its users: A managerial forecast

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Abstract

There has been a huge amount of talk on the potential of using big data in organisation, making it a new buzzword and even a fad. However, some of the latest published material exposes the challenges involved in implementing BD (BD) approach, where the uncertainty surrounding its applications is rendering it ineffective. The paper looks at the mind-sets and perspective of executives and their plans for using BD for decision making. Our data collection involved interviewing senior executives from a number of world class organisations in order to determine their understanding of BD, its limitations and applications. By using the information gathered by this is used to analyse how well executives understand BD and how well organisations are ready to use it effectively for decision making. The aim is to provide a realistic outlook on the usefulness of this technology and help organisations to make suitable and realistic decisions on its investment.

1. Introduction

Professionals and academics are becoming increasingly interested in the field of big data (BD) and data analytics. Data collection was born as a result of the development of computer based database management systems. Companies invest heavily into acquiring data, and analysing it. More recently the focus has switched towards data available through the internet which appears to have brought about new data collection opportunities. As the smartphone market developed further, data sources extended to include those from mobile and sensor networks. Consequently, organisations started using the data and analysing it. Thus, the field of business intelligence emerged, which deals with gathering data, and analysing it to gain insights and use them to make decisions (Chen, et al., 2012).

BD is seem to have a huge immense potential to provide powerful information businesses. Accenture claims (2015) that organisations are extremely satisfied with their BD projects concerned with

enhancing their customer reach. Davenport (2006) has presented applications in which companies are using the power of data analytics to consistently predict behaviours and develop applications that enable them to unearth important yet difficult to see customer preferences, and evolve rapidly to generate revenues.

Therefore, that BD collection and analytics not only provide opportunities for organisation to gather useful insights into their business processes, but also understand customer behaviours and patterns. Indeed giant online corporations, such as, Amazon have already applied BD and analytics to transform organisations, reconstructing their fields respectively (Davenport, 2006). It seems from the literature review that with collection and 'crunching' (Davenport, 2006) BD, known as BD analytics provides companies with a virtually unbeatable competitive advantage. Indeed Davenport (2006) argues that using data analytics is absolutely necessary, as it provides virtually infinite ways of differentiating. Most companies use similar technologies, offer similar products, business process improvement and development, is a strong point of differentiation. This is definitely not where the opportunities in collecting, extracting and analysing data end. Companies are using BD to monitor anomalies in consumer behaviour identify fraudulent activities or thefts. Another interesting example that shows the potential of BD, is when the retail giant Target found out that a customer was pregnant, simply by using data analytics. Other applications that have already surfaced include customized applications for individual customers. Other applications that have been predicted by leading consultancy groups in the world suggest BD may also find application in changing organizations, and its stakeholders, and also forming new hypothesis, leading to newer experiments (Anderson & Rainie, 2012).

Therefore, BD and analytics, seem to hold valuable information that can impact the profitability of companies positively. Indeed over the last few years, the trend of using BD is increasingly moving from a tool to understand the market, to a toll to help make decisions. The modern market is more competitive than ever, and business environment is changing fast. In this scenario using data analytics is becoming essential, as differentiation becomes essential. But, to succeed in competing by adapting and transforming organizations is essential. Therefore, data analytics has also caught the interest of business executives, who can use it to make organisational decisions (Davenport, 2006).

In context of decision making, BI and BD and analytics can be considered to be similar (Kowalczyk & Buxmann, 2014).With business intelligence being at the core of decision making, it seems that the organisations looking to capture, crunch and use BD need to focus on revamping their business intelligence systems. That's how they will have access to the tools, technologies, and apps to get

maximum benefit out of it. Therefore it is pertinent that we focus on the role of BD on organisational life from top management perspective.

1.1. The Challenges of Implementing BD to Improve Organisational Performance

Literature points towards humongous potential that BD has when it comes to making business successful and profitable, which indicates its importance. However, it does not mean that professionals agree with its potential. Both case studies and surveys, that have been presented above provide a summary of potential of BD in both improving commercial performance of companies and also building a competitive advantage. However, both case studies and surveys also present many challenges that form necessary obstacles that need to be overcome if organisations need to use BD effectively. Not only that, but also how executives plan to tackle these obstacles would definitely impact the users and how they made decisions and used BD.

As mentioned before, the origins of business intelligence are digital databases, and originally data analytics were gathering, extracting and processing data from these digital databases. The next big revolution in business intelligence came with the internet. This increased the sphere, as well as variety of data availability, and also gave rise to web-based business intelligence and analytics. The latest revolution in this field is due to extensive use of mobile technologies, and also interconnection of many devices. Because of this, the variety of data gathered would increase, as well as the amount of data collected, which points out to why it's called 'BD'. The data gathered would become more complex, but also provide many more possibilities (Chen, et al., 2012).

Therefore BD represents data that huge is size, and comes from various sources. Recognising the definition of BD in literature indicates that data would not only increase rapidly in size, but also in variety. As the cost connecting devices goes down, the number of devices, or contraptions, would increase. However, in practice the understanding of BD might be limited. For example, a survey of executives recognises that BD is data that is huge in size and requires advanced techniques for analysis (Accenture, 2016). The definitions in theory and practice might be similar, as they both reflect the variety and complexity of BD. However, the practical implications might be different. For example, an organisation that only believes that BD requires advance analytical techniques, might overlook the fact that data that they previously thought to be irrelevant, such as data from video conferences. Thus, the definition used by organisations would impact what kind of BD would be used for decision making.

Furthermore, especially in context of using BD for decision making, implementing BD analytics for decision making might be a mistake in itself. This is because data simply refers to records of any

transactions that happened. Information on the other hand is data that has the capability of making an impact on the person who receives it. How information makes an impact on the receiver, which is the executive decision maker, is dependent on their underlying mind sets, and beliefs (Davenport & Prusak, 1998). Therefore, decision making is essentially intuitive, and also dependant on the intuition of the executives. Besides, there is a chance that organisations would assume that data analytics give the right insight, and may try to apply the same analytics in all scenarios and not customise it (Anderson & Rainie, 2012). A study of US manufacturers that have used BD and analytics to try to find performance measurement metrics has concluded that data driven analytics cannot replace designing experiments based on hypothesis, and then testing, and rebuilding along the way (Apgar, 2013).

Apparently, not only the mind sets of decision makers would impact what BD is used and also how it used, but also reaction of the society in general is important as well. With virtual networks of contraptions, content and people, privacy is also another concern. With so much data gathered from so many sources, there might be information available in the virtual networks, such as internet, which people might not want to share (Anderson & Rainie, 2012). This concern perhaps might be important in how the field of BD is shaped in the future.

Other than the impact of the feeling and reaction of the society about BD, the guardians of the data, the managers of the systems, and the analysts would be the most important assets of a company, as their mind sets would guide the extraction, analysis, use and implementation of BD (Anderson & Rainie, 2012). This also seems to point out to the fact that, the best predictors or effectiveness of BD are also perhaps the executives that have used BD in the past, and are going to use it.

Indeed, the existing literature on BD and its application in business intelligence is also based on practical experiences of practitioners, and takes it into account strongly. For example, Chen et al. (2012) compiled a list of key research opportunities that have emerged as BD collection evolves from data gathered and shared by networks of computers to that by network of interconnected devices. Even technical research in the field of data analytics is based on practical insights. For example, a research aimed at understanding how information for decision making is processed in context of BD. To make the research reliable interviews of practitioners at in BD field were utilised. This is because these practitioners are part of the decision process and understand the requirements of data and information in the context of the decision they are making (Kowalczyk & Buxmann, 2014). This is also why Accenture based its report about potential and challenges of BD, based it on the surveys and interviews of executives from giant corporations.

Using the same principle, this paper would use the opinions of executive to explore the awareness of BD in organisations, and their beliefs regarding what gaps BD can fill in decision making. This paper will also be unique, as it would not focus on how the field of BD analytics would be shaped in the future. Most of the research now, which deals with the applications of BD and analytics, is retrospective in nature. Therefore, they only describe how organisations have already used BD in decision making process, and not what they are aiming to do with it. Chen et al. (2012) compiled a list of emerging research fields in BD and analytics. This list was based on the papers published in to academic journals relating to BD and business intelligence. A report by Accenture, the leading IT services consultancy in the world, conducted a survey to understand interviewed executives to find out how they have used BD in the past improve performance. Davenport (2006) compiled case studies of successful implementation of data analytics to showcase potential of BD in transforming organisational decision making and improve performance.

Also, the future outlook of BD is mostly listed in the challenges that the field faces. A survey of executives involved with BD initiatives in giant corporations lists how the organisations have already implemented BD and what challenges do they foresee (Accenture). Similarly a paper describing upcoming research trends related to applications of BD, is quite vast. It describes emerging trends based on applications of BD, such as data collection and analytics, and also based on different fields, such as, e-commerce and healthcare. However, it is based on the challenges that these fields are facing and what kind of applications can help solve these problems (Chen, et al., 2012). This is certainly helpful, as most of the opportunities of development are based on challenges faced by businesses.

2. Methodology

Based on the literature review, perhaps the most important point, at least from the point of view of this paper, is that ultimately the humans would still be the most critical factor in successful and beneficial use of BD. The guardians of the data, the managers of the systems, and the analysts would be the most important assets of a company, as their mind sets would guide the extraction, analysis, use and implementation of BD (Anderson & Rainie, 2012). Therefore, the best source of insights and opinions are those of practitioners. Hence this research aimed to explore the perspectives of executives on usefulness of BD, to uncover what the future trends and limitation of it. The focus would be on those trends and limitations, which executives anticipate to impact business intelligence and define strategic

decision making. In this context, the executive information officers and practitioners who work directly with executive information officers were interviewed.

2.1. Research Design

As mentioned above, this research takes into account the subjective opinions and mind-sets of executives. Therefore the research philosophy is interpretive (Saunders, et al., 2012). In this care the research aims at exploring the "subjective and socially constructed reality" (Saunders, et al., 2012) of BD and data analytics and its applications. In this context a qualitative research provides the required insight. This is because for this type of research there should be an in-depth understanding of meanings of participant's actions and opinions. The two categories of research methods that can be used are qualitative and quantitative methods. Quantitative methods use numbers and mathematics to categorise and also analyse the results, while qualitative methods are record opinions of people in an organisation. As this research aims at understanding the mind-sets and believes, qualitative data collection, is enough for this purpose.

2.2. Questionnaire

To prepare the questionnaire secondary data was explored during literature review. The secondary data was taken from peer reviewed published research as well as reports by leading consultancies and research organisations. Subsequently, the questions formulated and the corresponding literary source are presented in the table below.

Question/Inquiry	Literature Source
What is BD to you *[BD Definition]*	(Accenture, 2016), (Chen, et al., 2012), (McAfee, et al., 2012), (Anderson & Rainie, 2012)
Which areas of business hold biggest gains for BD? *[Applications of BD in Decision Making]*	(Davenport, 2006), (Anderson & Rainie, 2012), (Accenture, 2016)
What factors influence you the most in deciding the appropriate business intelligence and data systems for decision making? *[Applications of BD in Decision Making]*	(Davenport, 2006), (Davenport & Prusak, 1998), (Kowalczyk & Buxmann, 2014), (McAfee, et al., 2012), (Press, 2014)
In what way would data and information influence your and your team's decision making most profoundly? *[Impact of BD on Decision Making]*	(Davenport, 2006), (Davenport & Prusak, 1998), (Kowalczyk & Buxmann, 2014), (McAfee, et al., 2012), (Press, 2014)
How would you transfer and record implicit information *[Managing the influence of Human Bias]*	(Kowalczyk & Buxmann, 2014), (Davenport & Prusak, 1998)

What factors would determine the effective use of BD? *[Applications of BD in Decision Making]*	(Anderson & Rainie, 2012)
What are the privacy concerns regarding data? What are other ethical concerns *[BD ethical issues and data protection]*	(Anderson & Rainie, 2012)

Table 1: Questions for the Executive Interviews

The detailed reasoning about selecting the questions, and their formulation is discussed in the next section.

2.3. Key Findings from Secondary Data Serving as a Source for the Questions

As evident from above stated information BD has huge potential in helping companies making better decisions. The successful companies are moving towards using systems that can go beyond basic statistical comparisons and predict behaviours (Davenport, 2006). Thus, the time for simple statistical comparisons is past, and future trend is based on BD based information systems that can actually learn and adapt with customers.

The success of prediction systems is dependent on various factors. The first is what kind of data must be uncovered and analysed in order to perform accurate predictions. To do that organisations need to understand what is BD, in order to be able to battle identify and deploy it. If companies are able to do it, they can also use it to track and analyse events, customer behaviours and impacts of their decision in ways that were never possible to be seen (Davenport & Prusak, 1998).

Indeed there is a possibility that the gap between definitions exists. A report based on interviews of executives by consulting giant Accenture indicated that generally BD is defined as data that is large in size and requires advanced techniques for analysis (Press, 2014). A broader definitions used in literature describes BD in three aspects (McAfee, et al., 2012)

- BD is humongous is size (volume). The amount of data currently available on the internet is more than on billions of shelves filled with text, and is rapidly increasing.
- BD is created and accessed rapidly, so companies can respond faster and be more agile (velocity).
- BD comes from various source, such as, the message boards, sensors, location indicators, and even digital video and audio (variety).

As mentioned in the introduction the definition of BD in literature classifies BD in three dimensions of velocity, variety and volume, while the practitioners' definition depends on the applications. Several reports indicate that CEOs and executives realise that BD is complex and requires advanced analysis techniques (Accenture, 2016). Executives have recently seen data collected from various interconnected devices, such as, sensors and actuators. Thus data collected would not only represent new types of information that could be used for decision making, but also include new points of interaction, which would mean that more can be seen into the system then was possible before (Anderson & Rainie, 2012).

Thus how BD is defined seems to also show in how BD might impact business intelligence systems. It also entails the type of expertise that needs to be developed. As mentioned before, technologically it means systems need to be develop that can predict outcomes of decisions and behaviours. However, business intelligence systems are still limited by the human capacity of those using them. BD is inherently huge in size and, especially with the introduction interconnected devices, complex. In order to use it, is has to be utilised, which means that new tools, systems, as well human skill and capacity needs to be developed. Indeed there is a risk that the data would surpass the available expertise, and might remain unutilised or underutilised (Andersson & Rainie). So, there would definitely be a need of building that expertise, and this could be another important trend that would impact the development of business intelligence systems.

Most of organisational decisions utilising BD and analytics have been related to finding new markets to expand into, or identify new customer needs to develop new products (Accenture, How). Organisations that have been highly successful with utilising BD have used it to understand customer behaviours to develop potential new products/services as well as well new potential clients. However, companies have also used BD to build new processes, or improve processes (Davenport, 200). As BD evolves, new applications also seem to emerge. This would definitely impact business intelligence systems, and also the scope of decisions that could be made.

With BD, decision making seems to be moving towards evidence based decision making from. The human aspect of business intelligence systems, also means that the assumptions and biases would impact decision making. Therefore, ultimately the analysis might be prone to distortion by the mind-sets and assumptions of the analysis and decision maker. Furthermore, there is a chance that some practitioners might distort information to present their own point of view (Andersson & Rainie). Organisations are therefore expected to formulate strategies to make fact based decisions, rather than

opinion based decisions. This would impact parts of business intelligence systems that focus on displaying information for analysis.

2.4. Choice of Sample & Research Limitation

To take part in this research, the interviewees had to either be executive decision makers, directly working with the business intelligence systems. Thus executive information officers, and people working with them directly were selected. However, participants did not have any particular requirement regarding the field of work. In fact, participants were selected randomly, and the sample that was used contained participants from various fields.

The choice of the sample would result in accurate data about the mind-sets and opinions of executives, and people they work with. The participants replied to questions during face to face interviews, telephonic interviews and also written replies to questions sent via email. To ensure accuracy, and honest recording and replication of the data, the calls and face-to-face interviews were recorded.

Furthermore, not limiting the selection of interviewees to a particular field meant that the core value of BD that was common across different fields of applications could be identified. Also, the research explores the link between cognitive decision making process and BD. Therefore, the detail of technology, and the artificial intelligence (AI) technology deployed for collection and analysis of BD was not the focus of this research.

The above premise are key in determining the limitations of this research. Firstly, the research aims at identifying and evaluating the core value of BD, which is common across all fields of applications of BD and industries where it is deployed. Furthermore, the research does identify and evaluate issues that might be specific to a certain industry, certain application of BD or a certain AI deployed for big data analytics.

Based on the research strategy, participants were shortlisted and contacted. The contact was made through former industry contacts, LinkedIn and also the educational institution. The final participant list is as follows

Participant Name	Short Description
Marc Van Den Burg	IT director of Tilburg University in Netherlands
Prateek Gandhi	BD consultant who has worked with large corporations, such as Samsung, for developing Customer Relationship Management (CRM) software
Jalal Ashayeri	Academic Director of TIAS Business School and a consultant who has worked with giant multinational corporations, such as Nokia and Philips
Lex Hager	Former Big Data Strategy Consultant at Accenture
Nadeem Asif	Head of IT Strategy, Architecture and Data at Provident Financial Management Services, United Kingdom
Mohammed Khan	Chief information officer (CIO) of General Electric (GE) Capital, United Kingdom

Table 2: Details of Participants/interviewees

3. Results

Interviewees were asked the questions presented in table 1 and their responses were collected, summarised and tabulated in a matrix. The responses were analysed to look at the understanding of BD by decision makers and what gaps in decision making do executives expect to fulfil with BD. Furthermore, the awareness of concepts and their ideas about limitations regarding use of BD and strategies to utilise it for decision making were also noted. The analysis revealed the insights provided in the paragraphs:

3.1. Digital Data that is Complex & Unconventional

Participants recognised that BD is complex and digital, and identified two major characteristics that determined what kind of business intelligence systems they were pursuing. Firstly, BD is unconventional data that comes from different, interconnected sources. Marc Van Den Burg, the IT director of Tilburg University in Netherlands, quoted that the possibility of collecting data from unconventional sources, such as sensors and video cameras, provides immense opportunities. It is now possible to track movements and visuals, and therefore, observe behaviours that could never be sourced before. Thus in the future BD would move beyond the conventional quantitative data and include qualitative data as well. The source of this data can be internal systems deployed by the company, and also external systems that may be owned by other entities.

Secondly, BD is also data within the organisation that was never collected before. It could be offline databases. Professor Ashayeri is the Academic Director of TIAS Business School and a consultant who has worked with giant multinational corporations, such as Nokia and Philips. According to him, BD also includes data from internal management systems, which were not integrated with business intelligence systems. This distinction is important because it means that decision makers now have access to previously invisible information. Thus, they can now get a fresh perspective and make better and variegated decisions.

From the opinions of experts and executives mentioned above, it was seen that generally professionals recognise the importance of using data that was usually buried deep inside organisational information systems, and giving decision makers access to it. However, while executives did recognise the importance of data from unconventional sources, the importance was emphasised usually only by executives with a higher focus on applications of data, then on implementation of the systems.

3.2. Past Experience as a Source of Application

The executives who were interviewed identified many applications of BD analytics that included generating more revenue, monitoring performance of business by identifying key performance indicators (KPIs), and developing new process, or revamp existing processes. However, the experiences are based on past experiences. Lex Hager, a consultant at Accenture, recalled helping customers, which include large multi-national corporations to develop processes and improve existing processes. Dr. Mattias Axelsson, the deputy research director, identified applications of BD product and service development. When these executives were asked about the potential applications they see in the future, they mostly were uncertain.

However, not all executives were uncertain though. Professor Ashayeri stated that based on what is happening in the environment, business would need to evolve their analytical capacities, and also how well they can use data analytics. Marc van den Burg, IT director of Tilburg University, Netherlands, provided some exciting insights. He pointed out towards the potential of using data gathered for a different application and using it to get insight for a completely irrelevant application. This, according to him, is a tested and proven method to get new perspectives and insights. Lex Hager of Accenture echoed his words, and identified it as a major application coming up. Ultimately in both cases the source of information was past experiences of executives. Furthermore, the newness of the field, and uncertainty in applications was seen across the board with all interviews.

3.3. Intelligent Data Collection Platforms

Identification of possibility of collecting and processing data from unconventional sources, and the immense insights that the previously invisible sources hide, has prompted companies to develop business intelligence systems that collect this data and presents them for decision making. Mohammed Khan, chief information officer of General Electric (GE) Capital, United Kingdom, disclosed that the company keeps investing in new business intelligence systems, and when it comes to BD the recent focus has been on consolidating data from enterprise level for integrated processing. Asif Nadeem, head of IT Strategy, Architecture and Data at Provident Financial Management Services, United Kingdom, have recently started developing single customer view, a business intelligence system that consolidates and represents complete data about customers at one place.

However, organisations are not only focusing on collecting data from within the organisation but also outside of the organisation. The next generation business intelligence systems, according to Professor Ashayeri, would automatically search for relevant external data. This points' towards a trend of business intelligence systems that provide access to a global pool of data. The systems doing that would come in two forms. Open systems would provide open public access to data, while closed systems would provide access to private data, owned by the enterprise. For example, Microsoft's azure provides its users access to all data available in databases owned by Microsoft.

Ultimately, what organisations would choose would depend how data from these sources could be integrated with systems, how easy is it to maintain these systems, and what is the value of investment. For example a company that believes in crowdsourcing, that is, to release organisational information to public, in order to generate ideas.

Lex from Accenture, however, warns against relying on this method blindly. He believes that not determining the organisational requirement, would probably be a huge financial and operational burden. It is important to start small and then scale from here. A business intelligence system is successful only if it answers the questions of the decision makers, and it is important to focus on the question. Professor Ashayeri also had similar opinion, and cited examples of his work with Nokia, and how they started first with making a template of question before moving towards choosing what business intelligence system to implement.

3.4. Building Competitive Advantage

Prateek Gandhi, a BD consultant who has worked with large corporations, such as Samsung, insists that ultimately the purpose of using business intelligence is to increase revenues, profitability or both. By inspecting other responses it seems that Mr. Gandhi is right, but using BD provides opportunities to do it in variety of ways. Mr. Khan of GE, and Mr. Asif of Provident have identified applications of BD in effective risk management, and also management of operations.

It seems that ultimately organizations can use to BD to explore, monitor and control various elements of the organization, ultimately develop a competitive advantage that can help them stay ahead of competitors, and generate profits. Mr. Marc of Tilburg University, stated that the competitive advantage could simply be in the form of having access to data before the competitors and built expertise, before they catch up.

3.5. Faster Decision Making

Using BD based business intelligence systems can enable executives to observe systems (both qualitatively and quantitatively) and have access to data on a single platform. This would enable decision makers to have access data they need to validate their rationale. Thus BD based business intelligence systems should also be mobile and be able to provide access to information on the go, and faster. This, according to Professor Ashayeri an important factor that determines successful implementation of BD for decision making.

3.6. Developing the Capabilities Now and in the Future

The focus on unconventional sources and unified data collection and representation platforms entails a requirement to process this data and use it. Experts have identified that organisations not only need to build analytical skills in employees but also deploy systems that can do the analysis and present information. According to Lex Hager, a former consultant at Accenture, a leading IT consultancy recognised that clients recently are highly interested in self-learning systems. These systems are able to learn based on hit-and-trail, and therefore have the ability to not only analyse but also improve analysis with experience. Whether human or computer system, more and more data that was previously seen to be unrelated would be combined and processed. For example, customer's calling log to GPS data of the car to understand where the most calls are made, or email data to determine the closeness between colleagues.

However, as it will be clarified in the next heading, regardless of companies opting for machine learning based capability development, or human based capability development, humans, particularly the decisions maker would again be the most important factor in the process. Furthermore, the systems would also evolve over time. Professor Ashayeri of TIAS Business School, in fact predicted that BD based business intelligence systems, like all products in the market would finally fall into the commodity phase of product life-cycle, and downgrade to openly available decision support systems. Marc, the IT director of Tilburg University also pointed out to the open access movement, which would eventually allow people to do their own analytics. With such amount of uncertainty, an open and curious mind seems to be a very valuable asset. Marc van den Burg insisted that ultimately data is only useful for hypothesis testing. This view was echoed by professionals by recognising that data only answers questions, which professionals come up with.

3.7. Keeping Track of the Bias

Regardless of type of business intelligence system used, and the share of technological and human aspects within the system, how BD is used for decision making is still governed by the underlying assumptions and biases. From the interviews it seems that human biases are present in the form of preference of certain types of data. According to Mr. Gandhi, the biases are based on the experiences. For example a digital marketer would always consider number of clicks as an important data, but it might be useless in other aspects. The digital bias, seems to be present in the form of how data is placed.

Thus a trend to capture the ‘narrative’ of the decision rationale is seen among decision maker. The narrative captures not only the rationale but also the background information regarding the experiences and biases of decision maker. By having multi-disciplinary team, these narratives can be discussed and elaborated further. For the system biases, ‘template’ based approach is seen, which records the specifics of choosing a certain choice of data and method of display to explicitly record the biases and assumptions of the system.

Therefore, he results have revealed two key findings emerged, which not only provide insight about the awareness of BD in organisations, but also provide understanding of executives about BD and its applications to decision making. The executives understand BD to be complex, and its sources to be unconventional. Consequently, they can describe some strategies for using BD for decision making.

However, they recognise that new applications would keep on emerging, and would also evolve as the business environment evolves.

Consequently, it seems companies are implementing systems now that ensure organisation wide data is accessible to decision makers. In this context, the cost of implementation of the business intelligence systems, including cost of maintenance and upgrades, and return on investment turned out to be the most important factors effecting the selection of business intelligence systems. Regarding the strategies for using BD, executives seem to recognise the idea of BD collected for another application, and combine it for previously seemingly unrelated applications.

4. Conclusion

According to executives, BD seems to provide opportunity for decision makers to discover perspectives that were unknown before, and look at problems in the light of these new, previously impossible to discover perspectives. Thus, decision makers would like to use the data to look evaluate their decisions, and thus make strong, accurate decisions faster than competitors.

In this context, decision makers recognise that it is important to compare data that is seemingly unrelated to each other, and get new insights. They also recognise the importance of using unconventional data sources, such as sensors tracking movement in a virtual court, and cameras tracking movement of eyes in while customers look at shelves at a supermarket. The executive information officers also recognise that cost of implementing and operating a business intelligence system, and return for investment is essential.

From interviews it was also discovered that executives, both decision makers and information officers and consultants working with them, believe that it is important to first determine what questions the organisation requires to be answered by BD. They believe it is more effective to that first, rather than starting to collect data first.

It seems that the strategy of combining and comparing seemingly unrelated data and setting the requirements before selecting a business intelligence system, seemed to be in conflict. This is because executives have recognised that there will always be assumptions underlying the reasoning and rationale behind using certain data. In this case executives would ultimately be guided by their own assumptions about which unrelated data sets have the potential to be related to each other. Since, the

source of ideas of executives seems to be already successful implementations of BD analytics, it also implies that there is a chance that their ideas might not be good, as a strategy successful in one organisation might fail in another.

4.1. Organisation Using BD Effectively: An Agile Organisation

In a seemingly right move, organisations do seem to move in the right direction. Some are looking to deploy unconventional data sources, such as video cameras and movement tracking sensors, while others are trying to bring all the data buried deep in the organisations into single platform, through which it is readily accessible to decision makers. Executives also recognise the cost of business intelligence systems and return of investments as important factors when it comes to implementing business intelligence systems. Furthermore, executives also recognise the important role that implicit assumptions play in decision making, and the thus the importance of recording and surfacing underlying assumptions.

Based on above, and risks mentioned in the previous section, organisations need to develop agile business intelligence and decision making structures. This way they can take calculated risks, and test new strategies with small, bearable loss of capital and time. When it comes to implementing business intelligence systems, agile capabilities are needed to be developed. Fortunately, it is possible to deploy systems, with ability to evolve with respect to gathering data from within organisation as well as outside of organisations, and also with respect to applications and analytical capabilities.

4.2. Limitations of Research & Future Research Recommendations

In this research the opinions of executive decision makers about effectiveness and limitations of BD by executives were explored. However, executives from different industries were selected. Therefore, the research covered various fields, and industries, and investigated the objectives on a general level. It would be interesting to see how individual industries are implementing BD into decision making. By using this executive opinions and future plans regarding BD in individual industries can be explored, giving a specialised view. Furthermore, the research does not go into specific details about how external BD enters the hierarchies of systems, and effects the data and information processing systems in organisations. In the same context it could be seen how data enters hierarchies of systems in a specific industry. Furthermore, the above recommendations can also be explored with reference to the

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