

BUSINESS INTELLIGENCE, BUSINESS ANALYTICS, AND INTELLECTUAL CAPITAL: AN OPPORTUNITY FOR INNOVATION POTENTIAL IN THE PRIVATE HEALTHCARE?

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Abstract: This paper looks upon the role of business intelligence (BI), business analytics (BA), and intellectual capital (IC) in managerial decision-making in the private healthcare sector in Finland, and scrutinizes the potential for innovation, enabled by BI/BA as a function and think it's value creation in organizations. The study was conducted by qualitative research methods with inductive approach using semi-structured, thematic interviews. The study scrutinizes the managerial insight of BI and BA and the tools' use in data-driven value creation, also contemplating the potential for organizational operation, both from private healthcare and consulting companies' point of view, enabling the management of the private healthcare sector to utilize the whole potential and best practices. Two practical outcomes of the study are: it will provide information and understanding on the managerial aspect of BI/BA area in the Finnish private healthcare sector companies and show its potential for innovation.


1 INTRODUCTION


Finnish private health care sector has been changing during recent years; a need for data-driven management and decision-making especially at the organizational level has emerged (Ratia and Myllärniemi 2017; Bates et al. 2014, Stewart et al. 2016). The phrase 'data-driven' is seen in various contexts, from strategy to concrete operational approach. The decision-making may generally be divided into strategic decisions, conducted by the top management, and operational level, where the decision-making concerns the everyday operations. The latter is done by operational business managers and alike. The role of business intelligence (BI) and business analytics (BA) in decision-making logically varies between the organizations case-specifically. Value of BI/BA can be generated on different value creation levels, where the significance of BI/BA is linked to the value created with these actions (Ratia and Myllärniemi 2017; Ratia et al. 2017). At its best, value creation may

mean innovating, e.g. new business openings based on the findings and interpretations of the data.

According to the study the healthcare sector benefits from innovations, not only clinical ones but also regarding the cost effectivity and efficiency of the entire healthcare system, with technology playing a vital role (Omachonu and Einspruch 2010). Although the utilization of BI/BA and tools may be considered as IT-infrastructure change, a successful BI/BA renewal requires managerial commitment and absorptive capacity (Foshay and Kuziemsy 2014; Isik et al. 2011). The data driven approach is strongly related to the intellectual capital's (IC) role in value creation, its acknowledgement is one crucial driver for organizational performance (Ratia 2018; Hussinki et al. 2017). Continuous development of operational approaches, technologies, and infrastructures, such as BI/BA, can be considered as one of the roles of managing IC. Using the IC enables continuous data creation in the organizational systems, which requires management of human, social, and structural capital within this ecosystem (Secundo et al. 2017; Ratia and Myllärniemi

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2018). Similarly, the well-functioning infrastructures and managerial approach are essential (Helander et al. 2022).

The purpose of this paper is to point out the role of BI/BA and IC in managerial decision-making with an example of the private healthcare sector organizations. Secondary goal is to show their connection to organizational value creation and innovation. IC may be regarded as a driver of BI/BA utilization, and thus data-driven value creation (Ratia 2018). Moreover, the notion is close to claim that the more IC-components are involved, the more value can be generated. Combined BI/BA and IC may contribute to creating new business opportunities (Ratia et al. 2018).

This study combines IC and BI/BA used in the organizational data-driven decision-making and researching the potential of innovation. By analysing the value creation factors in terms of BI/BA and IC in the private healthcare industry sector, the study brings understanding of the factors affecting the value creation potential of innovations. The practical outcome will provide information for practitioners of BI/BA and IC in organizational decision-making, also showing the potential of them in creating innovations. The generalizability of the findings needs closer scrutiny.

First the paper presents conceptual basis for BI/BA and IC. The Walter et al.'s (2001) model for value creation along with a theoretical discussion on knowledge-based innovation in the private healthcare is introduced. Followed by empirical setting, the methodology and the empirical material showing the results of knowledge-based innovation potential and data-driven value creation in the Finnish private healthcare sector. Future avenues for research are proposed and the conclusions and discussion are presented in the end.

2 BI CREATING VALUE AND INNOVATION POTENTIAL

2.1 Business Intelligence?

A manager needs data. Organizational decision-making is to be based on data and knowledge of the organizations operation and environment. For this, the operation requires decision-making support tools, i. e. information systems, such as business intelligence, to enable data-driven decision-making in the organization (Bolloju et al. 2002). This includes e. g. financial information, cost evaluation and performance evaluation (Bose 2003). Even if decision-making is based on data, there is an interactive knowledge

management process, requiring knowledge-sharing between decision-makers and data providers (Wang and Wang 2008). The effects of such initiatives are different for various groups, which requires recognizing the issues (Hellsten and Pekkola 2020).

To understand business analytics (BA), one needs to understand the concept of business intelligence (BI). In research literature, BI is often described being multidimensional having several definitions with similar features. There are some differences in the description of BI. For instance, Turban et al. (2008) identifies BI to be a concept combining different tools, applications, and methods. A review by Nykänen et al. (2016) introduces the technological and the processual approaches to BI. Lönnqvist et al. (2006) suggest that BI has many similar concepts, e.g. competitive intelligence, market intelligence, customer intelligence, strategic intelligence, and data analytics. These may have minor discrepancies between them. In summary, it can be identified as being a selection of techniques, practices, methodologies, and applications to analyse critical business data to enable better business decisions (Côte-Real et al. 2014; Nykänen et al. 2016).

However, the traditional concept of BI is facing changes as new methods and concepts, e.g. big data and machine learning, emerge. In research as well as among practitioners. Business intelligence, business analytics and big data have been recently used interchangeably (Ratia and Myllärniemi 2018; Trieu 2017; Wang et al. 2016). BI and related concepts, such as business analytics, may effect positively on business performance (Ratia and Myllärniemi 2018; Kakhki and Palvia 2016). Data processing capabilities require tools to enable knowledge and value creation to the organization (Jinpon et al. 2011). As of the most novel approach of BA, the value generating difference to their previous versions is being accumulated by timely access to data, real time analysis and visual or storytelling presentation of required information (Ratia and Myllärniemi 2018; Popovič 2017). BA-tools are ranked among the most important technologies by chief information officers (Yeoh and Popovič 2015, Visinescu et al. 2016). The predominant approach in the healthcare BA research is concentrating on the clinical side and less on managerial aspects.

2.2 Intellectual Capital in value creation

Seems that BA utilization can generate more value in organization the more IC components are used in

the value production (Ratia et al. 2018). IC components are important in data-driven decision-making (Ratia 2018). The literature identifies Intellectual Capital (IC) as a multilateral concept, hard to define, as there are several perspectives on the topic and no precise definition. To understand the role of IC in discussion, we introduce Secundo et al.'s (2017) four stages of IC evolution. The first two stages of IC focus on the awareness of IC and acknowledging its potential in creating competitive advantage in organizations and its meaning for strategic management and measurement of its efficiency (Secundo et al. 2017; Petty and Guthrie 2000; Ratia and Myllärniemi 2018). As the third stage of IC evolution, IC is introduced as a dynamic system of intangible assets, where the focus is on the interactions between IC components and managerial activities (Secundo et al. 2017; Guthrie et al. 2012; Silvestri and Veltri 2011; Ratia and Myllärniemi 2018). The fourth stage of IC evolution introduces a broader perspective of IC, focusing on the ecosystems, where knowledge can be created on a wider scale (Secundo et al. 2017; Dumay and Garanina 2013; Ratia and Myllärniemi). Focusing on the new social aspects, where human, relational, and structural capital are being combined into a new view of IC. A view with focus on performance of IC in networks. The knowledge flow goes beyond traditional boundaries of relational capital and where there exists a knowledge flow between networks (Secundo et al. 2017; Guthrie et al. 2012; Dumay and Garanina 2013; Borin and Donato 2015; Edvinsson and Lin 2012; Edvinsson and Lin 2009). Intellectual capital is considered to be an essential part of organizational value creation (e.g. Secundo et al. 2017; Moustaghfir and Schiuma 2013; Ratia et al. 2018).

The concepts of value and value creation are brought up in business discussions (Ojala and Helander 2014; Ratia and Myllärniemi 2017). The extended concept of value is a trade-off between benefits and sacrifices (e.g. Ojala and Helander 2014; Hugos et al. 2011; Ratia and Myllärniemi 2017), which can be tangibles or primary, for example enhanced performance and resource utilization, or being intangible or secondary, such as competence, market position, social rewards, time, effort and energy (e.g. Walter et al. 2001; Ojala et al. 2014; Myllärniemi and Helander 2012; Hagen et al. 2006; Nordgren 2009; Ratia and Myllärniemi 2017). Modified Walter et al.'s (2001) function-oriented value analysis is used to point out the BA-tools' role in value creation as a basis of our analysis (Ratia and Myllärniemi 2017; Myllärniemi and Helander 2012; Walter et al. 2001). IC and value functions frameworks support the suggestion of Secundo et al. (2017), that value creation is

the main objective for incorporating BA approach into organisational IC strategy. Furthermore, the role of IC is to enable continuous development of approaches, technologies, and infrastructures to enable data creation in the organizational IC ecosystem, requiring management of human, social, and structural capital, or IC components within this ecosystem (Secundo et al. 2017; Ratia and Myllärniemi 2018).

2.3. Knowledge-based innovation

An ongoing competition and growth of information has forced organizations to reconsider their competitive edge and value creation capacity. (Lerro et al. 2014). As a concept, innovation within economic and managerial fields can be considered multilateral. Even though innovation is a complex combination of different conceptualizations, the literature agrees about innovation having an origin in newness and change. There has been an ongoing debate about the meaning, location and nature of newness and change (e.g. Lerro et al. 2014; Damanpour, 1992; Becker and Whisler, 1967). One of the first definitions of innovation was a new combination of productive resources or recombining existing capabilities and resources (Moustaghfir and Schiuma 2013; Schumpeter 1934; Pennings and Hariato 1992). Innovation can be seen as organizations searching out for new resources or discovering on how to utilize the existing resources in a new way. One perspective is that innovation is formed of organizations enhancing knowledge sharing and generating economic value through co-creation (Lerro et al. 2014; Galunic and Rodan 1998; Miles et al. 2009). IC components in BA utilization can provide organization an opportunity to grow its' ability to create value and potential for innovation (Ratia et al. 2018).

When it comes to technology, technical resources and knowledge may also have a positive impact on technical innovation (Lerro et al. 2014; Damanpour 1991). Companies are developing their technological capabilities to be able to improve their efficiency and innovativeness through new methods of knowledge flow and data gathering (Santoro et al. 2017; Del Giudice and Straub 2011; Del Giudice and Della Peruta 2016). For example, the private healthcare organizations are implementing BA-tools, to enable increased efficiency in their organizational performance (Ratia and Myllärniemi 2017). Research is often concentrating on the internal resources, rarely combining internal and external knowledge. Combination of internal and external data was considered to be an element enhancing organizational decision-making and creating potential for innovation (Ratia 2018). Knowledge-

based view is often suggested to explain innovation processes, especially open innovations, where internal and external resources are combined to create new products and services (Santoro et al. 2017; Vanhaverbeke and Cloudt 2014; Ferreras-Méndez et al. 2016).

3 RESEARCH SETTING

The aim of this research is to understand the role of IC and BA in managerial decision-making in the Finnish private healthcare sector organizations, and to examine, what is the potential of BA-tools in creating potential for innovations, and thus value. The research was conducted by using qualitative research methods and a case study research strategy which is suitable for studying complex and context-dependent research topics as it provides better explanations and deeper understanding on the research questions as well as enables the adjusted questions and gather more information (Yin, 2003). In addition, flexible semi-structured interview allows information gathering to be conducted effectively and conveniently (Qu and Dumay 2011).

The private healthcare case companies, that were participating in the research, have business activities in the dental, social, and health care. Furthermore, among companies involved were Finnish and international companies having an office in Finland. To identify the relevant companies and to analyze of their suitability for this study both the private health care and the consulting, open-source documentation about the companies' background was gathered. The semi-structured thematic interviews were conducted as face-to-face interviews, skype-interviews, and phone interviews. The interview discussions were recorded and transcribed to enable systematic organizing and analysing the gathered data (McLellan et al. 2003).

The interviewees were executives and top managers mainly from ICT (information and communication technology) or financial organizational functions, chosen on a basis of their area of responsibility for Business Intelligence within their organization. Ten thematic semi-structured interviews were conducted. The thematic interviews included issues e.g. what are the benefits of BA-tools utilization, how they use BA in decision-making and how BA is used in management.

In addition, twenty technology and management consultants were chosen to be interviewed. The approach was semi-structured, thematic interviews. The discussive interviews included issues e.g. what value

do BA tools bring to the private healthcare and whether is BA being a part of the strategy

One private healthcare company was chosen for deeper case study. The approach was to study different organizational levels and BA from their perspective. The study was conducted with semi-structured, thematic interviews. The four interviewees of private healthcare organization were business and finance directors as well as representative of controlling function. The gathered data was analysed and classified according to the interview themes in the first round. In the second analysis round the identified classes were further integrated by using the theoretical framework of value creation as the analysis lens. In chapter 4.1. we present our results by answering to the interview themes based on the analysis round one. In chapter 4.2. we analyse the result with Walter et al's framework, based on the second round of the analysis round.

4 RESULTS AND IMPLICATIONS

4.1 The role of BA-tools in data-driven decision-making

The thematic interviews among the private healthcare companies' were centred around the benefits of BA tools utilization, how they use BA in decision-making and how BA is used in management. All the private healthcare companies participating in the research shared that there were significant benefits of BA. The benefits varied from seeking for efficiency and enhancing business operations to data-driven decision-making and creating new products. Competitive advantage was also mentioned as a value creating factor. Utilization of BA on decision-making was considered to be divided into operative decision-making and higher-level decision-making. BA was clearly the tool for both operative and managerial decision-making. Operative BA concentrates mainly on following specific KPI's (key performance indicator) and actions based on the data. On managerial level, the focus was more on monthly reporting and as a strategic management tool. The operative daily or weekly data-driven decision making was considered more tangible and data-driven management was clearly still in a development stage in many of the organizations, even though there is a strong will to continue towards an enhanced data-driven management.

The interviews among technology and management consultants discussed the value BA tools bring to the private healthcare and whether BA is a part of

the management strategy. Among the consultants, efficiency was considered an important value adding factor, e.g. optimizing business and operational processes, and forecasting. Data-driven, or evidence-based decision-making, timely access to business-critical information and efficient utilization of organizational intellectual capital (IC) were considered to bring value. The actual value was a larger question than just BA-tools, more as a whole combination of IC dimensions. Modern BA solutions are able to reduce the dependency of ICT function and heavy specifications in advance, e.g. different information for ad-hoc decision-making can be gathered in real-time. Sometimes the value is created together with other angles of digitalization, e.g. business process automation or RPA (robotic process automation). Social co-creation of BA was also considered valuable, as they create the potential for innovation. Utilization of external data and combining it to existing data was seen as an asset, as it could create new business opportunities. Some criticism appeared, mainly focusing on the fact that BA-tools themselves do not bring value, but the actual BA and understanding data, business and KPI's that are being measured. BA is not always included as a part of the management strategy, sometimes it is a part of a larger digitalization strategy. Sometimes the link to the strategic level is weak, even though a strong link between strategy and BA are strengthening both.

The interviewed healthcare company reported seeking for operational excellence. Understanding customers' needs and understanding own resources were considered to bring value. Utilization of BA in business-critical decision-making was considered valuable. BA as a process and concept was seen to bring value to customers by creating new products, services, and business concepts, and enhancing efficiency in current ones. Also data-based product and service innovations are being created, especially in digital services and platforms. These innovations are being co-created together with customers. The aim is to bring value by providing overall care relationship and health management rather than single healthcare services, again aiming for more holistic solutions. The value of being able to predict the future (as good as it goes), planning for new actions, and looking forward was clearly stated. BA is an important part of operational management throughout the organization, also in forecasting and new business development. All the operative management is based on either actual reporting or forecasting. Finding anomalies in the business processes was considered as part of data-driven management. BA is a ground for all decision-making.

4.2 Data-driven value creation: an innovation potential

More knowledge about managerial practices is still needed. Healthcare organizations could use BA to create value. The identified value creation functions of BA-tool utilization from the empirical data is shown by applying modified framework of Walter et al. (2001) (below). The modifications to the findings are based on earlier research of the healthcare sector (Myllärniemi and Helander 2012) and private healthcare sector (Ratia and Myllärniemi 2017). The benefits of BA-tool utilization were collected, analysed, and used in Table 1. to point out the direct and indirect value functions of BA utilization.

Table 1: Direct and indirect BA-tool utilization value functions and their measurement in the private healthcare sector (based on Walter et al. 2001, Myllärniemi et al. 2012 and Ratia and Myllärniemi 2017).

Value function	Description of the function	Measurement examples for private healthcare sector
DIRECT		
Profit	Performance and efficiency	<ul style="list-style-type: none"> - Seeking for efficiency - Enhancing business operations - <i>New products and services when commercialized</i> - <i>Utilization of organizational IC</i>
Volume	Scalability	<ul style="list-style-type: none"> - Scalability of decision-making - Resource optimization
Safeguard	Reliability of data	<ul style="list-style-type: none"> - Data-driven decision-making - Timely and accurate data - Reducing dependency of ICT functions - Spotting anomalies in business performance
INDIRECT		
Market	Market position	<ul style="list-style-type: none"> - Competitive advantage on the market - Understanding customer needs and the market
Innovation	Creating new business opportunities	<ul style="list-style-type: none"> - Creating new products and services - Social co-creation of BA - Efficient utilization of external data sources and combining with organizational data - Overall care relationship, co-created with the customers, health management
Scout	Creating value through data	<ul style="list-style-type: none"> - External data sources creating new market knowledge

The function-oriented value analysis enables the identification the kind of value that can be co-created in the private healthcare organizations by utilizing BA-tools. The analysis of the value functions revealed that organizations aim for efficiency and improving their business. When commercialized, new products and services could bring direct value. Utilization of organizational IC can be direct value creating factor in some cases.

Also other direct value bringing functions were in the key role, e.g. scalability of decision-making, data-driven decision-making, quality of data, reducing dependencies and quality of business process or performance. As indirect value creation, the main examples were position on the market, and social co-creation of BA together with stakeholders as well as co-creation of new products and services together with customers to achieve overall care relationship or to enable health management as a service.

Furthermore, it is not surprising, that a business organization is seeking for improved performance and optimization of resources etc. thus more profitable business. Through indirect value functions private healthcare organizations aim to find new and innovative ways to create value. For example, creating new products and services together with customers, and health management as a service. Nevertheless, this value function model helps us to understand the activities and functions that create value in the private healthcare sector.

The value creation, utilizing BA-tools in the private healthcare sector, can be seen multifunctional. As a classification for BA-tools value creation, we used modified direct and indirect value functions and their measurement -model (Walter et al. 2001; Myllärniemi et al. 2012). The value creation generated by efficient BA utilization and data-driven approach in decision-making and creation of new products and services are the key factors when building competitive advantage on the private healthcare sector. The most significant elements in value creation in the private healthcare sector can be considered to be co-creation of new products and services and health management as a service.

5 DISCUSSION

This paper introduces a novel approach to discussion of the impact of business analytics (BA) derived from business intelligence and BA-tools to the role of BA and IC in managerial decision-making in the private healthcare sector organizations, and the potential of BA and BA-tools in creating innovation potential and value. The healthcare is facing changes and challenges all over the world, not only having a pressure for improving performance, but also in utilizing their data more efficiently (Ratia and Myllärniemi 2017). The utilization of BA and tools could be considered as one of the ways to improve the efficiency (Ratia and Myllärniemi 2017; Nykänen et al. 2016; Malmi 1999). We analysed the direct and indirect value functions of BA utilization, to gain better understanding

of the managerial decision-making and value brought by innovation potential in the context of the private healthcare in Finland.

The study showed several significant benefits of BA utilization. The benefits varied from efficiency and enhancing business operations to data-driven decision-making and creating new products. Utilization of BA in decision-making was divided into operative decision-making and higher-level management decision-making. BA created value for the organizations, optimizing business and operational processes, data-driven or evidence-based decision-making, timely access to business-critical information and efficient utilization of organizational IC. Social co-creation of BA and new products and services together with customers and health management as a service were clear value adding functions. The actual value was seen to be a larger question than just BA-tools or the direct benefits. Some criticism appeared pointing out that BA-tools themselves do not bring value, but rather understanding of the data and business. They may or may not bring actual value. As a result, the target is to bring value not only by data-driven decision-making, but also by providing better understanding of the big picture and whole care relationship and health care instead of individual healthcare services.

There are two practical outcomes of this study. Firstly, this study will provide deep understanding on the managerial aspect of BA tool utilization in the Finnish private healthcare sector companies. Secondly, this study will provide information on what are the value creating factors that BA and tools provide to create potential for innovation. This study will help the consulting companies to understand how they can support the business and managerial decision-making in the private healthcare sector organizations. This also helps the private healthcare companies to discover their potential of value creation in utilizing BA and tools. As to the generalizability of the findings, we assume that similar findings will appear in other environments as well, but this needs more attention before any conclusions are made. To get deeper view on this issue, we need to gather more empirical data from the private healthcare organizations, from different organizational levels. We need to research more of the required capabilities for BA-tool, especially from the vendors perspective, to be able to point out specific tool requirements and functional features that are essential for the private healthcare sector to gain deeper understanding of factors having impact on value creation (Ratia et al. 2017; Brandão et al. 2016).

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