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A framework for big data integration within the strategic management process based on a balanced scorecard methodology

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ABSTRACT The purpose of this research is to study the impact of big data initiatives on strategic management processes. While the majority of strategic management disciplines have had research dedicated to the use of strategic management theories to understand how big data affect organizational performance, the body of research on big data lacks academic work capable of examining how to integrate big data into the strategic management process. The main contributions of this work are: (1) it highlights the strategic use of big data; (2) it analyses the main frameworks/models proposed by scholars that support the use of big data as a strategic management tool, and outlines this research gap; and (3) it proposes a new framework that integrates big data within the strategic management process based on a balanced scorecard methodology.

KEYWORDS Balanced scorecard, big data, big data analytics, big data framework, business intelligence, strategic management, strategic management process

1. INTRODUCTION

Big data (BD) is considered a key corporate asset (Court, 2015; Polese, Troisi, Grimaldi, & Romeo, 2019). The decision-making process was redefined in order to incorporate the new strategic effect of BD concepts (Polese, Troisi, Grimaldi, & Romeo, 2019). BD has become a source for innovation (Soon, Lee & Boursier, 2016) and competitive advantage (Shan, Luo, Zhou & Wei, 2018) by transforming decision-making and leading to new strategic models (Davenport, 2014; Walls & Barnard, 2020). Moreover, strategic theorists raise the need to understand how BD influences functional decisions within organizations, in order to respond to new market innovated products and the new shape of digital markets (Mazzei, & Noble, 2020).

Two drivers were identified in the course of evaluating the decision-making process effectiveness using BD: the consideration of data as a strategic asset, and the needed operational skills to implement a BD business-oriented model. Hence, big data analytics (BDA) is the main player in the decision-making processes (Polese, Troisi, Grimaldi, & Romeo, 2019). Furthermore, Bischof et al. (2016) argue that BD still represents, for a large number of companies, a tool that can enhance their reporting and monitoring capabilities. For a limited number of companies, BD represents an opportunity to create an innovative business model. In the latter case, BD is integrated within the company's structure, processes, infrastructure, technologies and mainly the corporate strategy (Bischof, Gabriel, Rabel, & Wilfinger, 2016; Mazzei & Noble, 2017).

However, although BD efforts were focused on infrastructure, tools and technologies, many researchers highlighted the need to tackle the strategic incorporation of BD technological

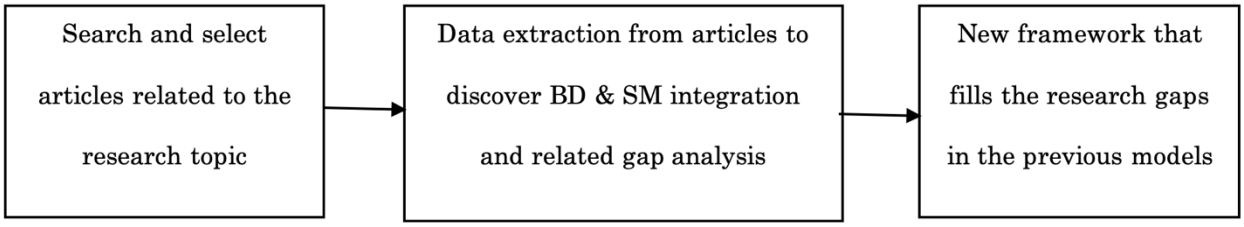


Figure 1 Steps for this study's semi-systematic literature.

developments and the link between BD and strategic management (SM) (Falsarella, Jannuzzi, & Sugahara, 2017; Mikalef, Pappas, Giannakos, Krogstie, Lekakos, 2016).

While BD technologies have been developing rapidly, academic research on the integration of BD with SM is still in its infancy (Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019; Mikalef, Pappas, Giannakos, Krogstie, Lekakos, 2016; Lin & Kunnathur, 2019; Shams, & Solima, 2019; Wang, Kung, & Byrd, 2018). Polese et al. (2019) argue that the strategic use of BD in the organization strategy can be implemented through the integration of related processes and technological architectures. Moreover, BD affects organizational culture; it converts firms to become data and evidence-based organizations (Braganza, Brooks, Nepelski, Ali & Moro, 2017).

Hence, considering the importance of SM to better understand the implications of BD in an organizational context, the lack of a SM framework that integrates BD to improve corporate strategy process, and the emerging role of BD as a tool for corporate innovation and transformation, the research question that guides this work is: how can BD be integrated within the SM process to guide organizations to improve their competitive advantage?

Thus, in light of this, the main goal of this study is to provide a framework that fills the research gaps in the previous models and integrates BD within the SM process.

This work is inspired by previous related studies tackling the strategic use of business intelligence (BI) and BD, including Alnoukari & Hanano (2017), Holmlund et al. (2020) and Wheelen & Hunger (2008).

The remainder of this paper is organized as follows. The next section looks at the fundamentals of BD and SM. Then a section discusses in details some of the latest academic research that highlights the use of BD with SM. Thereafter, the next section provides an overview of the frameworks/models that support the use of BD as a SM tool. Then, the paper proposes a framework named "BD-BSC" that integrates BD within the SM process based on a balanced scorecard methodology. The final section ends this paper with some concluding remarks and future work.

2. RESEARCH METHOD

This study reviews literature on BD and SM processes, and analyses how BD tools and techniques can be integrated into the SM process. The research method adopted was a semi-systematic literature review, as this approach is suitable for emerging topics such as BD. The main purpose of the semi-systematic literature review is to provide an overview of the research area, as the research questions can be broad, the research strategy may or may not be systematic, and the analysis and evaluation phase can be quantitative or qualitative (Snyder, 2019). This study uses this approach to evaluate the literature on the use of BD with SM, to understand this topic in a comprehensive perspective, and to discover the research gaps on this topic. The three steps of our literature review are presented in Figure 1.

The first step was the definition of the research question as presented in Section 1. Based on the research question, the search and selection for articles was conducted based on the recent related studies' findings.

The second step was to conduct an in-depth reading and analysis of the papers to identify the contributions and the gaps for future research.

The third and last step was to suggest a new framework that fills the research gaps in the previous models and to provide a detailed description for each stage.

3. THEORETICAL BACKGROUND

3.1 Big Data

With the data explosion coming from clicks, sensors, and technological innovations, new fields become more and more necessary, especially in BD, and Internet of Things (IoT) (Alnoukari, 2020-a; Mazzei & Noble, 2020; Porter & Heppelmann, 2014; Shin, 2016).

Every person is currently considered a "data generator" and organizations become "information processors" (Mazzei & Noble, 2020). Bischof et al. (2016) argue that BD is a key technological component that can provide the basis for smart product. The key benefit of BD is that a high volume of very diverse data can be processed at a high speed (Bischof, Gabriel, Rabel, & Wilfinger, 2016). However, BD is currently generating more data than organizations are able to manage, store and analyze (Walls & Barnard, 2020).

Moving from 3 Vs into 5 Vs, and finally 7 Vs, our work updates the definition of Fosso Wamba et al. (2015) of BD to incorporate all of the 7 Vs as follows: "BD is a holistic approach to manage, process and analyze the 7 V's (i.e., volume, variety, velocity, veracity, value, valence, and variability) in order to create actionable insights for sustained value delivery, measuring performance, establishing competitive advantages, and becoming a source of innovation." (Alnoukari, 2020-b).

Mazzei & Noble (2020) argue that BD, with its capabilities in collecting, handling, analyzing and presenting huge amount of data, will be an evitable source for achieving and sustaining competitive advantages. However, BD can be seen as an extension to business intelligence and business analytics (Mazzei & Noble, 2020). Bischof et al. (2016) argue that BD is not a single technological set that can be bought off the shelf. It is a wide range of technological components that in combination can provide the 7Vs' characteristics.

According to Sadovskyi et al. (2014), most scholars agree that BD enables organizations to create entirely new innovative products, and new business models. They also agree on the fact that BD helps achieving competitive advantages. Suoniemi et al. (2017) noted that BD technologies provide the ability to generate customer insight that was not previously possible. Furthermore, by analyzing fine-grained data and identifying the subtle trends and patterns in the individual customer behavior and attitudes, BD is able to provide firms with the ability to understand their customers individually, in real time, rather than segmenting them demographically. Moreover, Lin & Kunnathur (2019) argue that BD facilitates sensing by identifying market requirements and opportunities, then develops seizing by transforming these requirements and opportunities into innovative products and services, and finally supports reconfiguring by leading the organizational transformation into BD-driven firms and reorganizing firm's resources and competencies to maintain a competitive advantage over competitors.

The main constraint facing companies when applying BD analysis is the high volume of data collected from internal and external sources that can exceed the capacity of the company storage and tools (Polese, Troisi, Grimaldi, & Romeo, 2019).

BDA is defined as an innovative approach to deliver sustained value (Xie, Wu, Xiao & Hu; 2016), and enable competitive advantage by managing and analyzing the 5 Vs that are BD related dimensions (volume, variety, velocity, veracity, and value) (Fosso Wamba, Gunasekaran, Akter, Ren, Ji-fan, Dubey, & Childe, 2017). BDA allows firms to manage and analyze strategy through a data lens (Fosso Wamba, Gunasekaran, Akter, Ren, Ji-fan, Dubey, & Childe, 2017). Holmlund et al. (2020) argue that BDA are the approaches, tools, and methods that can help organizations to develop insights from BD initiatives in order to improve firms' decision-making. Hence, BDA provides the organizations the ability to gain considerable value and competitive advantage. According to Walls & Barnard (2020), insights provided by BDA can improve the efficiency of the whole organization operations, as well as the strategy. From a marketing point of view, Saidali et al. (2019) argue that classical data analytics are unable to acquire valuable business insights. They propose combining BDA and classical marketing analytics in order to gain valuable and real time insights, thus improve the marketing decision-making process (Saidali, Rahich, Tabaa, & Medouri, 2019).

3.2 Strategic Management

A strategy is a fundamental framework through which an organization can maintain its continuity in the market, and maintain its adaptability to environment changes to gain competitive advantages (Fries, 2006; Porter, 1996; Teece, Pisano & Shuen, 1997). Traditionally, strategy can be seen as a coherent and integrative view for decision-making, or a long-term objective with action plans and priorities for the corporate resource allocation (Wells, 1998). It can also be seen as a response to external opportunities, threats, internal weaknesses and strengths. It can be also seen as a logical system that differentiates between managerial tasks at the different corporate levels: corporate, business and functional (Global Intelligence Alliance, 2004).

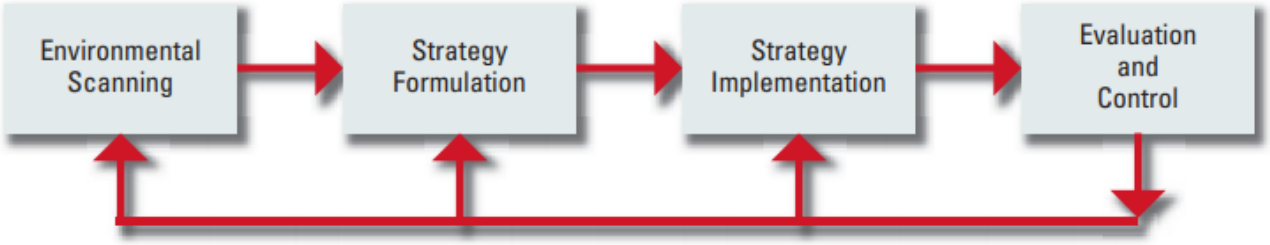


Figure 2 Basic elements of the strategic management process (Wheelen & Hunger, 2008).

Strategic management (SM) is a framework for decisions and actions that result in the formulation and implementation of plans to achieve a company's objectives and setting long-term directions (Alnoukari, 2009; Kruger, 2010; Fries, 2006; Omalaja & Eruola,2011). Porter (1996) summarizes the SM basic elements as a strategy process, a strategy content and a strategy context. These elements provide four essential steps for the SM process (Krishnakumar, 2015; Nedelea & Paun, 2009; Wheelen & Hunger, 2008) (Figure 2 & 3). Environmental scanning includes both internal and external scanning. Strategy formulation includes the corporate vision and mission, as well as the corporate objectives, strategies and policies. Strategy implementation drives the strategy into action (Krishnakumar, 2015; Nedelea & Paun, 2009; Wheelen & Hunger, 2008). Finally, the strategy carry out an evaluation and control, which monitors actual performance against desired performance, and the needed corrective actions (Wheelen & Hunger, 2008; Wells, 1998).

Balanced scorecard is an important managerial tool that helps organizations to articulate their strategy into actionable initiatives and projects (Alnoukari & Hanano, 2017). In addition, it provides the roadmap for strategy implementation, execution, and monitoring and control (Olszak, 2014).

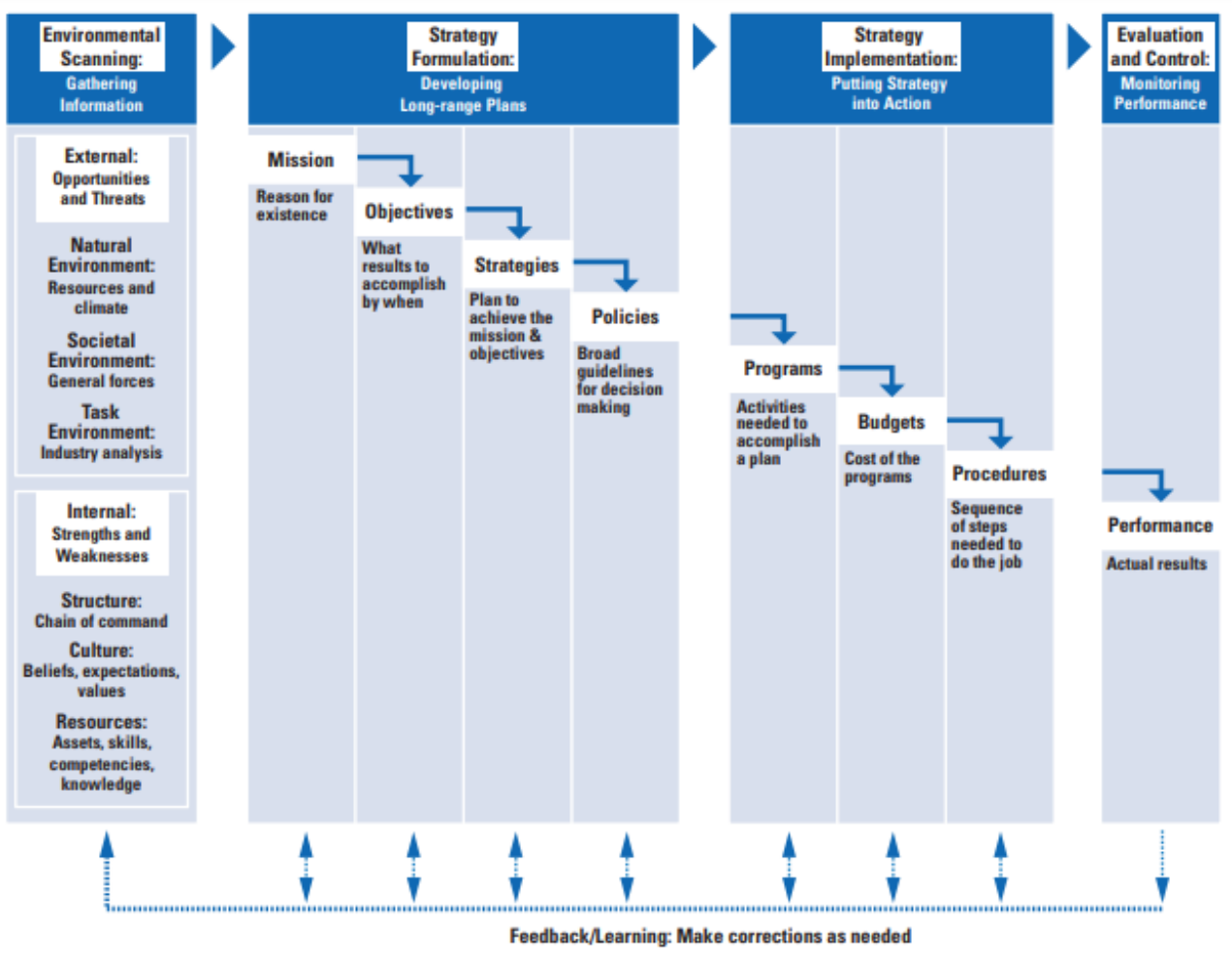


Figure 3 Strategic management model (Wheelen & Hunger, 2008).

Moreover, balanced scorecard helps top management indicating the right strategic decisions to be taken (Alnoukari & Hanano, 2017). According to Fries (2006), balanced scorecard translates corporate vision and strategy into action, information, and intelligence. Balanced scorecard considers that a corporation has four main perspectives (Kaplan, 2010): financial, customer, internal business process, and learning and growth. Financial measurements are the most important driving factors for top management to evaluate the company position in the market. Customer measurements including customer focus and satisfaction are used to evaluate the company image. Internal business process measurements allow managers to monitor and evaluate business processes and whether they cover all required and predefined customer needs. Employee learning and growth measurements are mainly used to evaluate the company commitment to its long-term strategy in terms of its human resources.

4. THE USE OF BIG DATA WITH STRATEGIC MANAGEMENT

There is a strong relationship between BD and SM (Şen, Körük, Serper, & Çalış Uslu, 2019). However, BD efforts are focused on infrastructure, tools and technologies (Mikalef, Pappas, Giannakos, Krogstie, Lekakos, 2016). According to Braganza et al. (2017), BD is more than a technology, and to be fully effective it should be incorporated into corporate strategy. Many researchers highlight the need to tackle the strategic incorporation of BD technological development, and the link between BD and SM theories (Mikalef, Pappas, Giannakos, Krogstie, Lekakos, 2016). Wang et al. (2018) address the lack of understanding the strategic implications of BD by examining the historical development, architectural design, and component functionalities of BD analytics.

New research confirms that BD will provide the opportunity to bring new theories and practices to organizational science and SM approaches. Furthermore, Mazzei, & Noble (2020) argue that strategy scholars need to comprehend and create new theoretical approaches in order to provide integration between corporate strategies and BD, and re-shaping strategic decision-making. Mikalef et al. (2016) argue that decision makers do not have not enough thoughts on how BD strategy could be adopted and implemented to drive their business strategies.

Polese et al. (2019) argue that the strategic use of BD in organizational strategy can be implemented by the integration of related processes and technological architectures. However, according to Bischof et al. (2016), technology, alone, is not sufficient to achieve a strategic impact that leads to a significant strategic performance. Organizational adoption is an important factor to drive the use of BD across the entire organization (Bischof, Gabriel, Rabel, & Wilfinger, 2016). Walls & Barnard (2020) argue that BD in the lens of SM is the capability needed in order to gain organizational performance. They further argue that BDA capability is becoming a SM tool that leads an organization to incorporate innovation into business. Hence, it can be considered a business model for both innovation and a driver for innovativeness, and should be aligned with business strategy (Walls & Barnard, 2020). Lin & Kunnathur (2019) argue that organizational strategic orientation represents firms' strategic willingness and preparedness. Strategic orientation is divided into market, entrepreneurial, and technology orientations (Lin & Kunnathur, 2019). Strategic orientation is shaped by the firm's organizational culture, as it is rooted in the firm's beliefs and values. Strategic orientations contribute to organizational performance (Lin & Kunnathur, 2019). Strategic literature recognizes that business strategy should be aligned with the organizational culture, core values, systems and processes, and resources and capabilities (Barchiesi & Fronzetti Colladon, 2019).

5. AN OVERVIEW OF THE FRAMEWORKS/MODELS THAT SUPPORT THE USE OF BIG DATA AS A STRATEGIC MANAGEMENT TOOL

In the following sub-sections, the paper provides an up-to-date overview about the frameworks/models that support the use of BD as a SM tool. The frameworks/models are presented according to their publishing year.

5.1 Strategic Framework for Customer Experience Insights

Holmlund et al. (2020) built a strategic framework for customer experience (CX) management based on CX insights generated from BDA. Their framework is based on four stages including backtracking: CX and CX data, CX analytics, CX insights and CX actions.

The CX and CX data stage is based on the touchpoints within and outside the organization's control in the digital, physical and social realms. The CX data generated ranges from highly structured CX data that can be represented numerically to highly unstructured CX data that is typically contained in hard-to-count formats such as multimedia data. Furthermore, CX data can be categorized into solicited and unsolicited forms, according to the touchpoint interactions evaluation.

The CX analytics stage is based on BDA used to analyze and interpret CX data. The CX analytics stage has four levels of analysis: descriptive, inquisitive (or diagnostic), predictive, and prescriptive.

The CX insights stage is classified into attitudinal/psychographic, behavioral, and market insights. Attitudinal/psychographic insights provide knowledge about satisfaction, advocacy, and valuable efforts by organizations. Behavioral insights help organizations with the knowledge about the behavioral aspects and consequences of the CX. Market insights are extremely valuable as they are related to the knowledge about organizational performance in terms of the CX in relation to the marketplace.

The Holmlund et al. (2020) framework is developed for data-driven organizations, thus their CX actions stage is related to organizations' capabilities that could be accomplished using BDA-enabled CX insights. The dynamic system of CX actions is related to touchpoint monitoring, prioritization, adaptation, and journey design. According to Holmlund et al. (2020), touchpoint journey monitoring actions use CX insight to collect a set of touchpoint performance indicators. For example, Finning, a Caterpillar dealer, has transformed from a traditional repair service to a provider of support for customers' machines through predictive and prescriptive BDA. CX insights enable Finning to track a machine's location, prevent premature failure, prolong service life, minimize downtime, increase operator efficiency, reduce the cost of repair, and recommend solutions. Touchpoint journey prioritization uses CX insights to allocate/reallocate human, technical and monetary resources to direct the development and maintenance of any touchpoint without redesigning the whole journey each time. Touchpoint journey adaptation relies on CX insights to generate suggestions to develop touchpoints. For example, Spotify, a streaming provider, created a personalized experience for each customer. Spotify capitalized on descriptive and predictive BDA to generate CX behavioral insights (i.e. knowledge on listening habits) and design highly personalized touchpoints. Spotify sent each customer a personalized email with information about their listening habits. These actions allowed Spotify to create personalized touchpoints in each customer's journey by generating custom playlists.

Touchpoint journey design uses CX insights to design potential journey offerings and distribute clear requirements across different organizational functions. For example, John Deere, an agricultural equipment manufacturer, capitalized on BDA and equipped its machines with sensors that allowed its customers to access and analyze their machine data, benchmarking it against other machines and combining it with historical data in real time and for free. Thus, John Deere introduced new touchpoint design that changed its customers' entire journey. Currently, the myJohnDeere.com platform is opened to suppliers, retailers, and software developers. John Deere transitioned from a manufacturing business model to a platform-centric model, and thus achieved innovation and revolutionized the agriculture industry.

5.2 A Framework for Business Process Data Management based on a Big Data Approach

Hassani & Gahnouchi (2017) proposed a framework for business process data management based on a BD approach. It intends to combine the two perspectives of business processes and BD. The main goal of this framework is to ensure business process improvement using BD.

In order to achieve the combination of business processes and BD, this framework provides the following fundamental steps. First, it starts with process (re)design based on BDA by modeling processes to clearly describe the business scenario, then it carries out process configuration with BD generation tools in order to customize the process with external information systems. Once the process has been designed and configured, it is deployed during the process execution. Process analytics is required after the process execution to analyze process functionality.

5.3 Conceptual Research Framework

The conceptual research framework is based on the resource-based view and dynamic capability view SM theories, and management information system literature (Mikalef, Pappas, Giannakos, Krogstie, Lekakos, 2016). The proposed framework provides managers and decision-makers with the basis on how to increase business value and competitive performance using BD and business analytics.

According to Mikalef et al. (2016), the IT resources including infrastructure, human skills and knowledge, relational resources and data must be put into directed initiatives in order to get a competitive edge. Hence, the firm must have the IT competencies to transform individual IT resources into IT-enabled dynamic capabilities that include sensing, learning, coordinating, integrating and reconfiguring. IT competencies are the sources used to transform BD IT resources into competitive assets. Thus, the conceptual research framework can help determining the business value of BD.

5.4 The Marketing Mix Framework for Big Data Management

Fan et al. (2015) proposed the marketing mix framework that relies on marketing intelligence. This framework identifies the data sources, methods and applications related to marketing's most important perspectives: people, product, place, price, and promotion.

The proposed framework provides guidelines for organizations aiming to apply marketing intelligence to meet their strategic marketing goals. This framework is based on the five marketing mix perspectives. The data is collected from various sources, then converted into actionable marketing knowledge using a variety of analytics methods, and finally utilized to support marketing intelligence applications. The data in this framework is collected using various methods including demographics, social networks, customer review, clickstream, product characteristics, product category, promotional data, transactional data, location-based services, and surveys. The methods utilized in the proposed framework are based on data mining including association, classification, clustering and regression. Different applications are applied according to each of the five marketing mix perspectives, including customer segmentation and profiling, product ontology and reputation, promotional marketing analysis and recommendation system, pricing strategy analysis and competitor analysis, and location-based advertising and community dynamic analysis. Product reputation management is a marketing intelligence tool that uses text-based reputation data from the web, in addition to the graphical images of products posted on the web. This tool is using an automated product ontology mining method that can build product ontologies based on textual descriptions of products extracted from social media. Then, these product ontologies can be used to support product reputation applications. Location-based advertising is an important marketing intelligence tool. It enables customers to get timely advertisements or product recommendations based on their current locations, and their future moves to other locations. Community dynamic analysis provides firms with the ability to predict their changing product preferences. As a result, firms can develop an effective marketing strategy based on the time and location dynamics of a group of their customers (Fan, Lau, & Zhao, 2015).

5.5 9S Framework

According to Lake & Drake (2014), the 9S framework (BD Wheel) helps firms and managers to understand the impact of BD on business. Furthermore, the 9S framework helps view the interplay between data and analytics from different technical and managerial strategic directions (Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019). Statistical thinking is at the center of the 9S wheel since it is the common perspective across all other aspects of BD. The remaining 8 Ss are strategy, structure, style, staff, synthesis, systems, sources, and security. Strategy and structure are tightly coupled to highlight the mutual impact of organizational structure on the organization's strategy (Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019).

5.6 Analytical Discussion

The Holmlund et al. (2020) strategic framework is based on CX insights generated from BDA. This framework includes four stages based on CX data: BD acquisition, BDA, BD insights and BD actions. Although the Holmlund et al. (2020) strategic framework was built for CX management, it can be applied to other types of applications as well. Hence, it can use any type of data including financial, talent and business process data. However,

Hassani & Gahnouchi's (2017) framework's intent is to analyze and improve business process functionality using BD. The Mikalef et al. (2020) framework's focus is to increase business value and competitive performance using BD and BDA. It highlights the mutual effects of IT competencies on organizational capabilities and business strategy. The Mikalef et al. (2016) framework helps determining the business value of BD. Fan et al. (2015) proposed a framework based on marketing mix and marketing intelligence. It can be considered a guideline for organizations aiming to apply marketing intelligence to meet their marketing strategic goals. This framework can be extended to use other types of data, and evaluate all their strategic goals including financial, talent and business processes. In the same vein, the 9S framework helps understanding the impact of BD on business. Moreover, it highlights the mutual impact of organizational structure on the organization's strategy (Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019).

Although all these frameworks support the use of BD as a SM tool, the main research gap in this domain is that they are unable to integrate BD within the SM process. This issue provides reason to suggest the BD-BSC framework that is described in the following section.

6. BD-BSC: A FRAMEWORK FOR INTEGRATING BIG DATA WITHIN THE STRATEGIC MANAGEMENT PROCESS

BD-BSC effectively integrates BD within the strategy development process. The main strategic themes are incorporated and improved in order to strengthen the organization's long-term success (Alnoukari & Hanano, 2017). This could be achieved when the strategic themes deliver greater values to customers at lower cost. When these themes are properly implemented, organizations could increase their profitability results. Therefore, strategic themes could be used to observe markets and competitors, and enable top management to continuously adjust their strategies when the environment changes (Alnoukari & Hanano, 2017).

The following sub-sections provide detailed description about our proposed BD-BSC framework (Figure 4). This framework is based on the SM model (Wheelen & Hunger, 2008) and BSC-BI framework (Alnoukari & Hanano, 2017). The BSC-BI framework was built to integrate business intelligence within the SM process (Alnoukari & Hanano, 2017). The BD-BSC framework follows the four main phases of the SM process: environmental scanning, strategy formulation, strategy implementation, and evaluation and control. The BD-BSC framework integrates the BD process's main stages including data acquisition, BD analytics and BD insights within the first phase to support environmental scanning and provide the four main inputs for balanced scorecard methodology, customer insights, financial insights, talent insights and business process insights. The BD-BSC framework includes a feedback/learning process. Arrows coming out of each stage of the framework take information to each of the previous stages. Framework users often must go back to revise or correct decisions made earlier (Wheelen & Hunger, 2008). For example, poor performance (as measured in evaluation and control) usually indicates that something has gone wrong with either strategy formulation or implementation. It could also mean that a key variable, such as a new competitor, was ignored during environmental scanning and assessment (Wheelen & Hunger, 2008).

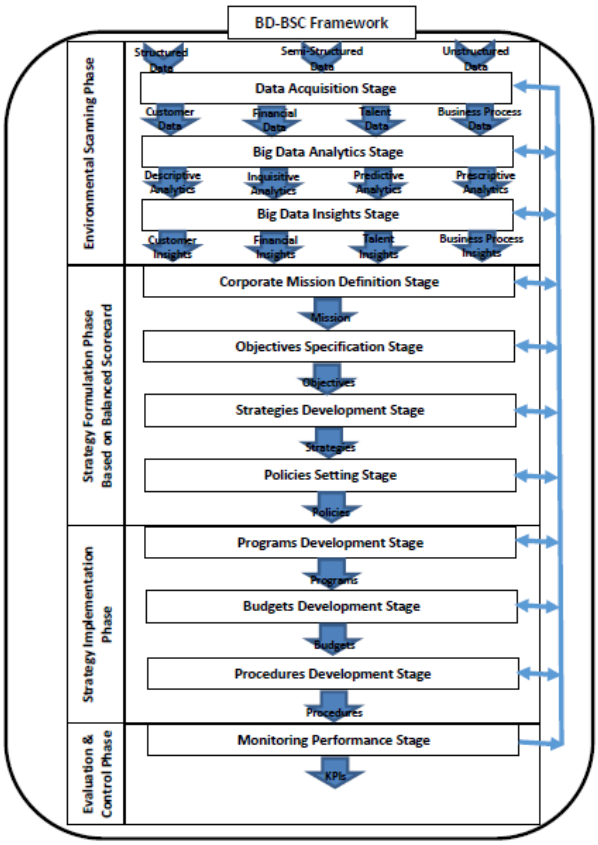


Figure 4 BD-BSC framework.

6.1 Environmental Scanning Phase

The environmental scanning phase includes both internal and external scanning (Global Intelligence Alliance, 2004). External scanning focuses on competitors, customers, and suppliers in addition to technology and political forces, whereas internal scanning focuses on the corporate structure, culture and resources (Global Intelligence Alliance, 2004). The main purpose of the environmental scanning phase is to identify the strategic factors (Wheelen & Hunger, 2008). The traditional way to conduct environmental scanning is through a SWOT analysis (Wheelen & Hunger, 2008). However, the BD-BSC framework uses BDA and BD insights to conduct environmental scanning based on the structured and unstructured data from the data acquisition stage.

In the following sub-sections, a detailed description is provided for the three BD-BSC environmental scanning stages: data acquisition, BD analytics, and BD insights.

6.1.1 Data Acquisition Stage

According to Jin & Kim (2018), BI's "raw data" has been expanded into "Big Data" due to advanced technology capability. BI focuses primarily on structured and internal enterprise data, overlooking valuable information embedded in unstructured and external data (Marín-Ortega, Dmitriyevb, Abilovb, & Gómezb, 2014). This could result in an incomplete view of the reality, and biased enterprise decision-making (Llave, 2018; Ram, Zhang, & Koronios, 2016; Marín-Ortega, Dmitriyevb, Abilovb, & Gómezb, 2014). Hence, the BD 3Vs definition tackles these concerns. The three Vs are volume, variety, and velocity. The main source of this exponentially increased data is coming from the unstructured data of social networks, blogs, text messages, videos and audio (Braganza, Brooks, Nepelski, Ali, & Moro, 2017). Variety refers to the different types of data that can be manipulated using BD technologies (Faroukhi, El Alaoui, Gahi, & Amine, 2020). Structured, semi-structured, and unstructured data types are currently included under BD processes (Faroukhi, El Alaoui, Gahi, & Amine, 2020). Unstructured data is the challenging key that allows BD to overcome the main deficiencies of the traditional methods.

Holmlund et al. (2020) employs solicited and unsolicited data for interaction evaluation. Answering a survey, writing an invited review, or participating in a feedback workshop are some kinds of solicited data. However, customer feedback through emails, social media commands, or face-to-face interactions are examples of unsolicited data.

6.1.2 Big Data Analytics Stage

BDA can enhance the comprehension of business opportunities, and give better insight into customer behavior and services/products effectiveness (Fan, Lau, & Zhao, 2015; Polese, Troisi, Grimaldi, & Romeo, 2019). Fan et al. (2015) argue that analytical models based on single data sources may provide limited insights that consequently lead to biased business decisions. Using multiple and heterogeneous data sources can provide a holistic view of the business and leads to better decision-making. Furthermore, they argue that BDA supports marketing intelligence by providing the ability to monitor customer opinions toward a product, service, or company using social media mining techniques. Customer opinion mining is a key factor for strategic marketing decisions that can be based on multiple data sources including social media, transactions, surveys, and sensors, which can be applied to discover marketing intelligence. Ram et al. (2016) listed five main advantages when applying BDA: increasing data visibility, improving organizational performance, improving meeting customers' needs, revealing valuable insights, and revealing new business models, products and services.

BDA helps executive managers to plan an organization's short-term and long-term goals (Palem, 2014). BDA has been successfully used in many areas. Different analytics have achieved a great success including in usage-based insurance, predictive maintenance, epidemic outbreak detection, and sentiment analysis (Palem, 2014).

BDA adds additional characteristics to the conventional data analysis. These include innovated technologies and skills that enable organizations to use deep analytical capabilities, and integrate a wide range of data types from a large number of relatively unreliable data source in order to provide a meaningful and reliable source of business information (Sadovskyi, Engel, Heininger, Böhm, & Krcmar, 2014).

The BDA stage in our BD-BSC framework has four levels of analysis: descriptive, inquisitive (or diagnostic), predictive, and prescriptive. Descriptive BDA is related to "What happened?" answers. These kinds of analytics help to further describe the situation

analysis. Typical examples include descriptive statistics using charts, cross tabulation, or clustering graphs. Inquisitive DBA is related to "Why did things happen?" answers. These kinds of analytics help validating research hypotheses, determining causation, and identifying variables to achieve desired results. Typical examples include statistical inference techniques or factor analysis. Predictive BDA is related to "What could happen?" answers (Waller & Fawcett, 2013). These kinds of analytics help predicting future trends. Typical examples include forecasting models, classification models, or neural networks. Prescriptive BDA is related to "What should happen?" answers. These kinds of analytics help providing quantifiable answers when solving a problem. Typical examples include optimizations modeling, queuing modeling, or simulations (Holmlund, Van Vaerenbergh, Ciuchita, Ravald, Sarantopoulos, Villarroel-Ordenes, & Zaki, 2020).

After generating BDA, the BD-BSC framework is able to generate different insights including market, behavioral and attitudinal insights.

6.1.3 Big Data Insights Stage

BD insights refer to the value and benefits gained from BD (Chen, Mao, & Liu, 2014). According to Holmlund et al. (2020), BD insights can be developped using BDA in order to improve a firm's decision-making. Similarly, Walls & Barnard (2020) stated that insights provided by BDA could improve the efficiency of the organization's full operations, as well as the strategy.

Due to its high importance, Value is one of the new Vs, most recently added to the BD definition (Erevelles et al., 2016). Wang et al. (2018) stated that the word "big" in BD does not only imply size, but rather the ability to produce insights, and manage complex types. Hence, BD insights close the knowledge and time gaps of the traditional methods.

Walls & Barnard (2020) highlight the need to structure and manage BD initiatives in order to have insights from data, and the ability to act quickly to achieve a positive impact on organizational performance.

Dubey et al. (2018) consider BDA capability to be one of the organizational capabilities that provides organizations with the ability to produce insights that enable the data-driven decision-making process by analyzing its huge data with non-traditional methods using BD tools and techniques. Moreover, Akter et al. (2016) argue that BDA capability provides organizations with the ability to deliver insights using data management, technology, and talent capability to transform business for a competitive advantage and gain business value.

Polese et al. (2017) noted that BDA provides the ability to show behavioral insights about customers. These can be turned into strategic advantages (Şen, Körük, Serper, & Çalış Uslu, 2019). Moreover, Saidali et al. (2019) suggest combining BDA and classical marketing analytics in order to gain insights that are more valuable, and improve the marketing decision-making process. Furthermore, Suoniemi et al. (2017) argue that BD resources improve a firm's ability to better innovate and optimize any marketing elements in the mix with BD predictive capability. Hence, firms have the ability to get more insights into customer behavior, and also have the ability to tailor person-, context- and location-specific offers, and more in real time. Holmlund et al. (2020) suggest a strategic framework for customer experience management based on customer experience insights generated from BDA. Holmlund et al. (2020) noted that the majority of organizations still face difficulties in generating relevant customer insights. They further argue that data and information cannot, themselves, provide customer insights. Holmlund et al. (2020) found that customer insights could be generated by data transformation through analysis and interpretation: values are gained through the ability to drive actions.

Holmlund et al. (2020) classified customer experience insights as attitudinal/ psychographic, behavioral, and market insights. Attitudinal/ psychographic insights provide knowledge about satisfaction, advocacy, and valuable efforts by organizations. Behavioral insights help organizations with the knowledge about the behavioral aspect and consequences of the customer experience. Market insights are extremely valuable as they are related to the knowledge about organizational performance in terms of the customer experience in relation to the marketplace.

In contrast, other scholars argued that it is difficult for organizations to understand how to leverage BD insights in order to create value (Erevelles, Fukawa, Swayne 2016; Walls & Barnard, 2020). Even though an organization may extract BD insights successfully, there is no guarantee that they are able to utilize these

insights effectively (Erevelles, Fukawa, Swayne 2016; Walls & Barnard, 2020).

The BD insights stage in our BD-BCS framework is considered the core engine to deliver the insights needed for balanced scorecard implementation. Customer insights (Holmlund, Van Vaerenbergh, Ciuchita, Ravald, Sarantopoulos, Villarroel-Ordenes, & Zaki, 2020), financial insights (Costa, Dantas, Santos, Medeiros, & Rebouças, 2018), talent insights (Nocker & Sena, 2019), and business process insights (Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019; Braganza, Brooks, Nepelski, Ali, and Moro, 2017; Hassani & Gahnouchi, 2017) are delivered in this stage. They are all considered inputs into the strategy formulation using a balanced scorecard in the next phase.

6.2 Strategy Formulation Phase

The strategy formulation phase includes defining the corporate mission, specifying achievable objectives, developing strategies and setting policy guidelines (Global Intelligence Alliance, 2004; Kaplan, 2010; Wheelen & Hunger, 2008). Firms with mission statements containing the customers served explicitly and technologies have significantly higher growth than those firms without such statements (Wheelen & Hunger, 2008). BD insights provided in the previous phase support corporations defining better mission statements. Fulfillment of the corporate mission could be achieved by developing corporate objectives (Kaplan, 2010; Wheelen & Hunger, 2008). Good corporate objectives should state what is to be accomplished and by when (Kaplan, 2010; Wheelen & Hunger, 2008). Quantified corporate objectives are better and could be measured in later phases. BDA and BD insights help organizations specify quantified corporate objectives. Corporation mission and objectives can be achieved by creating a comprehensive master plan or strategy (Kaplan, 2010; Wheelen & Hunger, 2008).

Three types of strategies should be developed to provide an overall strategic direction: corporate, business and functional strategies. A corporate strategy provides an overall direction for the company and management of its businesses (Wheelen & Hunger, 2008). Typically, the corporate strategy fits within the following three main categories: stability, growth and retrenchment (Wheelen & Hunger, 2008). The business strategy usually occurs at the business unit or production level. The business strategy emphasizes the company's improvement in the competitive position of its products or services (Wheelen & Hunger, 2008). Business strategies may fit within two main categories, the competitive and cooperative strategies (Wheelen & Hunger, 2008). Business strategies provide companies with the ability to enhance their competitive advantages. Functional strategy is usually taken by a functional area to achieve business and corporate objectives by maximizing resource productivity (Wheelen & Hunger, 2008). Corporate, business and functional strategies form a hierarchy of strategy that complement and support one another. Functional strategies support business strategies, which in turn, support the corporate strategy or strategies. BDA and BD insights help organizations developing realistic corporate, business and functional strategies based on data mining and knowledge discovery algorithms. Policy is a decision-making guideline that links the strategy formulation and its implementation (Wheelen & Hunger, 2008).

The BD-BSC framework's strategy formulation phase is based on a balanced scorecard methodology. Using customer insights, financial insights, talent insights, and business process insights delivered from the previous phase, the BD-BSC framework supports organizations to formulate corporate missions, specify corporate objectives, develop strategies at all levels, and set policy guidelines for the implementation phase.

6.3 Strategy Implementation Phase

The strategy implementation phase is the process by which the strategies and policies are translated into actions, by developing programs, budgets and procedures (Global Intelligence Alliance, 2004; Kaplan, 2010; Wheelen & Hunger, 2008).

Strategy implementation may require overall changes in corporate culture, structure and management system (Wheelen & Hunger, 2008). The implementation phase is usually conducted by middle- and lower-level managers under the top management's review and guidance. Hence, the implementation phase may involve day-to-day decisions in resources allocation (Wheelen & Hunger, 2008). The programs provide all the needed activities and steps to accomplish the operational plans (Wheelen & Hunger, 2008). Budgets list the detailed cost of each program, and thus provide the basis to measure profit

performance (Wheelen & Hunger, 2008). Finally, procedures provide all the necessary details to conduct a particular task or job (Wheelen & Hunger, 2008).

The BD-BSC framework's strategy implementation phase translates corporate strategies and policies developed in the previous phase into programs, budgets and procedures, based on the balanced scorecard's four perspectives. Strategic plans are executed to provide the necessary implementation's activities.

6.4 Evaluation and Control Phase

The evaluation and control process measures performance results and compares them with the desired performance (Global Intelligence Alliance, 2004; Kaplan, 2010; Wheelen & Hunger, 2008). Managers at all levels use the resulting performance measures to take corrective actions and resolve problems (Wheelen & Hunger, 2008). Based on performance results, management may need to adjust its strategy formulation and/or implementation (Wheelen & Hunger, 2008).

The BD-BSC framework's evaluation and control phase is based on Key Performance Indicators (KPIs) to make comparisons between desired and achieved performance measures. KPIs are used for the analysis of reaching goals and objectives (Alnoukari & Hanano, 2017). BDA contribute to SM as they measure the organization's performance. Balanced scorecard is used to indicate whether BDA match critical performance indicators.

7. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Our goal with this paper was to signal the importance of BD integration within the SM process. Hence, we provided a comprehensive and integrative framework in which BD, BDA and BD insights are used through balanced scorecard lenses to support strategy formulation and implementation.

Throughout this paper, we emphasized that BDA and BD insights could provide the needed base for strategy development. Traditional methodologies were based on SWOT analysis and other strategic tools to provide clear environmental scanning. BDA and BD insights enhance the environmental scanning process, and provide accurate insights that help formulate better corporate strategies.

In terms of implications, we integrated the literature on BD, SM and balanced scorecard and highlighted how an organization could apply these different technologies and methodologies to improve the development of corporate strategy. Research at the intersection of BD and SM is in its early development phase (e.g., Al-Qirim, Rouibah, Serhani, Tarhini, Khalil, Maqableh, & Gergely, 2019) and we hope that our integrative framework can help both practitioners and researchers reflect on the growing complexities of using BD within SM.

To conclude, we have outlined some avenues for future research in this area. We propose some opportunities for future studies in this promising research area. Future studies could focus on the implementation of a BD-BCS framework in different areas including telecommunication, banking and education. Other studies could tackle the use of other SM tools with BD.

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