Is Big Data Technology The End Of Balanced Scorecard Criticisms ?

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Abstract

Balanced Scorecard (BSC) is considered an important system to measure performance. However, it suffers from some difficulties, particularly in the implementation phase, which may reduce its benefits. This paper aims to develop a BSC model in the Big Data environment; the model focuses on how to benefit from Big Data analytics in BSC model implementation. This model uses Big Data analytics to overcome BSC criticisms and improve BSC efficiency.

Keywords: Balanced Scorecard, Big Data Analytics, Big Data, Performance Measurement Systems

1. Introduction

The increased complexity of performance measurement systems (like Balanced Scorecard) has led to an increase in the amount of data (created by smart devices, RFID technologies, sensors, social media, video surveillance and more). These data require innovative techniques (store, process and analyze) to provide meaningful information to support decision-making.

Big Data analytics techniques (such as predictive methods, pattern recognition techniques, cluster analysis and other quantitative and qualitative methods) can support performance measurement systems based on the analysis of a huge volume of structured and unstructured data. Structured data refer to kinds of data with a high level of organization, such as information in a relational database. Unstructured data are the data we cannot easily store and index in traditional formats or databases includes email conversations, social media posts, video content, photos, voice recordings, sounds, etc. Combining this messy and complex data with other more traditional data is where much of the value lies. Many companies are starting to use Big Data analytics to complement their traditional data analysis to support decision-making. Therefore, the **main research question is:** How can Big Data analytics be used to improve the Balanced Scorecard model?

The remainder of this paper is organized in four sections; the next section is the "Literature Review". The second section is "What is Big Data?". The third section is "Balanced Scorecard in the Big Data environment" where I developed a BSC model in the Big Data environment. Finally, there is the "Final Remarks" section.

2. Literature Review

Balanced Scorecard

When I reviewed the BSC literature, I found that some organizations face many challenges when they implement BSC. Kaplan and Norton, (1996) argue that there is not a unique BSC model valid for implementation in all organizations, according to culture and business activity. The challenges and criticisms are as follows.

Kaplan and Norton, (2001) put forward some reasons for BSC failure: first, using too few measures (two or three) per perspective may be a cause of BSC failure because a good BSC should have an appropriate mix of outcomes (lagging indicators) and performance drivers (leading indicators) of the company's strategy. Therefore, when the organization constructs

too few measures in each perspective, it fails to obtain a balance between leading and lagging indicators or non-financial and financial indicators. Therefore, we need to obtain a balance between leading and lagging indicators. Second, the organization adopts too many indicators and this will lead the organization to lose focus and fail to find any linkage between indicators, so we have to obtain only the indicators that reflect strategy and are most critical. Third, the measures selected for the scorecard do not reflect the organization's strategic objectives; this happens when the organization tries to apply all their Key Performance Indicators (KPIs) into each perspective without screening only for the measures that are linked to its strategy. Therefore, the organization's strategy is not translated into action and the organization does not obtain any benefit from the BSC. So we have to select only measures that link to the organization's strategy. Fourth, the development process (implementation) takes too long, so it can happen that during the implementation process, the strategy has changed. This results from the fact that some indicators have become obsolete and require new indicators, measuring the wrong indicators can distract an organization from its strategy.

Dinesh and Palmer (1998) argue that the most important weakness that poses a risk to the success of the BSC is system complexity. Rickards, R. C (2007) found that the BSC includes complex and overlapping indicators and this complexity increases with an increasing number of variables.

Ittner and Tarker (1998) argue that the design cost of the multi-dimensional performance metrics is too high, and in particular for the Balanced Scorecard.

David (2005) found the measures used to evaluate performance may vary, which leads to different results, ambiguity and confusion among employees, resulting in system failure.

Kurtzman (1997) declared that confusion among the financial and non-financial performance measures in BSC results in a tremendous amount of information (information overload), which causes fragmentation of efforts on multiple targets, and detracts from its effectiveness.

Ghosh and Mukherjee (2006) argue that the desire of some parties (such as creditors and bondholders, and sometimes shareholders) to improve financial performance without improving operational performance, may force the management to focus too much on the financial perspective, this makes the card unbalanced.

Meyer et al. (2002) found that the performance index to measure the non-financial side is difficult because the governing metrics in BSC are the financial metrics and there is no guidance on how to collect all the financial and non-financial metrics with each other when we make a comprehensive evaluation of the performance.

Ghosh and Mukherjee (2006) argue the need to assign measures weights, whether financial or non-financial, on the basis of its importance to the organization. This would make BSC more useful and more practical, but this task is complicated and not easy.

Lawrie, Cobbold and Issa (2004) argue the reasons for the inadequacy of metrics; first the need to focus on a limited number of metrics (filtering) most appropriate for the purposes of the preparation of reports relating to strategic performance. Second, the need for clustering metrics, in other words, putting metrics in groups, and each group reflects the strategic goal for each side of the BSC four sides.

Schneiderman (1999) found that the failure to choose the appropriate non-financial performance measures, particularly because of their novelty and the lack of consistent standards leads to organization failure in applying BSC. As Lingle and Schiemann (1996) have said, poor choice of appropriate metrics due to the lack of clarity of objectives from the beginning may cause many organizations to fail in applying BSC. Companies may develop clear and precise targets at the level of financial and operational dimensions, but they do not take enough time to define precise targets at the level of the dimensions of customer satisfaction, employee performance, innovation and development.

Lingle and Schiemann (1996) found that companies that fail to manage the measurement process effectively do not seek to use any mechanisms for helping employees accept the systems of measurement. They added that the model is used for only measurement purposes and reporting results and not to improve the interaction between the various departments to improve the company's results.

The previous criticisms do not mean to question the ability of the model to measure the performance of the business. The problem lies in the implementation of the model and those in charge of its implementation and not in the model itself.

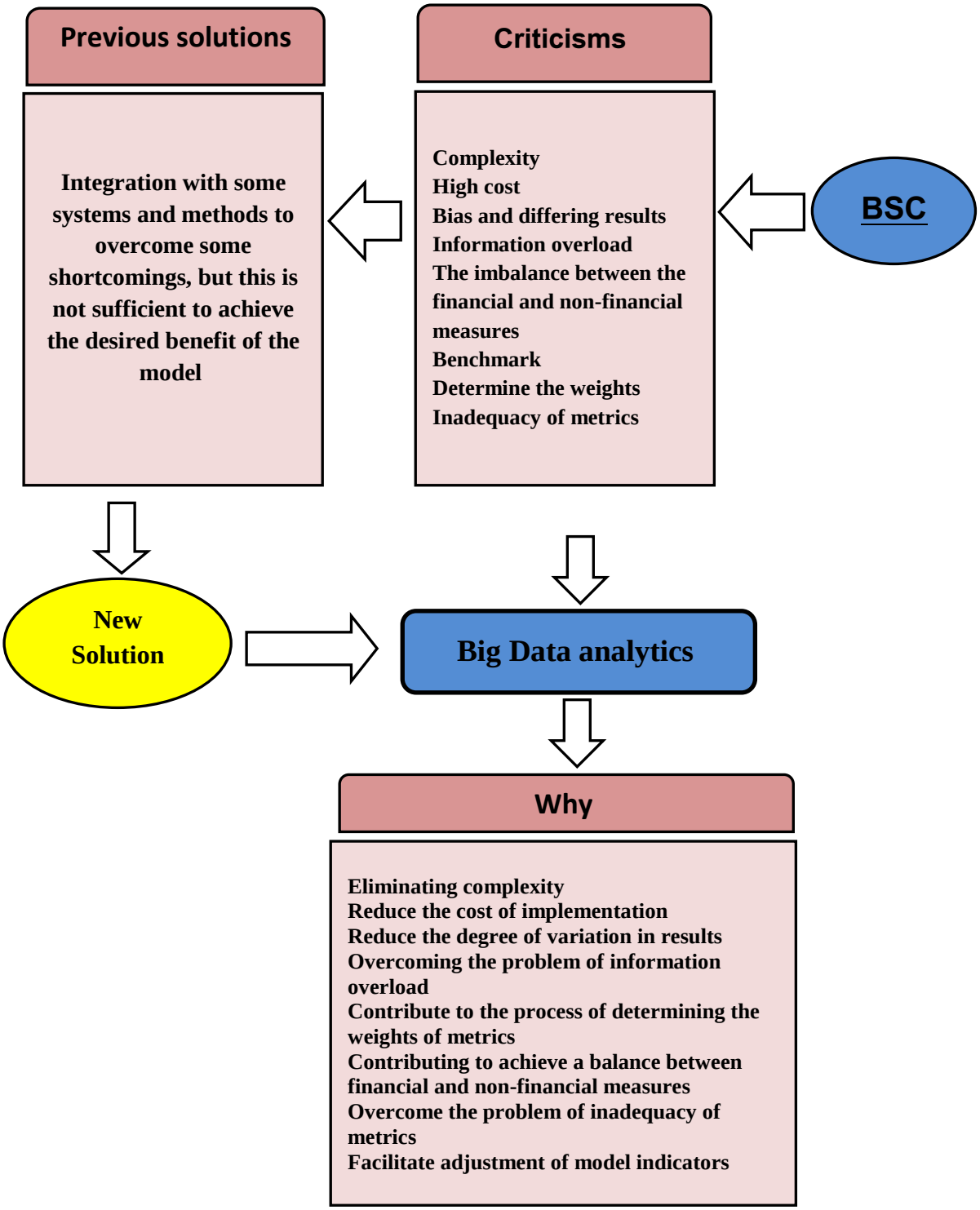
After reviewing the BSC literature, and gathering evidence about BSC implementation challenges, I believe that Big Data technology can strongly contribute to BSC model improvement. Big Data analytics and BSC have the same purpose; they aim to support the decision- making process with meaningful and appropriate data through a series of activities such as analyzing and interpreting data from past actions to influence the future performance in a complex environment.

Most researchers focused on the development of the intellectual frame of BSC, linked it with the concepts of strategic management, and tried to achieve integration between it and other models and systems, but without taking into account the practical implementation problems that hampered the model implementation in many organizations. I investigate using Big Data analytics to overcome these problems to develop the model practically with the same degree of development of its intellectual concepts to match the nature of business needs. Kaplan (2012) confirmed that 20 years on from the model discovery and following various studies that have tried to take advantage of its capabilities and develop it, it was necessary to focus more on the practical side of the BSC and find practical solutions to the implementation problems.

Manville (2007) argues that effective IT systems are a prerequisite for BSC model implementation for the easy flow of information among various departments and immediate information access for all employees at various management levels. Moreover, to achieve integration and connectivity among all sectors in the organization to enhance increasing the effectiveness of measurement, evaluation systems, results of performance indicators, feedback reports, and other basic BSC key elements.

Therefore, Big Data analytics can play an important role in BSC model development. In addition, it can help in overcoming previously mentioned deficiencies of the BSC model. Moreover, Big Data analytics can serve as a communication system among the different levels of management within the organization.

The following figure summarizes BSC criticisms and the proposed Big Data solution:



Proposed Big Data technology to overcome BSC implementation problems

3. What is Big Data?

The term "Big Data" was used for the first time in 1997 by Michael Cox and David Ellsworth in a paper in the IEEE conference to explain the visualization of data and the challenges created by it in computer systems (Cox & Ellsworth, 1997).

TechAmerica Foundation's Federal Big Data Commission (2012) defined Big Data as a term to describe the large volumes of data, which are complex and different and variable, and require techniques and technologies to get, store, distribute, manage and analyze information.

Big data is a new type of data that needs different tools and technologies to deal with it, and Big Data analytics are the methods used to create insights from it. Several Big Data definitions are centred on size and scale, others have focused on the technological implications. For example; McKinsey defines Big Data as the datasets whose size represents a challenge for traditional computing technologies Manyika et al., (2011).

Russom,P. (2011) and others argue the characteristics of Big Data, commonly known as the 3Vs: Volume, this V suggests that the amount of data available to organizations is growing exponentially, and data sources are increasing in number and in the content they generate. It also reflects the trend to analyze a large chunk of the data rather than small samples, to capture more value. Velocity, refers to the speed of capturing the real-time data and the need to rapidly process it in real-time. Variety highlights the importance of unstructured data (text, audio, blogs, micro blogs, etc.), along with the traditional transactional data.

Others have added the variability of data flow as another attribute of Big Data. Recently, veracity has been proposed to stress the importance of quality and the degree of trustworthiness of the data (Zikopoulos, Eaton, DeRopos, Deutsch, & Lapis, 2012); some data are uncertain (things like sentiment analysis, weather conditions, the truthfulness of humans), which data cleansing cannot traditionally correct.

The most famous Big Data software is Hadoop, which supports data-intensive distributed applications, enabling applications to work with thousands of processor nodes and petabytes of data. Hadoop manages the streams of input data; it also provides the tools for data analysis.

Some big data benefits are: better integration and subsequent analysis of quantitative and qualitative data ; more accurate predictions ; and more efficient and effective decision making processes, which make the businesses more agile and efficient .

I want to refer to an example of Big Data application. Chen, Tao, Wang, and Chen (2015) introduced Fraud Risk Management at Alibaba under Big Data. Alibaba has built a fraud risk monitoring and management system based on real-time big data processing and intelligent risk models. It captures fraud signals directly from the huge amount of data of user behaviours and the network, analyzes them in real-time using machine-learning, and accurately predicts the bad users and transactions.

4. Balanced Scorecard in the Big Data environment

The Big Data concept is not only about the change in the volume of data, but the change in the method of collecting and analyzing data and ways to take advantage of it. Big Data has implications for the BSC model as I will illustrate now:

First, Big Data technology can collect, store, manage, distribute and analyze the huge amount of data existing in the organization according to BSC indicators. Moreover, it provides access to useful, timely and accurate information pertaining to each area of the BSC model. This leads to (1) solving the problem of the diversity of the required data and the effort in analyzing and extracting the results؛ (2) removing the problem of complexity resulting from multiple indicators with the help of Big Data technology tools. This in turn, contributes to the selection of appropriate indicators to measure performance without being restricted to a certain number of indicators.

Second, Big Data can develop and improve benchmarks through the ability to collect and store data about all aspects of the organization's activities for many years. Moreover, it provides the possibility of analyzing all data, and preparing appropriate reports accurately and quickly.

Third, it can discover behaviours associated with particular goal outcomes, which can contribute to the development of performance measures where the data can be collected in four areas: financial, customer, internal business processes, and finally growth and learning. In each of these areas, Big Data can identify new behaviours that affect the goal outcomes. Warren Jr, J. D., Moffitt, K. C., & Byrnes, P. (2015) argue that Big Data has a significant role in management control systems (MCSs) and gave an example: web use during work can be tied to growth and learning goals. Internal email may be correlated with the effectiveness of internal business processes as well as customer service quality. They also found that staff computers can be monitored to collect the activity logs that contain data about click streams. In addition, we can monitor phone calls, employee email and other in-office behaviours. Furthermore, companies can keep track of what employees do with company resources away from the office including vehicles, cell phones.

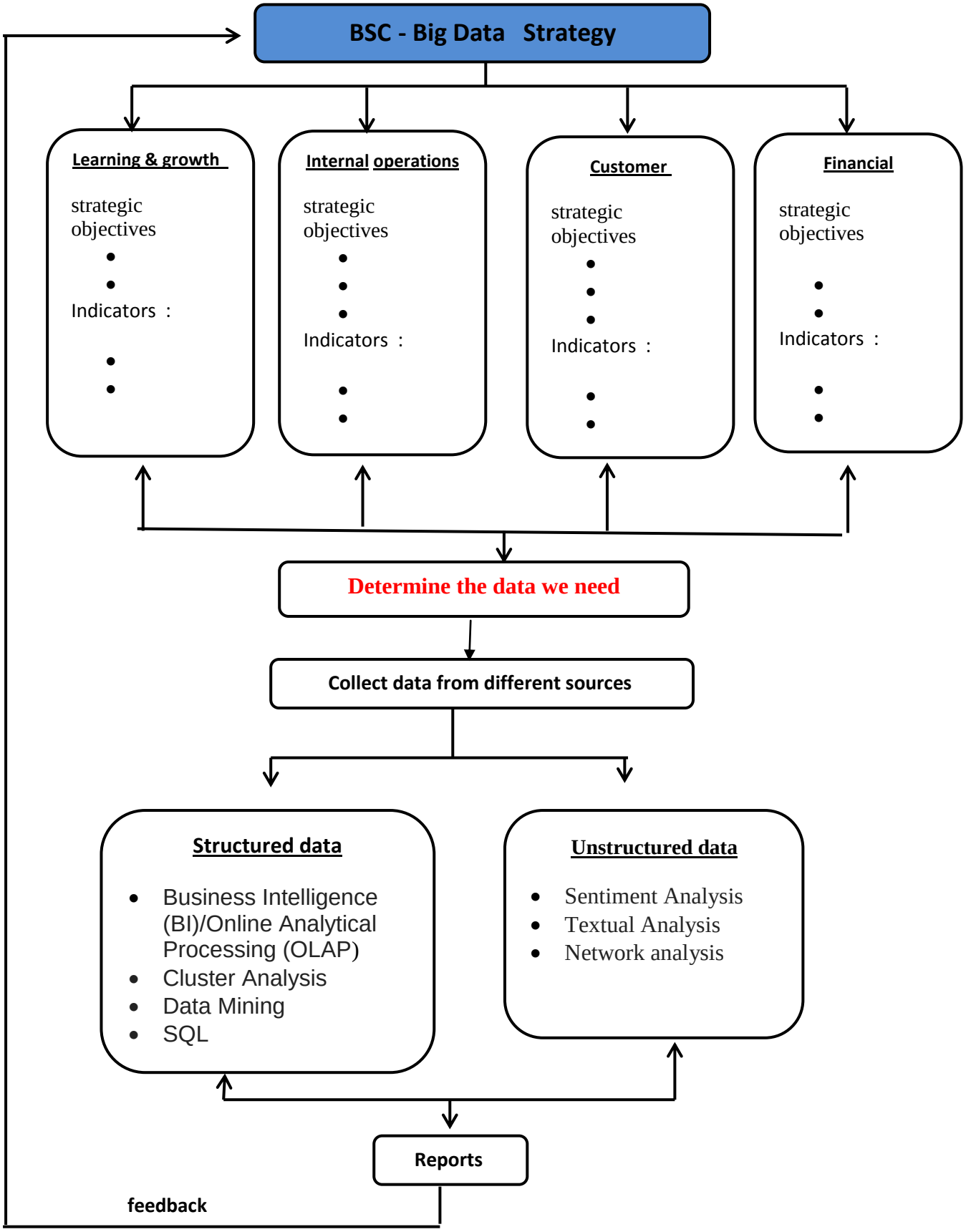
Fourth, there is increased interest in non-financial measures. Big Data deal with, extract and analyze information from non-structural data. These data include textual data (such as social networks, e-mail, forums, survey responses, company documents, news, call centre logs), audio data (such as customer call centres), and video data. Audio analysis used to efficiently analyze millions of hours of recorded calls, evaluate the performance of agents, confirm the turnover rates of sales, monitor compliance with the various policies (privacy and security policies).Video analytics can perform efficiently, and effectively supervise tasks such as the discovery of irregularities, the definition of the elements that have been removed or abandoned without supervision, disclosure of detecting loitering, or identify suspicious activities.

Fifth, the availability of data and the possibility of analyzing with the appropriate quality and speed help to illustrate key success factors in each side of the BSC model. Therefore, it can reduce the use of self-judgment by those in charge of performance measurement and decrease the possibility of obtaining different results.

We have to believe that the value of data lies in what we do with it. In the Big Data environment, we need to decide what data we really need, and what data we will use. Therefore, Big Data and Big Data analytics do not translate into competitive advantage as such. The first step is to form a clear strategy.

Based on the above analysis, I developed a BSC model in the Big Data environment. The model focuses on how to take the Big Data analytics advantage in BSC model implementation. The model steps are: first, the model starts with determining the company-targeted strategy, which clearly defines the scope in which the Big Data initiative will focus on BSC aspects. Second, for each dimension of the BSC model (financial, internal operations, customer, learning and growth) we have to identify sub-strategies. Therefore we can determine "what data we need" (note, to determine what data we need we have to ask business questions) to help achieve the main strategy. Moreover, we have to identify key performance indicators against actual progress. Third, identify the key data sources required to support the strategy, from the targets and key metrics and measures. Fourth, divide data into structured data and unstructured data, then identify the appropriate supporting business intelligence (BI), advanced analytics, and data warehouse (Big Data tools) to deal with data (store, analyze, predict). Finally, to prepare reports, and any feedback related to these reports, should be used to modify the main strategy.

Now we can define the technology stack and required data and analytics architecture to deal with BSC model data, to support the main strategy of the company, as illustrated in the following figure:



BSC model in Big Data environment

5. Final Remarks

The search in the Web of Knowledge and Scopus databases disclosed that there is no article available on the relationship between Big Data and BSC. One explanation to this finding is that Big Data is a quite recent issue. Therefore, this paper is the first attempt towards filling such gap.

McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D. (2012) provide the first evidence of the relationship between Big Data and performance measurement systems. These authors argue that Big Data allows managers to know better about their business and processes. Such knowledge can help them make better decisions that will likely lead to better business performance. Certainly, this will create competitive advantage, and the company will survive and grow .

I conclude from the above discussion that BSC presents some obstacles that prevent companies from taking the full benefits of it, therefore, what do we need to improve the BSC model? (1) We need to obtain a balance between leading and lagging indicators (financial and non-financial) by giving more focus to non-financial indicators. (2) Obtain only the indicators that reflect strategy and select measures linked to the organization's strategy. (3) Obtain senior management support. (4) Keep the development process short. (5) Improve benchmarks. (6) Reduce the cost of implementation. (7) Reduce the degree of results variation. (8) Make the model indicators adjustment process easier.

I believe that Big Data analytics with its wide capabilities can achieve this. The ability to store, manage and analyze the huge amount of data immediately and accurately make Big Data analytics capable of providing the key success factors to the BSC model.

For future research, I hope to make an experiment with that model to evaluate and guide performance in the Big Data environment.

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