



# **MANAGEMENT CONTROL SYSTEMS AND BIG DATA ANALYTICS INTERACTIONS: CONCEPTUAL FRAMEWORK**

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# Introduction

- Nowadays investment in different forms of information technologies is one of the most important factor, which helps organization gain competitive advantage and outperform the rivals.
- The very fast development of information technologies leads to enlarging the organizational capabilities for collecting large amount of information and data.
- This put information characteristics onto new level where they are in higher volumes, variety, velocity and veracity of information (Assunção, Calheiros, Bianchi, Netto, & Buyya, 2015; McAfee & Brynjolfsson, 2012; Zhou, Fu, & Yang, 2016).
- **According to several of these authors, usage of big data will lead to an alteration in many aspects of the organization.**

# Introduction

- **Therefore, the benefits from BDA can be identified also in the field of accounting and control of the organizations.**
- According to some authors BDA are able to support effective and efficient decision making process that could lead to better performance (Chang, Kauffman, & Kwon, 2014; Frizzo-Barker et al., 2016; Zhou et al., 2016).
- Other authors complement to this suggestions Frizzo-Barker et al. (2016) explaining that by using big data and analytics organizations could obtain more details and insights concerning the organizational functioning which gives the opportunity to streamline the processes within the organization.

# Introduction

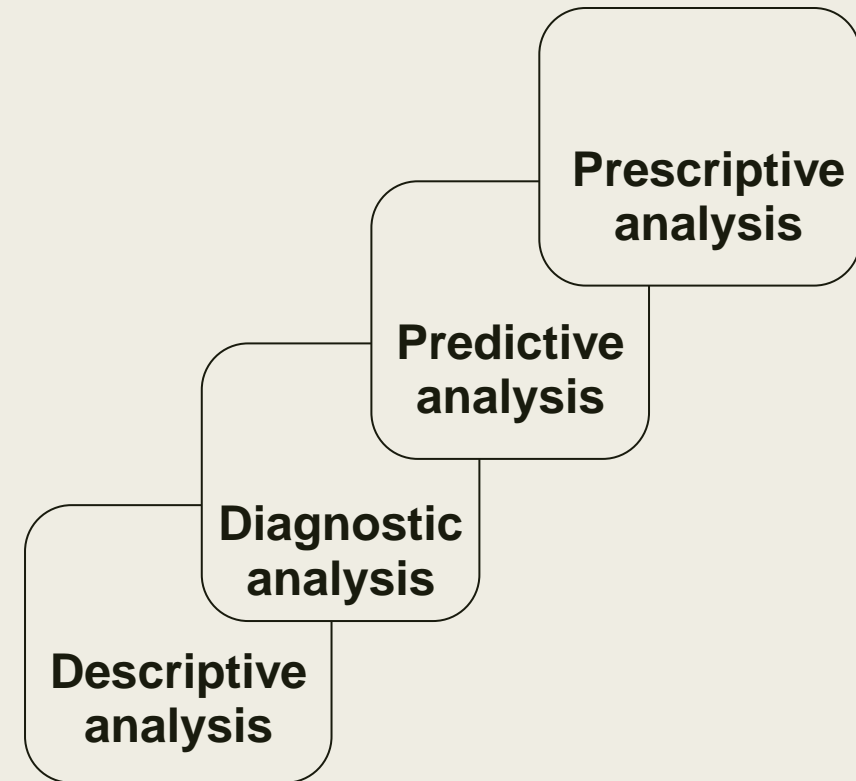
- **Since these positive effects concern accounting and control, it is obvious that it also can influences the management control (MC).**
- From managerial standpoint very often to accept BDA capable systems or processes, is not only the matter of investment, but also it is the matter of change the whole organization's culture (Rialti et al., 2018).
- One of the main obstacle for implementation of the automatic processes that can support the decision making process is related to the resistance not only on behalf of the employees but also the managers.
- **Nevertheless, all the benefits that usage of big data can brings are dependent on the acceptance of big data by organizations' managers (Teece, 2009).**

# Big Data Analytics

- **Analysis of data is a vital part of running a successful business.**
- When data is used effectively, it leads to better understanding of a business's previous performance and better decision-making for its future activities.
- The four types of data analysis are: **Descriptive Analysis, Diagnostic Analysis, Predictive Analysis, Prescriptive Analysis**
- **Nevertheless, all the benefits that usage of big data can bring are dependent on the acceptance of big data by organizations' managers (Teece, 2009).**

# Big Data Analytics

- The biggest use of **descriptive analysis** in business is to track **Key Performance Indicators (KPIs)**, which describe how a business is performing based on chosen benchmarks.
- **Diagnostic analysis** takes the insights found from descriptive analytics and drills down to find the causes of those outcomes. It is useful to create more connections between data and identifies patterns of behavior.
- **Predictive analysis** uses the data to summarize and to make logical predictions of the outcomes of events. This analysis includes **Risk Assessment**.
- **Prescriptive analysis** is the frontier of data analysis, combining the insight from all previous analyses to determine the course of action to take in a current problem or decision.



# The Aim of the Paper

- Given the fact that Big Data is a relatively new concept, it is not thoroughly investigated (Frizzo-Barker et al., 2016). Furthermore, the understanding of the role and influence that Big Data can have on the management control systems (MCS) is limited.
- **Therefore, the aim of the paper is to developed a conceptual framework of Management Control Systems (MCS) and Big Data Analytics (BDA) interactions.**
- **The purpose of the conceptual framework is to give the opportunity for conducting research whose results can contribute to the understanding of the interactions and interdependencies between BDA implementation in the MCS and achievement of the strategic goals of the organization.**
- Developed as a theoretical framework, it could shed a light on the question of how BDA capabilities, which are one of the most important factors for successful strategy performance, could affect MCS in order to achieve strategic goals of the company.

# What MCS ARE

- In the literature there are many definitions of management control systems. Some of them has much in common while other contains different characteristics. (Malmi and Brown, 2008).
- One of the earliest definition of MCS is given by Anthony (1965). It defines **management control as the process that managers use to guaranteed that the organizational resources are obtained and used effectively and efficiently in order to achieving the organization's objectives.**
- One broader definition has been given by Merchant and Van der Stede (2007). It stipulates that **MCS can be considered as everything tha managers could do in order to be sure that their organization's strategies and plans are carried out correctly and if any changes occurre they will be properly modified.**



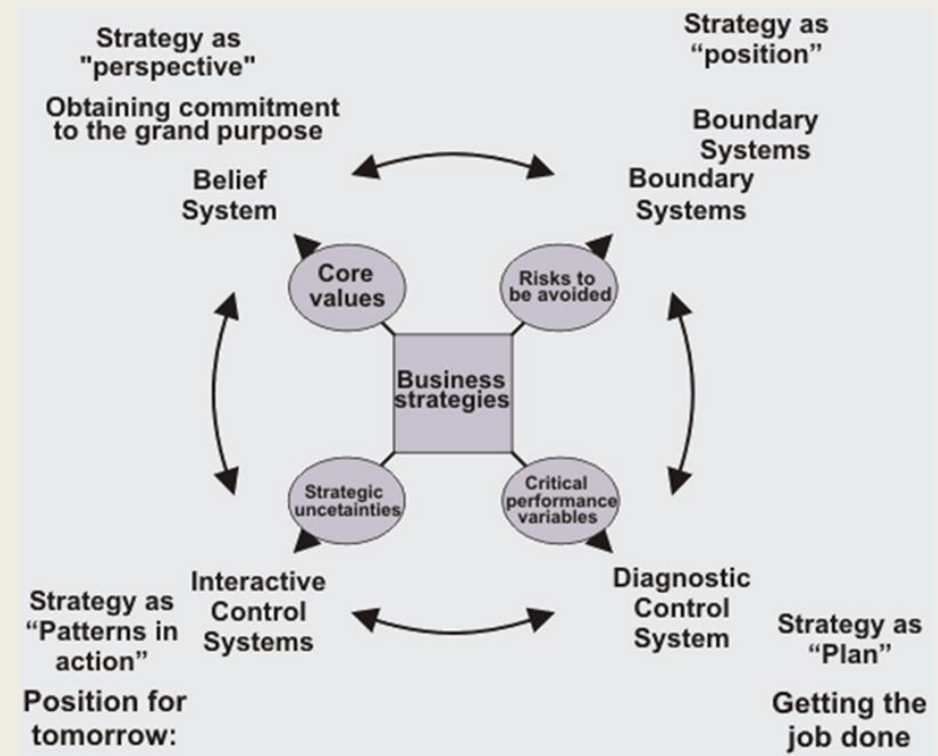
# The Conceptual Framework of MCS and BDA Interactions

- The conceptual framework is developed using as a base **Simons's Lever of control**, since he outlines that management control systems are **the formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities** (Simons 1995)
- Simons's concept of "Levers of control" states that control of business strategy is achieved by integrating the four levers of **beliefs systems, boundary systems, diagnostic control systems, and interactive control systems** (Simons, 2000).

# Simon's Levers of Control

In purpose of achieving reasonable control of the strategy he develops four levers of control. In order to be able to complete their function these levers of control should be used together, since they are mutually related and complemented.

They are meant to make managers of successful organizations always search how to achieve boat high degree of creativity and innovations and at the same time high level of control.



# The Conceptual Framework of MCS and BDA Interactions

- **Authors consider** this concept as an appropriate due to the fact that the strength of these levers in implementing strategy does not lie in how each is used alone, but rather in **how they complement each other when used together.**
- **According to the authors, this is the main reason considering that the implementation of BDA can improve the interactions between the four levers of control and thus will increase the positive effect on the strategy performance.**
- Usage of BDA could increase the interplay of positive and negative forces that create a tension between opportunistic innovation and predictable goal achievement and this could lead to better stimulation and profit growth control (Simons, 2000).

# The Conceptual Framework of MCS and BDA Interactions

The authors have decided to develop the **conceptual framework** using as a base Simon's levers of control **due to the following reasons:**

- The Simon's definition of MCS clearly states that MCS are closely related to the **information transmission.**
- Moreover, based on the **information managers perform procedures through which achieve effective strategy performance.**
- Last but not least BDA could **improve the interactions between levers of control.**

# BDA Capabilities

- The needed prerequisite for gain advantage on implementation of the new technologies are organizational BDA capabilities.
- According to (R.Rialti, G. Marzi, 2019) and others BDA capabilities have three specific components. They are related to routines that should be done in order to transform big data into valuable information.
- The first component is **BDA infrastructures**. This capability is essential since it is related to fact whether technologies are able to process different data flows and formats in any situation (Labrinidis & Jagadish, 2012; Rialti et al., 2018).
- The second component is **BDA managerial capabilities**. The ability of managers to choose and implement the correct infrastructure and elicit the useful and meaningful information is of vital importance for better organizational performance.
- Last but not least, component is related **to the personnel**. The employees should have the ability and willingness to use the new technologies since they are those who work with them and report to managers (R.Rialti, G. Marzi, 2019).

# The Conceptual Framework of MCS and BDA Interactions

- Based on the assumption that Simon's levers of control concern on one hand **objective** and on another **behavior** it is obvious that BDA can be widely and successfully used predominantly in the **Diagnostic control systems and Interactive control systems** that can be attributed to the **organizational objective**.
- BDA has a limited implementation in those levers that are related to the **human behavior** namely **Belief systems and Boundary system**. They appeal to employees' emotional side while Diagnostic and Interactive controls appeal to employees' rational side.
- *Despite the fact that BDA implemented in Boundary system can help to restrict deviant behavior.*

# BDA and Belief Systems

**Beliefs Systems** used to inspire and direct the search for new opportunities. Getting employees involved in what the organization is trying to accomplish is a powerful, positive control tool.

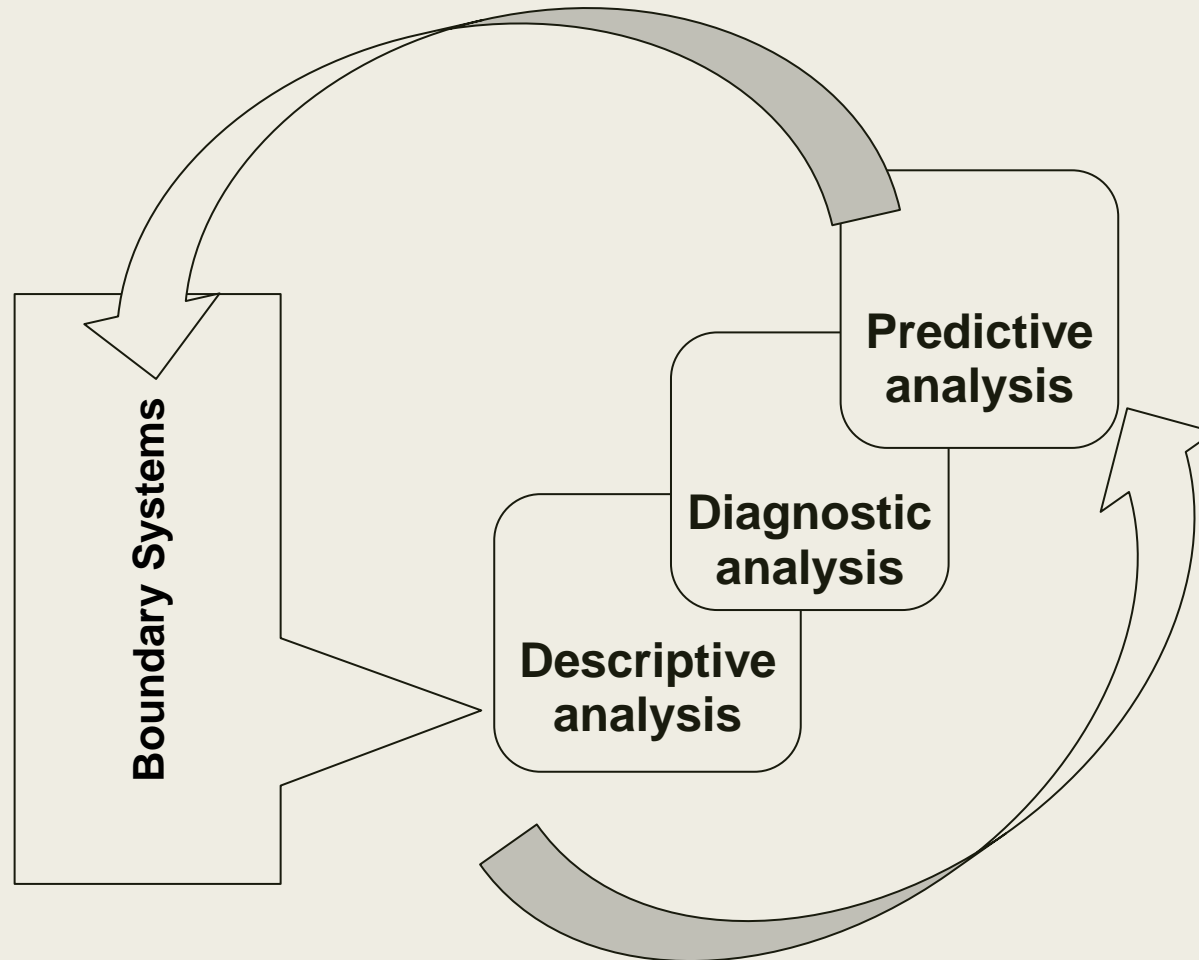
## **Interactions and Interdependencies:**

If the organization want to achieve strategic goals and better control on the strategy implementation using BDA a cultural shift is needed. The employees have to change their mindsets and go beyond them. Thus, the speed of processes will be improved and the cost will be reduced. According to ( Lu & Ramamurthy, 2011; Wamba & Mishra, 2017) this change of the perceptions can be described as a “big data culture”. If an organization want to remain competitive implementation an usage of digital technologies have to be adopted and this could form a new model of working. It is very important for the success of the strategy performance this shift in working practices to be implemented before other market competitors (Waller & Fawcett, 2013).

**To maintained the systems that would be able to respond to the particular customers’, there is a necessity of alignment between the IT department and the business team as they can be considered as an employees and react according their personal emotions (Gao, 2013; Wamba & Mishra,2017).**

# BDA and Boundary System

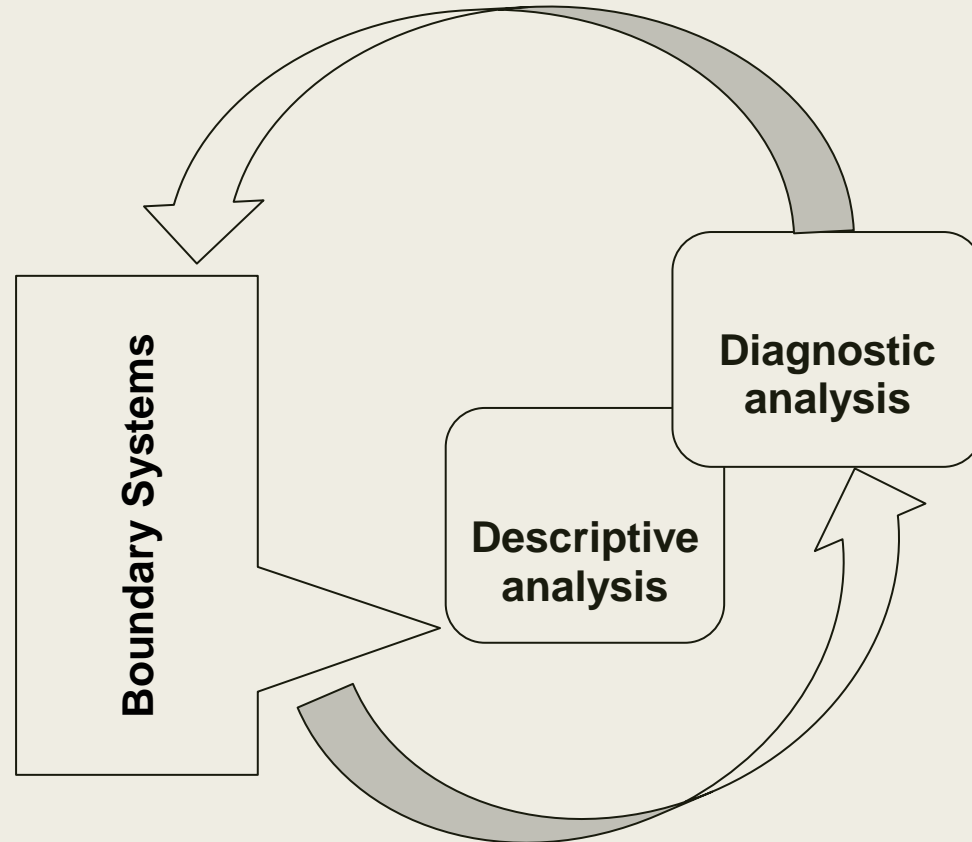
**Boundary Systems** is used to impose restrictions on behavior that is considered as unappropriated. It could be considerate as a guard against potentially deviant behavior. Boundary Controls outlines which employee actions are not allowed.





# BDA and Diagnostic Systems

**Diagnostic Control Systems** are to motivate, monitor and reward achievement of specified goals. They are related to key performance metrics based on the strategy. Using clearly defined targets and rewarding their achievement, diagnostic controls become one of the most important management control tools not only to communicate strategy but to motivate and hold employees responsible for their actions.



# BDA and Interactive Systems

**Interactive Control Systems** used to stimulate search and learning, allowing new strategies to emerge as participants throughout the organization to respond to perceived opportunities and threats. As a fourth lever of control, these systems focus attention on strategic uncertainties and enable strategic renewal. It updates the firm's strategy in response to unforeseen environmental disturbances. If companies are to win in the long term, they need to monitor and proactively respond to threats and opportunities.

## **Interactions and Interdependencies:**

Therefore, the implementation of BDA in this systems is crucial since they can improve achievement of the strategic goals. This could be performed due to the fact that those systems are able to collect unstructured data and analyzing them in real-time. Thus BDA give the organization to elicit the meaningful potential of big data and managers may obtain real-time information concerning changes not only within but also outside the organization (Wamba & Mishra, 2017). According to (Provost & Fawcett, 2013) **the continuous flow of information give the managers opportunities to act in accordance with environmental changes and enable then to adapt strategy so to succeed in achieving the strategic colas and gained benefits for the organization.**

# **First Hypothesis: Strategic Goals Achievement is Directly Linked to BDA Capabilities**

- When the organization has an access to information and properly trained staff to use it can obtain a competitive advantage and is able to discover new opportunities.
- The main goal of any organization implementing BDA and creating big data culture in their MCS is to improve strategy performance by gaining new knowledge (better understanding) in order to retain competitive market positions.
- A proper use of BDA help managers to access and interpret useful information and knowledge in order to improve organizational management (Chen, Chiang, & Storey, 2012).

## **Second Hypothesis :** **Effectiveness of MCS achieved through usage of BDA** **could influence the achievement of the strategic goals**

- It is well known that effectively controlled organizations are capable of managing their resources in an efficient manner so to be able to adjust their resources in rapidly changing environment in order to remain competitive.
- Moreover, management control is related to the human factor because it is performed by people and it is applied (imposed) on people.
- To high extend it depends on the manager's attitude toward employee's education, improving their ability in problem solving and their skills to react adequately to different challenging situation.

**Thank you for your attention!**