Integrating Big Data Technology Into Organizational Decision Support Systems

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INTRODUCTION

Organizational Decision Support Systems (ODSS) is defined as "a new type of DSS, focusing on the organization rather than the individual or the group," (George 1992, p 109). With the growing trend of global competitiveness and business complexity, the design of ODSS faces two critical challenges (Jespersen, 2018; Garrido, 2015). The first is the high pace of decision scenario relative to the corresponding decision-making cycles. The second challenge is the large scale of volume, variety, and velocity of data that exceeds the capability of traditional databases and data-warehouses in the system. A proposal of meeting such challenges is to provide the decision-makers with the capabilities of allowing them to feel, recognize, abstract, comprehend, analyze, and decide faster than the scenario pace. Using Big-Data technology (BDT) in ODSS would provide the decision-making team with such faster decision-making capabilities.

The BDT is a high resolution representation of real life in such a way that all movements, activities, thoughts, conversations, relations, feelings could be tracked, recorded and processed almost online (Sagiroglu & Sinanc, 2013). Such BDT as an accurate representation of real life could be used in both ways, to understand the real life and to control it (Wu et al., 2014). Fast cycles of understanding and controlling real life situations are the key functions of ODSS. The need for BDT is well recognized on several decision-making levels. The "Global Pulse" is a recent initiative of the United Nations Secretary General for accelerating discovery, development and scaled adoption of Big-Data innovation for sustainable development (UN Global Pulse, 2015). The impact of BDT on the economy has been referred to as "the new oil" (Kolb & Kolb, 2013: p. 10).

The goal of this chapter is to describe a conceptual framework for integrating BDT with traditional designs of ODSS. The updated conceptual design is validated using the Analytical Hierarchy Process (AHP) and the Quality Deployment Function (QFD) technique. The QFD technique correlates the design modules to common ODSS requirements after prioritizing it through the AHP. The conceptual design provides a system that is flexible and responsive to decision makers' need in developing their own ODSS. The initial stages required for implementing the conceptual design are given.

BACKGROUND

Decision support systems have traditionally supported the problem definition, alternatives development, alternatives analysis, choice, and implementation phases of the decision-making cycle. Courtney (2001) suggests moving from a classic decision-making paradigm model to a cycle that emphasizes synthesis and post implementation review as well as environment scanning.

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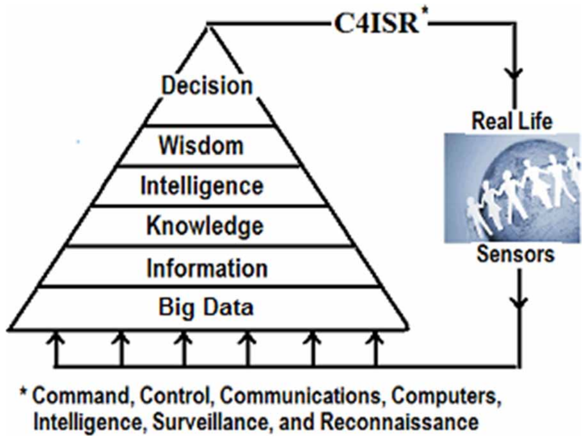
Figure 1. From Big-Data to Decision in ODSS
(Adapted from Kabeil & Kabil 2018)



The quality of decision, such as any other engineering product, is built from the very beginning all through the decision processing cycle (Davern et al. 2008). The generic decision cycle starts with data gathering that is processed further to higher levels of information, knowledge, intelligence, wisdom, and decision. The decision is implemented to move a real-world-situation to be more suitable for the next decision or action (Kabeil &Kabil, 2018).

Leverage the "Data" concepts and technologies to "Big-Data" ones affects all higher levels of the model depicted in figure 1. Information is defined as useful data. Usefulness of data depends on the user, time and context of the use (Shankaranarayanan & Cai, 2006). Transforming data to useful information starts with data cleansing and interpretation, which has been changed with the radical increase of Volume, Variety, and Velocity of Big-Data (LaValle et al 2011).

In the model under consideration, knowledge is defined as the know-how of object or concept behavior. According to the United Nations Development Program (UNDP), knowledge management is defined as "the practice of capturing, storing and sharing knowledge so that we can learn lessons from the past and apply them in the future." (UNDP, 2007: p. ix). Big-Data technologies open doors for new knowledge management methodologies using parallel processing on clusters of data servers (Cuzzocrea, 2014).

In the same context, intelligence is defined as the capacity of handling new situations. This definition is consistent with Wang's definition, which considers intelligence as the capacity to adapt under insufficient knowledge and resources (Wang, 1995).

Wisdom is defined, in the same context, as the values, ethics and beliefs that form the preferences of a decision maker (Kabil & Kabeil, 2011). Bellinger, et al. (2004) present a model of Data, Information, Knowledge, and Wisdom hierarchy in both the Knowledge Management and Information Science domains.

Decision is defined as a selection of course of actions among several alternatives to interact with a real-world-situation according to a set of preferences that reflect the group wisdom. The decision is implemented through a Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) System to move a real-world-situation to next phase of expected scenario (McDowall, 2019). Using emerging technologies of Big-Data in ODSS is reviewed in next sections.

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