A CONCEPTUAL FRAMEWORK FOR BUSINESS ANALYTICS SUCCESS

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ABSTRACT

The paper presents a conceptual framework that identifies factors, technological and organizational, that impact on the success of business analytics (BA) use in organizations. The framework explores BA success through three business disciplines: Decision Sciences (DS), Information Systems (IS), and Management. We believe that BA success comes from proper interaction between the three disciplines. In this summary paper we discuss the framework's viability through an existing example, and briefly discuss implications for practitioners and researchers.

INTRODUCTION

Business analytics (BA), the use of analytic techniques (driven by data and quantitative analysis) for organizational/managerial decision making, a new term that has been coined recently is a resultant of the parallel developments in the three fields, Management, DS, and IS. The history of BA can be traced back to the development of decision support systems (DSS). DSS used data and modeling tools to support decision making. With an easier availability of massive amounts of data in organizations and with the evolution of easy-to-use models and analysis tools for managers during the last decade, the concept of DSS (and data mining) evolved into BA.

Relatively few formal definitions of BA exist in the literature. In a seminal book, Davenport & Harris [1] define analytics as "the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions". Davenport & Harris further state that "analytics may be input for human decisions or may drive fully automated decisions". The authors list finance, manufacturing, research and development, and human resources as internal business processes which provide domains of analytics application in organizations. Several examples of successful use of BA in a variety of industries, for example, consumer products, financial services, hospitality and entertainment, pharmaceuticals, retail, transport, professional sports teams (organizations) and telecommunications can also be found in the same work.

From our literature review, it is fair to say that BA success and the factors/interactions that lead to it are not well understood. Hence the primary objective of this paper is to develop and present a framework for BA success. We argue that BA success lies at the intersection of three disciplines (i) Decision Sciences, (ii) Information Systems, and (iii) Management. Though considerable body of literature and some case-based evidence exists in different business disciplines as it pertains to BA, prior work has mostly been discipline-specific and not well integrated. We are building our framework based mostly on components derived from prior research in three distinct business disciplines that are needed for BA success in organizations: (a) basic quantitative modeling and analysis needs with respect to data, tools, and models, (b) IT infrastructure needs towards the support and successful implementation of BA technologies, and

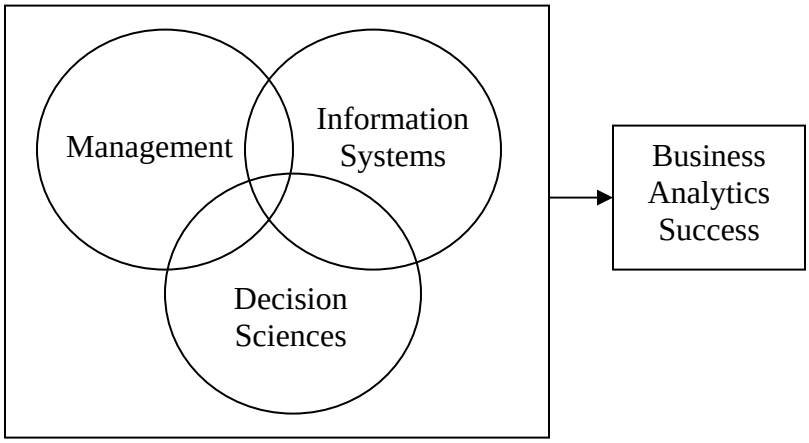
finally (c) top-down commitment to make analytics central to strategy coupled with an organizational culture that supports and rewards skillful use of data-driven analysis for the purpose of organizational decision making. Clearly a one-to-one correspondence between each previous component (a), (b), and (c) and broader business domains of DS, IS, and Management respectively is intuitively apparent. If one or more of the disciplines/components are taken away, BA success will be compromised.

FRAMEWORK FOR BA SUCCESS

The framework for BA success has been developed over the past one year. The authors began with a broad survey of existing literature in the field of business analytics in order to better understand this emerging area. Academic articles related to theory and practice in the area as well as trade press reports on the companies adopting and using business analytics were collected and studied. An initial list of factors/variables related to BA success was derived from the case material initially. A categorization of these variables was attempted next by the authors and during the process it was clear that the variables could be classified into three broad categories: managerial/organizational, information systems (IS), and decision sciences (DS) variables.

Some managerial factors/variables include but are not limited to (a) commitment of senior management to analytics and fact/data driven organizational decision-making, (b) per capita investment in training employees to enhance their skills with models/modeling, (c) teamwork, communications and partnering skills of employees, etc. Some IS factors include (a) availability, accessibility, and quality of internal and external data, (b) availability, and ease-of-use of tools for analysis, (c) amount of per capita investment in computer hardware, etc. Some DS factors include (a) availability of analytical models and tools, (b) use of spreadsheets in the organization, (c) percentage of employees with advanced degrees (graduate and beyond) in disciplines such as operations research, computer science, mathematics, and statistics, etc. Though we could develop a more exhaustive list of factors that could impact BA success, it became clear that the interactions between the factors (within and among disciplines) played a critical role in BA success. We have presented this idea in the form of a simple framework in Figure 1.

Figure 1: Framework of Business Analytics Success in Organizations



The framework consists of the dependent variable set (i.e., BA success factors/variables), the three sets of independent variables (i.e., managerial/organizational, IS, and DS variables), and the relationships between the variables (i.e., relationships between independent variables, the interactions, and relationships between dependent and independent variable sets).

The vehicle routing and scheduling system developed by Sears, Roebuck and Company (Weigel and Cao [2]) is a perfect illustration of our framework where an optimal blend between IS, DS, and management factors/variables resulted in a tremendously successful BA application. To develop the system, internal customer data such as location of customers, type of service required, products to be delivered, delivery time windows, etc. (IS factor) available from mainframe based databases was integrated (IS factor) with commercially available external data such as street networks, congestion etc. (IS factor) within a Geographical Information Systems (GIS) framework. The problem was modeled as a vehicle routing problem with time windows (DS factor) within a GIS framework (to accurately estimate travel distances) thereby highlighting the integration of modeling tools and software (DS factor). Sears' investment in hardware (IS factor) is apparent as the home delivery and routing systems developed are UNIX based and operate on either a central server or distributed workstations. Their investment in developing computing horsepower (IS factor) is also apparent that vehicle routing problem instances with approximately two million street network arcs could be solved in less than 20 minutes of computing time. All the IS and DS investments would have proved futile if Sears employees were not trained (management factor) by an outside firm to overcome difficulties associated with (i) shifting from text driven terminals to mouse based GUIs, a fundamental IT paradigm shift, and also (ii) to overcome unfamiliarity problems with the various model input parameters (DS factor). Managers in charge of regional routing offices encountered implementation difficulties as technicians and truck drivers resented the online tracking by the systems. However the problem was overcome as field managers themselves gained more confidence in the system and were able to communicate its benefits to truck drivers (end users in this case) and encouraged them to follow the routes the automated systems suggested (management factor).

CONCLUSIONS

The limited literature, practitioner accounts, and documentation of BA usage have simply alluded to the fact that data fueled developments in information systems, large scale quantitative analysis, and senior management buy-in have acted as catalysts in successful BA applications in organizations. However, what constitutes BA success is not very well understood and what specific factors, and interactions between those factors, that result in BA success is also not well understood. The BA success framework presented in this paper is the first attempt to fill this void.

Our framework provides practicing managers with a preliminary list of discipline-specific factors that are important for BA success. Most of the factors are universal, in other words, application (or industry) independent in nature. Hence it is imperative to identify other factors that are context specific. Several aspects of the framework can be further consolidated by researchers by identifying more discipline specific factors and interactions and further ranking the factors and interactions in order of importance.

REFERENCES

[1] Davenport, T. & Harris, J. *Competing on Analytics*. Boston, MA: Harvard Business School Press, 2007.

[2] Weigel, D. & Cao, B. Applying GIS and OR techniques to solve Sears technician-dispatching and home-delivery problems, *Interfaces*, 1999, 29(1), 112-130.

Note – This is a considerably summarized version of a more detailed paper (about 40 pages long) which can be made available upon request to any of the authors.