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The analytics paradigm in business research

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ABSTRACT

The availability of data in massive collections in recent past not only has enabled data-driven decision-making, but also has created new questions that cannot be addressed effectively with the traditional statistical analysis methods. The traditional scientific research not only has prevented business scholars from working on emerging problems with big and rich data-sets, but also has resulted in irrelevant theory and questionable conclusions; mostly because the traditional method has mainly focused on modeling and analysis/explanation than on the real/practical problem and the data. We believe the lack of due attention to the analytics paradigm can to some extent be attributed to the business scholars' unfamiliarity with the analytics methods/methodologies and the type of questions it can answer. Therefore, our purpose in this paper is to illustrate how analytics, as a complement, rather than a successor, to the traditional research paradigm, can be used to address interesting emerging business research questions.

1. Introduction

The introduction of the commercial Internet and its eventual prevalence over the past two decades has given rise to an influx of data in virtually every domain of the society (Davenport & Kim, 2013). Particularly, the transition from Web 1.0 to Web 2.0 (and to Web 3.0), whereby static pages gave place to user contributed content, inspired organizations all around the globe to invest extensively in infrastructures that improved their ability to collect data throughout and beyond the enterprise. In the business world, this abundance of data has led to increasing interest in almost every industry to develop capabilities and methods for extracting insightful knowledge from data to achieve competitive advantage (Provost & Fawcett, 2013). These new data sources, however, not only are too large and too complex, but also have created new questions that cannot be answered effectively with traditional analysis methods. To overcome these problems, new methodologies and processing techniques were developed that gave birth to a new era in business decision making referred to as the *[business] analytics* (BA) period (Mortenson, Doherty, & Robinson, 2015).

Over the past decade, BA has been regularly reported to be a top priority for many top-level managers (Holsapple, Lee-Post, & Pakath, 2014). Such an interest has not been a fad, but instead a result of compelling evidence corroborating the values of analytics to businesses. For instance, a study by Anderson (2015) showed that every $1.00 spent on analytics applications pays off $13.0. Other studies have also reported complementary benefits and promising contributions of analytics to operations (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011) or productivity of firms via data-driven decision making (Chae, Yang, Olson, & Sheu, 2014; Davenport & Harris, 2007; McAfee & Brynjolfsson, 2012). These findings suggest that developing analytics prowess has become an ineluctable commitment for businesses.

While businesses are at the forefront of employing various facets of analytics, academic research has not fully recognized its potentials. In most business and organizational science journals, research is dominated by certain paradigms that are either traditional and less related to the new analytics approach or adopt a narrow facet of analytics (Holsapple et al., 2014; Putka, Beatty, & Reeder, 2017; Tonidandel, King, & Cortina, 2016). As Shmueli and Koppius (2011) denote, almost all studies in these disciplines have used "*causal-explanatory statistical modeling and statistical inference to test causal hypotheses and to evaluate the explanatory power of underlying causal models*". While these prevalent modeling and problem solving paradigms have generated significant insights over the past decades, they have prevented researchers from working on emerging business problems. Additionally, since the emphasis of academic research has mostly been on modeling and analysis, rather than on the problem and the data, they have resulted in irrelevant theory and questionable conclusions (Breiman, 2001b). For instance, as Shmueli and Koppius (2011, p. 572) denote, several papers published in Information Systems (IS) journals used the discipline's dominant paradigm to make conclusions (e.g., about the predictive

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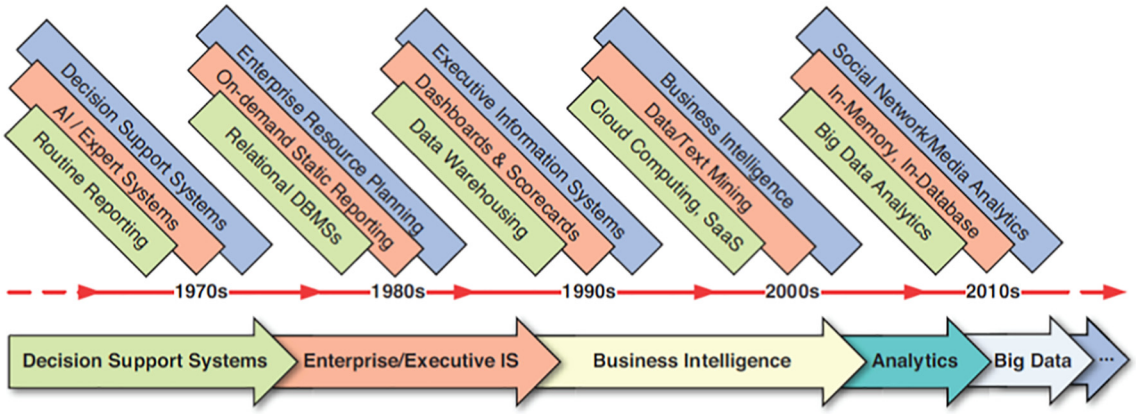

Fig. 1. A longitudinal view of the evolution of analytics.

power of models) that required other analysis approaches to be adequate. With the use of analytics not only can we produce more and more reliable information about the inherent structure of relationships between the focal variables, but also we will be able to generate more relevant research (Breiman, 2001b). Therefore, it is important for business researchers to add other tools besides hammer to their research toolkit, so that not every problem looks like a nail.

Although several reasons have been enumerated for the paucity of analytical studies in business journals, we believe two causes are the most salient. First and foremost, a majority, if not all, of business journals have historically placed a high value on publications that test systems of relationships specified by theory (Aguinis, Pierce, & Culpepper, 2009; Putka et al., 2017). Consequently, researchers have placed greater focus on modeling and analysis than on the problem and the data; leading to an overabundance of structural equation models to the point that other analysis methods are not considered sophisticated – i.e., scientific – enough. Second, and chiefly a ramification of the first cause, most business scholars do not typically receive the training required to understand and apply various business analytics methods during their graduate studies (Putka et al., 2017); and why would they when such methods are given no chance in top-tier business, and particularly management, outlets? Whereas this trend has changed in all industrial sectors and many academic areas, some business disciplines have not yet fully embraced the new analytics paradigm. We believe this trend has to change or those fields will not be able to accurately predict increasingly emerging important outcomes (Breiman, 2001b; Putka & Oswald, 2015), will fail to incorporate into their models some of the key drivers of their phenomena of interest (Putka & Oswald, 2015; Tonidandel et al., 2016), or cannot adequately address model complexity and uncertainty (Breiman, 2001b; Putka & Oswald, 2015).

This paper seeks to address these issues through a bottom-up approach. In other words, our goal is to raise an awareness among business scholars about the various types of questions that can be answered using the emerging business analytics paradigm. We hope through attending to the second cause of unpopularity of analytics, as indicated above, more interest is formed in this area, which in turn, can lead to a greater support for the promotion of this research paradigm among top-tier business and management journals. It deserves to mention, however, that our goal is not to provide a comprehensive overview of business analytics methods, nor a technical explanation of their mechanics or statistical foundations. Instead, we aspire to introduce some of the more common analytics methods used in prior research and provide examples for the business questions that can be addressed by such techniques. Most of the examples we discuss are taken from the information systems literature, which has traditionally been a pioneer in the application of these methods in business research.

Our focus is on promoting analytics as a complement to the traditional theory-driven hypothesis testing in business disciplines, rather than denigrating this research paradigm. To this goal, we structure the paper as follows. First, we review and integrate the various definitions of analytics to form a common understanding of the concept. Next, we provide an overview of the various types of analytics as classified by practitioners and scholars. Subsequently, we present the potential avenues of employing analytics to augment academic research before concluding the paper with a final discussion.

2. An overview of BA and its components

Despite its ostensible primacy in the past few years, analytics is not an entirely new paradigm and has been employed by corporations for several years, albeit in a narrower sense. It can be considered a continuation of efforts among management science scholars and practitioners in the 1940's when optimization and simulation techniques were developed to maximize output with limited resources (Mortenson et al., 2015). With the development of management information and decision support systems in the late 1960s and 1970s, analytics began to command more attention (Delen, 2015) and eventually evolved into an integration of operational research, machine learning, and information systems (Mortenson et al., 2015). Fig. 1 illustrates the evolution of analytics techniques and related terminology over the last few decades. Most researchers and practitioners in the field believe that the latest names for analytics, such as *big data* and its enabling tools/techniques (such as *deep learning, image processing, text mining*, and *sentiment analysis*) are just new names/labels (i.e., buzz words) for business analytics and its enablers, and the goal is still the same - to convert data into actionable insight for more timely and accurate decision support (Sharda, Delen, & Turban, 2017). That said, there is a specific emphasis in *big data*, which is on the volume, variety and variability of the data. Nowadays, the type of data available for analytics poses a variety of challenges (defined within the context of the three Vs), but at the same time, brings opportunities to organizations that are capable of converting them into real business outcomes (data → information → knowledge → action).

With the popularity of different buzzwords, the use of data and computing power for enhanced decision-making has borne various monikers in recent years. While decision support systems, expert systems, business intelligence, data and text mining, big data, and deep learning have been used to refer to certain techniques and technologies, they all share the same underlying purpose: employing internal or external, structured or unstructured data for actionable insights. Consequently, in this paper we use *analytics* loosely to refer to all such applications of data for better decision making. Therefore, our focus is on the common *process* and *purpose*, rather than different specifics, of such techniques.

The need to make data-driven decisions in a myriad of application areas, multidisciplinary nature, and multidimensionality of analytics