

Business Analytics and Firm Performance: A Literature Review

Henri Hussinki

LUT University, LUT School of Business and Management, Lahti, Finland

henri.hussinki@lut.fi

Abstract: Technological advancements and increasingly available intra- and extra-organizational data have attracted firms to invest in business analytics. Despite the growing number of firms that have invested in business analytics, only some of them have been able to turn their investments into tangible business benefits. This has raised questions among researchers and practitioners about the causal ambiguity between business analytics adoption and firm performance outcomes. Consequently, academic research community has recently launched an endeavor to produce empirical evidence on the relationship between business analytics and firm performance, considering different complementary resources, capabilities, and mechanisms that could better explain what firms need to gain business benefits from business analytics (e.g., Brynjolfsson and McElheran, 2016; Gupta and George, 2016). The purpose of this study is to improve the current understanding on the relationship between business analytics and firm performance. This is done by reviewing 47 peer-reviewed studies that have empirically studied the phenomenon. Academic literature that examines how firms could benefit from data and analytics has separated into several parallel sub-streams, including business analytics, data analytics, big data analytics, and business intelligence and analytics. In this study, an umbrella term business analytics is used to cover all of them. Thus, another objective of this study is to merge the research output of different sub-streams related to business analytics and firm performance. This establishes a more comprehensive view of the literature landscape. This study finds that firms can translate business analytics into business benefits by ensuring that they simultaneously possess different complementary resources and capabilities, that are valuable, rare, and difficult to imitate. Also, business analytics literature has matured into a stage where it is not focusing solely on data and analytics technology, but also on talent (employees and management) and organization (culture) aspects, which together provide a fertile ground for the firm's business analytics capability.

Keywords: Business analytics, big data analytics, data analytics, business intelligence, data, firm performance, literature review

1. Introduction

The promise of significant business benefits has encouraged firms to start investing heavily in business analytics. So heavily, that it is estimated to attract more investments than any other information technology. However, despite the increasing number of firms that are investing in business analytics, only some have succeeded to translate the business analytics investments into improved business performance. This phenomenon, sometimes referred as *information technology productivity paradox*, has provided the business analytics research community with a topical and managerially relevant research agenda – to understand and untangle the ambiguous relationship between business analytics and firm performance. Consequently, it has become one of the most surging and managerially relevant discussions within the business analytics research literature in the last 10 years. However, the relevant research output has been labeled under separate concepts and generated in parallel subsets of literature, including, for instance, business analytics, data analytics, big data analytics, and business intelligence and analytics. Echoing the opinions of some of the leading authors within the field, there is no need to separate the concepts from each other as standalone concepts (e.g., Mikalef et al, 2018). Therefore, this study unifies all relevant concepts and subsets of literature under the umbrella term business analytics. By doing so, this study has the potential to cover more relevant literature and conduct a more comprehensive literature analysis than some of the previous ones (e.g., Mohamed et al, 2020).

The timing of this literature review is suitable, as there has been a rapid increase of relevant literature in the last five years. By covering the relevant peer-reviewed studies from all subsets of the literature, this study has two objectives: The first objective is to improve and update the current understanding of the relationship between business analytics and firm performance. Second, this study aims at unifying the relevant business analytics related research literature that has been developing in several overlapping sub-streams. Achieving these objectives will result a comprehensive overview of the current state-of-affairs in the business analytics and firm performance literature, as well as enables development of academically and managerially relevant future research agenda.

After introduction, this paper moves on to describe the methodological choices. Next, findings are presented and discussed. Finally, the paper is concluded with the limitations, future research directions, and final remarks.

2. Methodology

The objective of this literature review is to present the current state-of-affairs of the literature on business analytics and firm performance. The literature search was done in January 2022 by using the abstract and citation database Scopus. A search string “data OR business AND analytic AND performance” was utilized. The search was targeted on document titles and limited to empirical studies, including journal articles, conference papers, book chapters, and books written in English and published between January 2000 and January 2022. The first search produced 402 document results. After article screening for inclusion based on titles the number of potentially relevant articles reduced to 110. After article screening for inclusion based on abstracts the number of potentially relevant articles reduced to 70. At this stage, a significant number of articles related to firm’s operational performance instead of business performance were excluded from further steps. Finally, after quality assessment based on full texts, the final number of articles included in the data extraction step was 47.

After literature selection, the initial coding scheme was developed. At first, it had the following structure: article author(s), year of publication, article title, research question(s), key concept(s), key definition(s), research method(s), empirical data source(s), key findings, and future research ideas. Based on the initial coding scheme, relevant data was extracted from the articles. After developing an in-depth understanding of the literature at hand, the coding scheme was amended with further codes which specifically to the research objectives of this study, such as complementary resources and capabilities for business analytics. Data was then synthesized based on the final coding scheme, and the findings were reported.

3. Findings

This literature review has three primary findings. First, the business analytics and firm performance literature shows signs of maturity and increasing business management relevance. Even though the earlier research, published in 2015 or before, focused mostly on technological aspects of business analytics, such as analytical tools, techniques, models, and methodologies (Klatt, Schlaefke and Moeller, 2011; Bronzo et al, 2013; Chae et al, 2014), the more recent research has extended the discussion to business analytics capabilities, that build on tangible, human, and intangible resources, such as data, technology, and other basic resources, technical and managerial skills for business analytics, and data-driven culture and intensive organizational learning (e.g., Gupta and George, 2016; Mikalef et al, 2020). Some articles define business analytics capability as the firm’s ability “to capture and analyze data towards the generation of insights by effectively orchestrating and deploying its data, technology, and talent” (Mikalef et al, 2019, p. 262), or the firm’s “competence to provide business insights using data management, infrastructure (technology) and talent (personnel) capability to transform business into a competitive force (Wamba et al, 2017, p. 358). In sum, business analytics capability does quite clearly refer to much more than data and technology. It consists of the necessary data and technology-related resources, but also, and more importantly, of analysts’ and managers’ skills, and the firm’s cultural orientation for learning using data in business-critical decision-making.

Second, the relationship between business analytics and firm performance is significantly influenced by firm’s complementary resources and capabilities (e.g., Brynjolfsson, Wang and McElheran, 2021). Several of the reviewed articles develop and empirically test research models that combine business analytics capability with different valuable, rare, and difficult to imitate resources and capabilities, which have theoretically significant roles in translating business analytics into improved firm performance. For instance, recent research highlights the complementary roles of dynamic capabilities (e.g., Wamba et al, 2017; Mikalef et al, 2020), business strategy alignment (Aker et al, 2016; Wamba et al, 2019), organizational culture (Behl, 2020; Upadhyay and Kumar, 2020), information technology capital, educated workers, high flow-efficiency production workplaces (Brynjolfsson et al, 2021), knowledge management (Ferraris et al, 2019, Shabbir and Gardezi, 2020), ambidexterity (Božič and Dimovski, 2019; Rialti et al, 2019; Aljumah et al, 2021), big data analytics management capabilities (Razaghi and Shokouhyar, 2021), and resource orchestration and circular economy implementation (Kristoffersen et al, 2021). In addition, business analytics positively influences firm performance through mediating outputs, such as informational benefits (Asadi Someh and Shanks, 2015), information quality (Ashrafi et al, 2019), technological innovation (Saleem et al, 2019), product and process innovation (Saleem et al, 2020), dual innovations (Su et al, 2020), sustainable product development (Ali et al, 2020), business process performance (Aydiner et al, 2019), business decision making (Chatterjee et al, 2021), and functional performance (Torres et al, 2018). Moreover, some studies have discussed about the moderating role of business analytics in the relationship between firm’s strategic activities and business performance. These studies have

found that business analytics increase the business value that firm can create through open innovation (Arias-Pérez et al, 2022), business model designs (Sun and Liu, 2020), and supplier development (Gu et al, 2021).

Third, the findings also show that empirical research literature on data analytics and firm performance accumulates in three major subsets including big data analytics, business analytics, and business intelligence and analytics. In the big data analytics subset, the extant research has produced strong evidence on the relationship between big data analytics capability, including technological, human, and organizational aspects, and different firm performance outcomes (e.g., Mikalef et al, 2020). In the business analytics subset of literature, research is concerned with the effect of different analytics approaches (i.e., descriptive, predictive, and prescriptive analytics) on firm performance (e.g., Klatt, Schlaefke and Moeller, 2011; Bronzo et al, 2013). In the business intelligence and analytics literature, the focus is on data and its utilization opportunities (e.g., Torres et al, 2018). Thus, while the three subsets of literature have accumulated quite independently of each other, they have dealt with the same issue of how firms could utilize data to seize business opportunities and achieve improved firm performance.

4. Discussion and conclusion

The purpose of this study was to improve the current understanding on the relationship between business analytics and firm performance. The findings suggest that business analytics (capability) consists of tangible, human, and intangible resources, which cover, for instance, data and analytics technology, technical analytical skills, business analytics management, and data-driven culture of the firm. Therefore, firms should pay attention to all three resource categories. Even the best datasets or the state-of-the-art technologies cannot compensate the lack of technical analytical skills, good business analytics management, or the firm's data-oriented culture. Or vice versa. However, business analytics capability alone is not enough to secure improved firm performance, as the reviewed literature indicates that firms need complementary, good fit resources and capabilities to support their business analytics capability. As the firm's business environment and strategic goals change frequently, also the resources and capabilities must be adapted to different situations. This also concerns business analytics capability, which can provide business benefits only when it can address the firm's current and future business needs.

The relationship between business analytics and firm performance is ambiguous and complex. Drawing from the resource-based view (e.g., Barney, 1991), firms are more likely to attain business benefits from business analytics, when they possess or have access to valuable, rare, and difficult to imitate resources that complement their business analytics capability. Also, in accordance with the dynamic capabilities theory (e.g., Eisenhardt and Martin, 2000), firms need dynamic capabilities to gain business value from business analytics (e.g., Wamba et al, 2017). Business analytics capabilities are among many valuable capabilities of the firm, which interact to produce higher-order capabilities that enable the focal firm to achieve competitive advantage. However, as the firm's business environment is turbulent and highly dynamic, it is crucial that the firm can rearrange and refocus its capabilities in accordance with the changing business needs. That is, when a firm strives to be competitive in a highly dynamic business environment, it needs to be able to sense the opportunities and threats, seize opportunities, and transform the organization, including business analytics and the complementary resources and capabilities (cf. Teece, 2007).

For managerial audiences, this study provides interesting implications. First, all aspects (resources) of business analytics capability should be considered when a firm aims at translating its investments in business analytics into business benefits. If one or some of the critical resources are lacking, the projected firm performance impacts of business analytics will be sub-optimal. Second, business analytics (capability) is only one of the firm's valuable capabilities, and it does not affect firm performance in isolation. Thus, managers need to combine business analytics with other, complimentary resources and capabilities, to integrate it into the firm's value creation processes. Both implications should be considered by firms when they start new business analytics initiatives, or else they may face the business analytics productivity paradox.

This literature review is affected by some limitations. First, as the literature for this study was searched through a single abstract and citation database (Scopus), some relevant articles may have gone unnoted. The next step for this literature review is to perform "snowballing" to identify potentially relevant articles from the studies that were already included in this review. Second, the literature analysis was carried out by a single author. Triangulation between two or more authors could have provided slightly different findings.

This study also paves way for interesting future research directions. First, as different complimentary resources and capabilities were found to significantly impact the relationship between business analytics and firm performance, future studies could further explore this research direction. For instance, research on the role of knowledge management could provide valuable insights on how knowledge-based value creation is related to the firm's data-driven initiatives. Second, most of the reviewed studies were cross-sectional by nature, and data was collected from a single country or even from a single industry. To understand how business analytics influences firm performance over longer period, longitudinal studies would be beneficial. In addition, international datasets and cross-industry comparisons would contribute the ongoing discussion by revealing potential cultural and industry-specific conditions that either hinder or bolster the impact of business analytics on firm's business performance. Third, use of perceptual, subjective firm performance measures is a common ground within the extant business analytics literature. Even though some studies have found that subjective and objective firm performance measures correlate significantly (probably due to the key informants' deep understanding of firm performance measures, see e.g., Ramakrishnan et al, 2020), it is an area where future research could make improvements. Use of secondary data sources to collect data on firm performance measures could increase validity and reliability of the business analytics research literature stream.

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