

12-12-2018

Systematic Review of the Roots of Business Analytics and Business Intelligence Systems: Learning from the past – looking into the future

Gloria Wren

Loyola College in Maryland, gwren@loyola.edu

Mary Daly

university college cork, mary.daly@ucc.ie

Frada Burstein

Monash University, frada.burstein@monash.edu

Frederic Adam

University College Cork, Cork, Ireland, FAdam@ucc.ie

Follow this and additional works at: <https://aisel.aisnet.org/sigdsa2018>

Recommended Citation

Wren, Gloria; Daly, Mary; Burstein, Frada; and Adam, Frederic, "Systematic Review of the Roots of Business Analytics and Business Intelligence Systems: Learning from the past – looking into the future" (2018). *Proceedings of the 2018 Pre-ICIS SIGDSA Symposium*. 27.

<https://aisel.aisnet.org/sigdsa2018/27>

This material is brought to you by the Special Interest Group on Decision Support and Analytics (SIGDSA) at AIS Electronic Library (AISeL). It has been accepted for inclusion in Proceedings of the 2018 Pre-ICIS SIGDSA Symposium by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Systematic Review of the Roots of Business Analytics and Business Intelligence Systems: Learning from the past – looking into the future

Completed Research Paper - Abstract

Gloria Philips-Wren

Loyola University Maryland

gwren@loyola.edu

Frada Burstein

Monash University

frada.burstein@monash.edu

Mary Daly

University College Cork

mary.daly@ucc.ie

Frederic Adam

University College Cork

fadam@ucc.ie

Abstract

Some authors have claimed that the research field of decision support systems (DSS) is no longer current or of interest and has been replaced by Business Intelligence and Analytics (BI&A) and Big Data research. In this paper we investigate the relationship of DSS to BI&A by presenting a systematic review of early DSS literature from 1922-1985 and its impact on BI&A to argue that BI&A research has its roots in data-driven decision support. The results of a review of 12 journals during the relevant timeframe confirm that BI&A has its foundations in DSS and can be considered a special category of decision support literature.

Keywords

Decision support systems, business intelligence, analytics, foundations.

Introduction

Some authors have argued that “as a data-centric approach, BI&A [i.e. business intelligence and analytics] has its roots in the long-standing database management field ... [while] the analytical techniques are grounded mainly in statistical methods developed in the 1970s and data mining techniques developed in the 1980s” (Chen et al. 2012, p. 1166). As a widely cited study (over 3,000 citations per Google Scholar), Chen et al. (2012) discerned BI&A research trends from a comprehensive literature search from the past decade (2000-2011) using keywords of ‘business intelligence’, ‘business analytics’, or ‘big data’ within the title, abstract, or subject indexing. Yet missing from this description is the impact of the rich research stream of decision support systems (DSS) that provided the earlier formative roots for BI&A and the related field of big data as a way to enhance human decision making. In this paper, we seek to augment the Chen et al. (2012) study by probing the research question: *What is the linkage (if any) between early DSS research literature and contemporary topics of ‘business intelligence’, ‘analytics’ and ‘big data’?*

One indicator of the evolution of DSS research toward BI&A is found in the name change of the AIS Special Interest Group on Decision Support Systems (SIGDSS) to its current name SIG Decision Support and Analytics (SIGDSA). The evolving research interests of the group are reflected in the titles and content of recent AMCIS mini-tracks. All seven SIGDSA-sponsored mini-tracks at AMCIS 2016 include either the term ‘analytics’, ‘BI’ or ‘big data’. The titles of eight of nine mini-tracks sponsored by SIGDSA at AMCIS 2017 use these terms. AMCIS 2018 mini-tracks from SIGDSA followed a similar pattern. This on-going shift in terminology and focus over time, has led some DSS researchers to debate the relevance of DSS literature to current and future research. We attempt to address this concern by examining the linkage of DSS and BI&A research.

Our premise is that the purpose of BI&A is to inform and enhance human decision-making using computing resources, and, as such, we expect its earliest roots to be in the DSS literature. In fact, some authors define BI&A in these terms, for example, “Business intelligence (BI) is often used as the umbrella term for large-scale decision support systems (DSS) in organizations” (Arnott et al. 2017). We take this view as a proposition and perform a systematic review of DSS literature published in management information systems (MIS) journals in the time period from 1922-1985. The DSS field is mature so we expect the best research from that time period to have published in journals; thus, we do not investigate conference proceedings in this timeframe. The timeframe was chosen to reflect the earliest MIS journal publication date of 1922 and

the initial publication date of the specialist *Journal of Decision Support Systems* in 1985, at which time the field had achieved recognition as an identifiable body of research.

In this paper, we trace the role of DSS as a foundational discipline to BI&A through the DSS references in BI&A articles. We uncover the definitions of BI&A and its associated characteristics, and the way that DSS research has been used to build theory and capabilities. In the following sections we describe our research methodology, results, conclusions, limitations, and future research.

Background

BI&A roots and definitions

There is no agreed upon definition of BI&A. However, BI&A is often categorized in terms of its capabilities to handle data types and convert them into knowledge for decision making (Chen et al. 2012; Watson, 2018; Phillips-Wren et al. 2015). For example, the ability to handle structured data, such as in structured database management systems (DBMS), unstructured data, such as images, sensor data, such as Internet of Things (IoT), and combinations of data types. In general, the more complex the data types that can be analyzed, the more advanced the BI&A. Chen et al. (2012) categorized these generations as BI&A 1.0, BI&A 2.0, and BI&A 3.0. BI&A 1.0 encompasses DBMS-based structured data, BI&A 2.0 includes web and unstructured data processing tools, and BI&A 3.0 brings in mobile and sensor data analytics. Since DBMS were developed alongside DSS and enabled data-driven DSS, there is general consensus that early BI&A was based on DSS (Watson, 2018). As BI&A evolved, however, its capabilities outstripped DSS, and the fields were seen to diverge. We were interested in ascertaining the views and definitions of BI&A from the literature that we analyzed citing DSS papers to see if these fields are actually distinct.

Research Methodology

Identification of DSS Literature

To define the corpus of relevant DSS literature, we performed a Google Scholar search for the terms ‘decision support system’, ‘decision support’, or ‘DSS’ in an article title between the dates of 1922-1985. Our view is that the author self-identified as part of the DSS research stream. This type of bibliographic search has known limitations and could be relaxed in future studies, although it is consistent with previous studies of this sort (e.g. Chen et al., 2012). We identified IS journals within the first 300 pages of Google Scholar results that would be considered part of the MIS research stream, implying that we eliminated psychology journals and journals specific to another business discipline such as marketing. We compared our list of journals with a contemporaneous study of leading MIS journals published in 1984 (Vogel and Wetherbe, 1984).

Identification of Related BI&A Literature

After identifying specific DSS articles, we investigated the citations for each DSS article. Specifically, we performed a Google Scholar search for the citations and manually looked at each article’s title for the search term ‘business intelligence’, ‘analytics’ or ‘big data’. Any BI&A article that met these criteria was downloaded for detailed analysis.

Results

Identification of MIS Journals and Number of Citing BI&A Research Papers

Within the first 300 pages of results of results from Google Scholar, we identified journals and performed a manual search of each journal’s archives to identify relevant DSS articles and the number of articles. Since we were interested in scholarly research literature, we eliminated the *Harvard Business Review* from our list of journals as practitioner-oriented. We note that other influential journals that have influenced DSS research have later initial publication dates, i.e. *Journal of Decision Support Systems* (1985), *Journal of Information Technology* (1986), *Information Systems Journal* (1990), *Information Systems Research* (1990), and *European Journal of Information Systems* (1991).

33 journal papers were found across the selected journals, which cited the original seminal DSS papers and had BI or BA or Big Data in their title. We also found other research outputs, such as books, dissertations or course notes / outlines but we eliminated them on the basis that they are not peer-reviewed research output at the same level as journal or mainstream conference papers.

Discussion

Referencing of DSS Research in BI&A Research

In this corpus of research outputs, the term BI was the most frequent, with 21 papers having BI in their title, whilst 6 had BA in their title and 4 had Big Data. One paper had both BA and Big Data in its title.

In terms of publication outlets, of the 33 papers, 11 were published in journals, 17 published in the proceedings of mainstream conferences, and 4 were workshops / specialized conference papers. Their publication dates ranged from 2000 to 2017, with a larger proportion published in recent years – over 63% published in the 2013-2017 period and 60% in the three more recent years (2015, 2016 and 2017) alone. Arguably, this indicates an increase in the perception of IS researchers of the relevance of the older seminal DSS material to the latest research on BI, BA and Big Data. We would consider this to be a sign that current research is informed by seminal DSS papers and that research in the use of big data to inform better decision making is cumulative.

Conclusions

This paper focused on the underlying roots of BI&A and investigated the linkage (if any) between early DSS research literature and contemporary topics of ‘business intelligence’, ‘analytics’ and ‘big data’. In order to do so, we presented a systematic review of early DSS literature from 1922-1985 and its impact on BI&A. To define the corpus of relevant DSS literature, we performed a Google Scholar search for the terms ‘decision support system’, ‘decision support’, or ‘DSS’ in an article title between the dates of 1922-1985. After identifying specific DSS articles, we investigated the citations for each DSS article. Specifically, we performed a Google Scholar search for the citations and manually looked at each article’s title for the search term ‘business intelligence’, ‘analytics’ or ‘big data’. We then downloaded each DSS-citing BI&A article to determine how the DSS reference was used in the article. Based on an analysis of these articles, we investigated definitions of BI&A.

We proposed initially that BI&A is a special category of DSS that is traditionally called data-driven DSS (Power, 2007), and we believe that our analysis supports this conclusion. According to the BI&A authors themselves, the roots of BI&A rest firmly in DSS research. This is consistent with the shift of decision-making becoming more reliant on evidence derived from the analysis of the data organized in a data warehouse, and the views of the original DSS “thinkers”, who predicted that a data warehouse will become a central component of decision support system architecture.

References

- Arnott, D., Lizama, F., and Song, Y. 2017. "Patterns of Business Intelligence Systems Use in Organizations," *Decision Support Systems* (97), pp. 58-68.
- Chen, H., Chiang, R. H., and Storey, V. C. 2012. "Business Intelligence and Analytics: From Big Data to Big Impact," *MIS Quarterly*, pp. 1165-1188.
- Power, D. 2007. "A Brief History of Decision Support Systems." *DSSResources.COM, World Wide Web, version 4.0, 4.1*. Retrieved September 2018.
- Phillips-Wren, G. E., Iyer, L. S., Kulkarni, U. R., and Ariyachandra, T. 2015. "Business Analytics in the Context of Big Data: A Roadmap for Research," *Communications of the Association for Information Systems* (37), Article 23.
- Vogel, D. R., and Wetherbe, J. C. 1984. "MIS Research: A Profile of Leading Journals and Universities," *ACM SIGMIS Database: the DATABASE for Advances in Information Systems* (16:1), pp. 3-14.
- Watson, H. J. 2018. "Revisiting Ralph Sprague’s Framework for Developing Decision Support Systems," *Communications of the Association for Information Systems* (42:1), Article 13.